ROHINI COLLEGE OF ENGINEERING AND TECHNOLOGY

(AUTONOMOUS)

(Anjugramam-Kanyakumari Main Road, Palkulam,Variyoor P.O.-629 401, K.K.Dist.)

Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai

Accredited with A+ Grade by NAAC

B.Tech. Agricultural Engineering

(B.Tech Agri)

Curriculum & Syllabus

(*2024-2025 Admitted Students Onwards*)

Vision Statement of RCET

To be an academic institute of continuous excellence towards education and research in rural regime and provide service to nation in terms of nurturing potentially higher social, ethical and engineering companion graduands.

Mission Statement of RCET

To foster and promote technically competent graduands by imparting the state of art Engineering education in rural regime.

To enunciate research assisted scientific learning by dissemination of knowledge towards science, agriculture, industry and national security.

Vision of the Department

To inculate competency in the field of agricultural Engineering in rural regime by promoting science based agricultural practices for the betterment of the society.

.

Mission of the Department

To provide and promote indepth knowledge in agricultural engineering through effective teaching learning methodologies.

To promote research in frontier areas, develop world class technologies in the field of agricultural engineering for the betterment of the society.

To impart training in entrepreneurial and life skills for enhancing employability.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1 Graduates will acquire sound theoretical knowledge in engineering principles in agriculture and apply them to solve real world problems.

PEO2 Graduates will have the required qualities for a successful career in Agricultural Engineering and related fields.

PEO3 To understand ethical issues and responsibility of serving the society and the environment at large.

PROGRAMME OUTCOMES (POs)

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6 Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life- long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO1 To design, develop agricultural implements for effective and efficient agricultural production.

PSO2 To engage in lifelong learning, commitment to quality and continuous improvement and the ability to work in multidisciplinary teams.

CREDIT INFO		
Sl.No	Category	Credits
1	Humanities and Social Science (HSS)	13
2	Basic Science Courses (BSC)	25
3	Engineering Science Courses (ESC)	25
4	Professional Core Course(PCC)	59
5	Professional Electives Courses (PEC)	18
6	Open Electives Courses (OEC)	12
7	Employability Enhancement Courses (EEC)	17
8	Mandatory Courses (MNC)	-
Total Credits		169

Humanities and Social Science (HSS)							
Sl.no	Course Code	Course Title	Course Type	L	T	P	Credit
1	24GE101	Heritage of Tamils	HSS	1	0	0	1`
2	24EN101	English for Engineers	HSS	2	0	1	2.5
3	24GE201	Tamil and Technology	HSS	1	0	0	1`
4	24EN231	Presentation and Language Skills Laboratory	HSS	0	0	3	1.5
5	24MG601	Product Innovation & Entrepreneurship	HSS	2	0	0	2
6	24GE701	Professional Ethics and Human Values	HSS	2	0	0	2
7	24AG701	Farm Management, Production & Resource Economics.	HSS	3	0	0	3
Basic Science Courses (BSC)							
Sl.no	Course Code	Course Title	Course Type	L	T	P	Credit
1	24MA101	Matrix and calculus	BSC	3	1	0	4
2	24PH101	Engineering Physics	BSC	3	0	2	4
3	24CY101	Engineering Chemistry	BSC	3	0	2	4
4	24MA201	Complex Variables and Transforms	BSC	4	0	0	4
5	24PH202	Applied Material Science	BSC	3	0	0	3
6	24CY401	Environmental Science and Engineering	BSC	2	0	0	2
7	24MA302	Probability, Statistics And Numerical Methods	BSC	4	0	0	4
Engineering Science Courses (ESC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24ME201	Engineering Graphics & Design	ESC	1	0	4	3
2	24CS201	Programming for Problem Solving using C	ESC	2	0	4	4
3	24EE202	Fundamentals of Electrical and Electronics Engineering	ESC	3	0	2	4
4	24GE231	Workshop Practices	ESC	0	0	3	1.5
5	24CS331	Programming for Problem Solving using Python	ESC	0	0	3	1.5
6	24ME303	Applied Thermodynamics	ESC	4	0	0	4
7	24EE404	IoT-Sensors and Devices	ESC	3	0	2	4
8	24AG331	Computer Aided Modeling and Assembly Laboratory	ESC	2	0	2	3

Professional Core Courses(PCC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24AG201	Crop Production Technology	PCC	3	0	2	4
2	24ME304	Fluid Mechanics & Hydraulic Machines	PCC	3	0	2	4
3	24CE301	Surveying and Leveling	PCC	3	0	2	4
4	24AG401	Theory of Machines	PCC	3	0	0	3
5	24AG402	Hydrology and Water Resources Engineering	PCC	3	0	0	3
6	24AG403	Machine Design	PCC	3	0	0	3
7	24CE401	Strength of Materials	PCC	3	0	2	4
8	24AG404	Unit operations in Agricultural Process	PCC	3	0	2	4
9	24AG405	Tractor and Farm Engines	PCC	3	0	2	4
10	24AG501	Soil Science & Engineering	PCC	3	0	2	4
11	24AG502	Farm Implements and Equipment	PCC	3	0	2	4
12	24AG503	Irrigation & Drainage Engineering	PCC	3	0	2	4
13	24AG601	Dairy & Food Engineering	PCC	3	0	0	3
14	24AG602	Post-Harvest Technology	PCC	3	0	2	4
15	24AG702	Renewable Energy Systems	PCC	3	0	2	4
16	24AG703	Remote Sensing & Geographical Information System	PCC	2	0	2	3
Professional Electives Courses I (PEC)							
FARM MACHINERY							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24AG571	Human Engineering and Safety	PEC	3	0	0	3
2	24AG572	Design of Agricultural Machinery	PEC	3	0	0	3
3	24AG573	Testing and Evaluation of Farm Machinery and Equipment	PEC	3	0	0	3
4	24AG574	Farm Power and Machinery Management	PEC	3	0	0	3
5	24AG575	Hydraulic Drives and Controls	PEC	3	0	0	3
6	24AG576	Precision Farming Equipment	PEC	3	0	0	3

Professional Electives Courses II (PEC)							
AGRICULTURAL PROCESSING							
1	24AG581	Refrigeration and Cold Storage	PEC	3	0	0	3
2	24AG582	Fruits and Vegetables Processing	PEC	3	0	0	3
3	24AG583	Storage and Packaging Technology	PEC	3	0	0	3
4	24AG584	Food safety management Systems	PEC	3	0	0	3
5	24AG585	Heat and mass Transfer	PEC	3	0	0	3
6	24AG586	Food Process Equipment and Design	PEC	2	0	2	3
Professional Electives Courses III (PEC)							
SMART AGRICULTURE SYSTEMS							
1	24AG671	Instrumentation and Control Engineering in Agriculture	PEC	2	0	2	3
2	24AG672	Database Management and Microprocessor Applications in Agriculture	PEC	2	0	2	3
3	24AG673	Data Analytics in Agricultural Systems	PEC	2	0	2	3
4	24AG674	Artificial Intelligence and Machine Learning for Agriculture	PEC	2	0	2	3
5	24AG675	Mechatronics in Agricultural Engineering	PEC	2	0	2	3
6	24AG676	Geoinformatics and Nano-Technology	PEC	2	0	2	3
Professional Electives Courses IV (PEC)							
RENEWABLE ENERGY ENGINEERING							
1	24AG681	Bio and Thermo Chemical Conversion of Biomass	PEC	2	0	2	3
2	24AG682	Solar and Wind Engineering	PEC	2	0	2	3
3	24AG683	Energy Conservation in Agro- Based Industry	PEC	2	0	2	3
4	24AG684	Co-Generation and Waste Heat Recovery Systems	PEC	2	0	2	3
5	24AG685	Energy Storage Systems	PEC	2	0	2	3
6	24AG686	Energy Auditing	PEC	2	0	2	3
Professional Electives Courses V (PEC)							
AGRI BUSINESS							
1	24EC771	Agri Business Management and	PEC	3	0	0	3

		Entrepreneurship					
2	24EC772	Agricultural Finance, Banking and Cooperation	PEC	3	0	0	3
3	24EC773	Technology of Seed Processing	PEC	3	0	0	3
4	24EC774	Mushroom Cultivation and Vermicomposting	PEC	3	0	0	3
5	24EC775	Value Addition of Indigenous Fruits and Vegetables	PEC	3	0	0	3
6	24EC776	Digital Marketing in Agricultural	PEC	3	0	0	3
Professional Electives Courses VI (PEC)							
CROP PRODUCTION & PROTECTION							
1	24AG781	Soil Fertility and Nutrient Management	PEC	3	0	0	3
2	24AG782	Plant Protection	PEC	3	0	0	3
3	24AG783	Extension Methodology and Transfer of Technology	PEC	3	0	0	3
4	24AG784	Agricultural Marketing	PEC	3	0	0	3
5	24AG785	Integrated Farming System	PEC	3	0	0	3
6	24AG786	Sustainable Agriculture and Food Safety	PEC	3	0	0	3
Open Electives Courses I (OEC)							
ARTIFICIAL INTELLIGENCE AND COMPUTER SCIENCE AND ENGINEERING							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24AI601	Artificial Intelligence and Machine Learning Fundamentals	OEC	3	0	0	3
2	24AI602	Business Intelligence and its Applications	OEC	3	0	0	3
3	24AI603	Data Science Fundamentals	OEC	3	0	0	3
4	24CS601	Augmented Reality /Virtual Reality	OEC	3	0	0	3
5	24CS602	Full Stack Development	OEC	3	0	0	3
6	24CS603	Software Testing and Quality Assurance	OEC	3	0	0	3
7	24CS604	Cloud Computing	OEC	3	0	0	3
Open Electives Courses II (OEC)							
CIVIL AND BIO MEDICAL ENGINEERING							
1	24BM701	Wearable Devices	OEC	3	0	0	3
2	24BM702	Telemedicine and Healthcare Delivery	OEC	3	0	0	3

3	24BM703	Medical Informatics	OEC	3	0	0	3
4	24BM704	Basics of Human Anatomy and Physiology	OEC	3	0	0	3
5	24CE601	Rural Development	OEC	3	0	0	3
6	24CE602	Geographic Information System	OEC	3	0	0	3
7	24CE603	Water Resources management	OEC	3	0	0	3
8	24CE604	Climate Change and its Impact	OEC	3	0	0	3
Open Electives Courses III (OEC)							
ELECTRICAL AND ELECTRONICS ENGINEERING AND ELECTRONICS AND COMMUNICATION ENGINEERING							
1	24EC501	Nano Electronics	OEC	3	0	0	3
2	24EC503	Digital Signal Processing	OEC	3	0	0	3
3	24EC504	Fuzzy Logic Systems and ANN	OEC	3	0	0	3
4	24EC506	Electronic System Design	OEC	3	0	0	3
5	24EE701	Robot Process Automation	OEC	3	0	0	3
6	24EE702	Electric vehicle Technology	OEC	3	0	0	3
7	24EE703	Smart Grid	OEC	3	0	0	3
8	24EE704	Energy Conservation and Management	OEC	3	0	0	3
Open Electives Courses IV (OEC)							
MECHANICAL AND MANAGEMENT							
1	24ME701	Additive Manufacturing	OEC	3	0	0	3
2	24ME702	Rocket Propulsion	OEC	3	0	0	3
3	24ME703	Industrial Safety	OEC	3	0	0	3
4	24ME704	Marine Vehicles	OEC	3	0	0	3
5	24MG701	Digital Marketing	OEC	3	0	0	3
6	24MG702	Industrial Psychology	OEC	3	0	0	3
7	24MG703	Logistics and Supply chain Management	OEC	3	0	0	3
8	24MG704	Corporate Social Responsibility	OEC	3	0	0	3
Employability Enhancement Courses (EEC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24AG351	Mini Project – I (Practical Crop Production)	EEC	0	0	2	1
2	24AG451	Mini Project – II (Design and Development of Project)	EEC	0	0	2	1
3	24EN451	Soft Skills Development	EEC	0	0	2	1

4	24AG551	Mini Project – III (Community Based Products)	EEC	0	0	2	1
5	24EN651	Business and Managerial Communications	EEC	0	0	2	1
6	24GE551	Quantitative and Reasoning Skills-I	EEC	0	0	2	1
7	24AG651	Mini Project-IV (Micro Project)	EEC	0	0	2	1
8	24GE651	Quantitative and Reasoning Skills-II	EEC	0	0	2	1
9	24AG751	Project Work Phase I (Design and Analysis)	EEC	0	0	4	2
10	24AG752	Industrial Training / Internship	EEC	0	0	0	2
11	24EC851	Project Work Phase II	EEC	0	0	10	5
Mandatory Courses (MNC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24MC101	Induction Programming	MNC	THREE WEEKS			
2	24MC201	Sports and Yoga for Youth Empowerment - I	MNC	0	0	2	0
3	24MC202	NCC CREDIT COURSE LEVEL - I	MNC	1	0	2	1#
4	24MC301	Sports and Yoga for Youth Empowerment - II	MNC	0	0	2	0
5	24MC401	NCC Credit Course Level - II	MNC	1	0	2	1#
6	24MC601	Disaster Management	MNC	1	0	0	*
7	24MC701	Constitutions of India	MNC	1	0	0	1#

SCHEME OF INSTRUCTION FOR FIRST YEAR B.Tech

Ist SEMESTER

S.No	Course code	Course Title	Category	L	T	P	C
THEORY COURSES							
1	24GE101	Heritage of Tamils	HSS	1	0	0	1`
2	24MA101	Matrices and Calculus	BSC	3	1	0	4
THEORY COURSE WITH LABORATORY COMPONENT							
3	24EN101	English for Engineers	HSS	2	0	1	2.5
4	24PH101	Engineering Physics	BSC	3	0	2	4
5	24CY101	Engineering Chemistry	BSC	3	0	2	4
6	24ME201	Engineering graphics & design	ESC	1	0	4	3
7	24CS201	Programming for problem solving using c	ESC	2	0	4	4
MANDATORY COURSES							
8	24MC101	Induction programming	MNC	THREE WEEKS			
TOTAL				14	1	15	22.5

IInd SEMESTER

S.No	Course code	Course Title	Category	L	T	P	C
THEORY COURSES							
1	24GE201	தமிழரும் தொழில்நுட்பமும் / Tamil and Technology	HSS	1	0	0	1
2	24MA201	Complex Variables and Transforms	BSC	4	0	0	4
3	24PH202	Applied Material Science	BSC	3	0	0	3
4	24CY201	Environmental Science and Engineering	BSC	2	0	0	2
THEORY COURSE WITH LABORATORY COMPONENT							
5	24EE202	Fundamentals of Electrical and Electronics Engineering	ESC	3	0	2	4
6	24AG201	Crop Production Technology	PCC	3	0	2	4
LABORATORY COURSES							
7	24GE231	Workshop Practices	ESC	0	0	3	1.5
8	24EN231	Presentation and Language Skills Laboratory	HSS	0	0	3	1.5
9	24CS331	Programming for Problem Solving using Python	ESC	0	0	3	1.5
MANDATORY COURSES							
10	24MC201	Sports and Yoga for Youth Empowerment - I	MNC	0	0	2	0
11	24MC202	NCC CREDIT COURSE LEVEL - I	MNC	1	0	2	1#
TOTAL				13	1	15	21.5

பாடநெறி குறியீடு	**24GE101**	**பாடத்தின் தலைப்பு:**	தமிழர்மரபு
கிரெடிட்	**1**	**L – T – P**	**1-0-1**

பாடத்திட்ட நோக்கங்கள்:

1. தமிழின் மதச்சார்பற்ற தன்மை, இந்திய மொழிக் குடும்பத்தின் திராவிட மொழி, திருக்குறளின் கருத்துக்கள், சமயங்களின் தாக்கம், நவீன இலக்கிய வளர்ச்சி ஆகியவற்றை நினைவு கூர்தல்.
2. தமிழர்களின் சமூக மற்றும் பொருளாதார வாழ்வில் நடுகல், சிற்பங்கள், சிலைகள் மற்றும் அழகிய கைவினைப் பொருட்கள், இசைக்கருவிகள் ஆகியவற்றின் தொடர்புடைய அறிவைக் கோடிட்டுக் காட்டுதல்.
3. தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகளை மனதில் பதிய வைத்தல்.
4. தமிழ்நாட்டின் தாவரங்கள் மற்றும் விலங்கினங்கள், சங்க நகரங்கள் மற்றும் துறைமுகங்கள், சங்க காலத்தின் ஏற்றுமதி மற்றும் இறக்குமதிகளை நினைவுபடுத்துதல், வெளிநாடுகளில் சோழர் படையெடுப்பைக் கண்டறிதல்.

இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கைக் கண்டறிதல், இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்குக்கு இணையாக இந்தியாவின் பிற பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கத்தை அடையாளம் காணுதல்.

அலகு I மொழி மற்றும் இலக்கியம்:	**[3 hours]**
இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம்- பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.	

அலகு II மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக்கலை:	**[3 hours]**
நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர்	

சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:	**[3 hours]**
தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.	

அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள்:	**[3 hours]**
தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறைமுகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி.	

அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு:	**[3 hours]**
இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தங்கங்களின் அச்சு வரலாறு.	

Total : 15 Periods

பாடநெறி முடிவுகள் (பாமு):

பாடநெறியின் முடிவில், மாணவர் பின்வரும் திறன்களைப் பெறுவர்:

பாமு	**பாடநெறி முடிவுகள்**	**மிக உயர்ந்த அறிவாற்றல் நிலை**
அலகு I பாமு:	தமிழின் மதச்சார்பற்ற தன்மை, திராவிட மொழியின் பங்கு, திருக்குறளின் கருத்துக்கள், சமயங்களின் தாக்கம், நவீன இலக்கிய வளர்ச்சி ஆகியவற்றையும் தெரிந்துகொள்கிறார்கள்.	கே 1
அலகு II பாமு:	தமிழர்களின் சமூக மற்றும் பொருளாதார வாழ்வில் நடுகல், சிற்பங்கள், சிலைகள் மற்றும் அழகிய கைவினைப் பொருட்கள், இசைக்கருவிகள் ஆகியவற்றை விவரிக்கும் ஆற்றலை பெறுகிறார்கள்.	கே 2
அலகு III பாமு:	தமிழர்களின் பாரம்பரிய விளையாட்டுகளை தெரிந்து கொள்ளுவதால் விளையாட வேண்டும் ஏன்ற ஆர்வத்தை பெறுகிறார்கள்.	கே 1
அலகு IV பாமு:	தமிழ்நாட்டின் தாவரங்கள் மற்றும் விலங்கினங்கள் பற்றிய அறிவையும், சங்க கால கட்டிடக்கலை, ஏற்றுமதி மற்றும் இறக்குமதி தொழில் நுட்ப அறிவை பெறுகிறார்கள்..	கே 1
அலகு V	இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கையும், இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு இணையாக	கே 1

பாமு:	இருப்பதையும், தெரிந்து கொள்கிறார்கள்.	

பாடநெறி முடிவுகள் மற்றும் நிரல் முடிவுகள் ஒப்பிடுதல்

பாமுகள்	மிக உயர்ந்த அறிவாற்றல் நிலை	பாடநெறி முடிவுகள்											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
பாமு**1**	கே 1	**2**	-	-	-	-	-	-	-	-	-	-	-
பாமு**2**	கே 2	**1**	-	-	-	-	-	-	-	-	-	-	-
பாமு**3**	கே 1	**1**	-	-	-	-	-	-	-	-	-	-	-
பாமு**4**	கே 1	**1**	-	-	-	-	--	-	-	-	-	-	-
பாமு**5**	கே 1	**1**	-	-	-	-	-	-	-	-	-	-	-

நிலை 3- அதிக ஒத்துப்போதல், நிலை 2- மிதமாக ஒத்துப்போதல், நிலை 1- குறைவாக ஒத்துப்போதல், நிலை 0- ஒத்துப்போகவில்லை

மதிப்பீட்டுத் திட்டம்:

கூறுகள்	மதிப்பீட்டின் வகை	அதிகபட்ச மதிப்பெண்கள்	குறைக்கப்பட்ட மதிப்பெண்கள்	இறுதி மதிப்பெண்கள்
தொடர்ச்சியான உள் தேர்வு	தொடர்ச்சியான உள் தேர்வு - I	100	40	40
	தொடர்ச்சியான உள் தேர்வு - II	100	40	
இறுதி பருவ தேர்வு	எழுத்து தேர்வு	100	60	60
மொத்தம்				100

மதிப்பீட்டு முறை

ப்ளூமின் வகை	***தொடர்ச்சியான மதிப்பீட்டு சோதனைகள்***		***இறுதி தேர்வு***
	1	**2**	
நினைவில் கொள்ளுதல்	60	50	60
புரிந்து கொள்ளுதல்	40	50	40
விண்ணப்பித்தல்	0	0	0
பகுப்பாய்வுதல்	0	0	0
மதிப்பிடுதல்	0	0	0
உருவாக்குதல்	0	0	0

இறுதி பருவ தேர்வு: (கேள்வி முறை)

- ஒவ்வொரு யூனிட்டும் இரண்டு 2 மதிப்பெண் வினாக்களையும் ஒரு 16 மதிப்பெண் வினாவையும் (இரண்டில் ஒன்று) கொண்டுள்ளது.
- பதினைந்து கேள்விகளுக்கும் பதிலளிக்க வேண்டும்

Course Code:	24GE101	Course Title:	Heritage of Tamils
Credits:	1	L – T – P	1-0-0

COURSEOBJECTIVES:

- Recalling the secular nature of Tamil, the Dravidian language of the Indian language family, the ideas of Thirukkural, the influence of religions and the development of modern literature.
- To outline the relevant knowledge of Nadukal, sculptures, statues and beautiful handicrafts, musical instruments in the social and economic life of Tamils.
- Terukhoothu, Karakatam, Villuppattu, KanyanKoothu, Wailatam, DholpaVaikhuthoo, Silampattam,Valali,Puliyattam, Memorizing the games of Tamils
- Flora and fauna of TamilNadu, Sangam cities and ports, reminiscence of exports and imports of Sangam period, tracing Chola invasion abroad.
- Identify the role of Tamils in the Indian Liberation War and identify the influence of Tamil culture in other parts of India along with the role of Siddha medicine in Indian medicine.

UNIT I LANGUAGE AND LITERATURE	[3hours]
Language Families in India - Dravidian Languages – Tamil as a Classical Language Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land -Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry-Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.	

UNIT II HERITAGE-ROCK ART PAINTINGS TO MODERN ART SCULPTURE	[3hours]
Hero stone to modern sculpture-Bronze icons-Tribes and their handicrafts-Art of temple car making Massive Terracott as culptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram-Role of Temples in Social and Economic Life of Tamils.	

UNIT III FOLK AND MARTIAL ARTS	[3hours]
Therukoothu, Karagattam, VilluPattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tigerdance - Sports and Games of Tamils.	

UNIT IV THINAI CONCEPT OF TAMILS	[3hours]
Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature –Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age- Overseas Conquest of Cholas.	

UNIT V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE	[3hours]
Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other partsof India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine –Inscriptions & Manuscripts – Print History of Tamil Books.	

Course outcomes:

On completion of the course, the student will have the ability to:

COs	Course Outcomes	Highest cognitive level
CO1	Know the secular nature of Tamil, the role of Dravidian language, the ideas of Thirukkural, the influence of religions and the development of modern literature.	K1
CO2	Understand the social and economic life of the Tamils and to describe sculptures, statues and beautiful handicrafts, musical instruments.	K2
CO3	Get the interest in playing Terukoothu, Karakatam, Villuppattu, Kanyan Koothu, Wailatam, Dholbaik Koothu, Silampattam, Valali, Tiger Actam, and splashing	K1
CO4	Acquire knowledge of TamilNadu's flora and fauna, Sangam architecture, export and import techniques.	K1
CO5	Know the role of Tamils in the Indian Liberation War and the role of Siddha medicine in Indian medicine.	K1

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	60	50	60
Understand	40	50	40
Apply	0	0	0
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

COsand POs Mapping

COs	Highest Cognitive Level	POs											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	K1	**2**	-	-	-	-	-	-	-	-	-	-	-
CO2	K2	**1**	-	-	-	-	-	-	-	-	-	-	-
CO3	K1	**1**	-	-	-	-	-	-	-	-	-	-	-
CO4	K1	**1**	-	-	-	-	--	-	-	-	-	-	-
CO5	K1	**1**	-	-	-	-	-	-	-	-	-	-	-

Schemeof Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Final marks
Continuous Internal Examination (CIE)	CIE– I	100	40	40
	CIE–II	100	40	
End Semester Examination (ESE)	Theory Exam	100	60	60
Total				100

End semester Examination:(QP PATTERN)

- Each unit consists of two 2 marks questions and one16marks question(either or).
- All the fifteen questions have to be answered.

TEXT BOOKS

1. .தமிழகவரலாறு - மக்களும்பண்பாடும் - கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்).
2. கணினித்தமிழ் - முனைவர்இல. சுந்தரம். (விகடன்பிரசுரம்).
3. கீழடி - வைகைநதிக்கரையில்சங்ககாலநகரநாகரிகம் (தொல்லியல்துறைவெளியீடு)
4. பொருநை - ஆற்றங்கரைநாகரிகம். (தொல்லியல்துறைவெளியீடு)
5. SocialLifeofTamils(Dr.K.K.Pillay)AjointpublicationofTNTB&ESCandRMRL–(inprint)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.

REFERENCEBOOKS

1.Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by:International Institute of Tamil Studies).

2.The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)

3.Keeladi-'SangamCityCivilizationonthebanksofriverVaigai'(JointlyPublishedby:Department Of Archaeology &Tamil Nadu Text Book and Educational Services Corporation, TamilNadu)

4.Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)

5.Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, TamilNadu)

6.JourneyofCivilizationIndustoVaigai(R.Balakrishnan)(Publishedby:RMRL)–ReferenceBook

Course Code:	24MA101	Course Title:	MATRICES AND CALCULUS (Common to ALL branches)
Credits:	4	L – T – P	3 – 1 – 0

Course objectives:

- To provide the basic tools of calculus mainly for the purpose of modeling the engineering problems mathematically and obtaining solutions.
- To learn the concept of eigenvalues and eigenvectors and to reduce the quadratic form to canonical form.
- To learn the foundation course of Single Variable and multivariable calculus plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

Teaching-Learning Process:

These are sample strategies which teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method does not mean only traditional method, but different type of teaching methods may be adopted to develop the outcomes.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Topics will be introduced in a multiple representation and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT I – MATRICES	[12 hours]
Eigenvalues and Eigenvectors and their properties – Diagonalization of a matrix (Symmetric matrix) – Cayley - Hamilton theorem (without proof) – Inverse and Power of a matrix by Cayley - Hamilton theorem – Quadratic forms and Nature of quadratic forms. Application: Reduction of a quadratic form to canonical form by orthogonal transformation.	

UNIT II – Differential Calculus	[12 hours]
Functions – Limit – Continuity – Derivatives – Differentiation rule – Product and quotient rules – Chain rules – Implicit differentiation – Logarithmic differentiation. Application: Maxima and Minima of functions of one variable	

UNIT III – FUNCTIONS OF SEVERAL VARIABLES	**[12 hours]**
Partial differentiation – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables. Application: Maxima and Minima of functions of two variables using MATLAB - Lagrange's method of undetermined multipliers.	

UNIT IV – Integral Calculus	**[12 hours]**
Definite and Indefinite integrals - Substitution rule - Techniques of Integration: Bernoulli's theorem (without proof) – Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals. Application: Area between simple closed curves.	

UNIT V – Multiple Integrals	**[12 hours]**
Double integrals –Double integrals in cartesian and polar coordinates – Change of order of integration– Area enclosed by plane curves – Triple integrals – Change of variables in double and triple integrals.	
Application: Volume of solids, Mass of Lamina	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Apply the matrix algebraic techniques for eigen value related applications
CO2	Understand the concepts of limit and continuity of functions
CO3	Compute the derivatives and the extreme points and solve engineering problems
CO4	Use the partial derivatives and the maxima and minima of multivariable functions
CO5	Use fundamental theorem of calculus to evaluate definite integrals
CO6	Apply the concepts of multiple integrals to find the areas and volumes of geometrical shapes

COs and POs Mapping:

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	2	1		2							2
CO2	2	1	1									1
CO3	3	2	1		2							
CO4	3	2	1									
CO5	3	2	1									
CO6	3	2	1		1							1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final marks</th></tr>
<tr><td rowspan="5">Continuous Internal Examination (CIE)</td><td>CIE – I</td><td>100</td><td rowspan="2">50</td><td rowspan="5">100</td><td rowspan="5">40</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>MCQ</td><td>20</td><td>10</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td>End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>60</td><td>60</td><td>60</td></tr>
<tr><td colspan="5">Total</td><td>100</td></tr>
</table>

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	20	20	20
Understand	40	40	20
Apply	40	60	60
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
3. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 2015. [For Units II & IV - Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8]

Reference Books:

1. Muthusubramanian R and Salivahanan S, "Basic Electrical and Electronics Engineering," McGraw Anton. H, Bivens. I and Davis. S, " Calculus ", Wiley, 10th Edition, 2016
2. Bali. N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
3. Jain. R.K. and Iyengar. S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition, 2016.
4. Narayanan. S. and Manicavachagom Pillai. T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.
5. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.Hill, NewDelhi, 2009.

Equivalent NPTEL/SWAYAM Courses

S. No.	Course Title	Course Instructor	Host Institute
1	Matrix Analysis with Applications	Prof. S. K. Gupta Prof. Sanjeev Kumar	IIT Roorkee
2	Calculus of One Real Variable	Prof. Joydeep Dutta	IIT Kanpur

Web Links and Video Lectures (E-Resources):

1. System of Linear Equations, Eigenvalues and Eigenvectors: https://www.nptelvideos.com/lecture.php?id=13416
2. Concept of Domain, Limit, Continuity and Differentiability: https://www.nptelvideos.com/lecture.php?id=13422
3. Matrix Diagonalization: https://www.nptelvideos.com/lecture.php?id=13481

Course Code:	24EN101	Course Title:	ENGLISH FOR ENGINEERS [COMMON TO ALL BRANCHES]
Credits:	2.5	L – T – P	2-0-1

2

Course Objectives:
• To develop an understanding of Basic English Grammar. • To enhance listening skills and select appropriate responses. • To practice presentation and speaking techniques. • To develop a quest for reading. • To practice professional writing.
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. Language learning softwares / Language Lab 3. Online Resources 4. Smart Class Room 5. Flipped classrooms 6. Project based Collaborative Experiential learning 7. Expert Lecture sessions

UNIT I - BASIC GRAMMAR- VOCABULARY AND EXPRESSIONS	[8 hours]

Grammar: Parts of speech - Types of sentences: Assertive - Imperative - Interrogative & Exclamatory - Affirmative - Negative - Gerunds & Infinitives - Tenses - Voices- Impersonal passives- Prepositions- Articles & Determiners- Cause and effect expressions - Vocabulary: Affixes- Synonyms & Antonyms - Homonyms - Homophones- Compound Nouns.

UNIT II - ACTIVE LISTENING - RESPONDING		[15 hours]
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	**Topic**	**Hours**
1.	Listening to Audio (Podcasts- Audiobooks- Radio Program) and Practice Exercise-Answering Cloze Test Based on Listening	3
2.	Listening to native speaker's Telephone Conversations–Analyzing a Product	3
3.	Listening to Job Interviews - Sports Commentaries / Animated stories / Anecdotes / Event narration	3
4.	Video Comprehension – Brainstorming and Note-Taking	3
CLASSROOM ACTIVITIES		
1.	Listening to Statistical Information and Follow-up Exercises. - Form Filling Exercises	1
2.	Debate and reviewing the performance of each participant - Panel Discussion	2

UNIT III: SPEAKING AND PRESENTATION SKILLS		[15 hours]
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	**Topic**	**Hours**
1.	Speaking Development through English software S-net or Globarena and Online Content (Tenses- Voices- SV Agreement- Prepositions- Coherence Markers- Relative Clauses- Modals- Punctuation)	5
CLASSROOM ACTIVITIES		
1.	Self-Introduction - Sharing Childhood Experiences- Talking about Favorite Personalities	1
2.	Describing Recent Innovation in Technology	1
3.	Interviewing Celebrities and Entrepreneurs	1
4.	Situational Conversations (Meeting a friend in a cafe) - Narrating Personal Experience	1
5.	Group Communication- Discussing Social Issues- Current Affairs and Debate	1
6.	Role-Play- Picture/Movie Description	1
7.	Presentation – I (Book /Movie Review- Story Telling- General Presentations)	2

8.	Presentation – II (Technical Presentations)	2

UNIT IV: READING BETWEEN LINES		[12 hours]
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	**Topic**	**Hours**
1.	Reading Comprehension - skimming - scanning (General / Technical passages	2
2.	Reading Longer Texts with Time Frame	2
3.	Reading Data using different types of Texts- Magazines and Internet Materials	2
4.	Reading Research Papers-- Editing/Proofreading	2
CLASSROOM ACTIVITIES		
1.	Job Advertisements – Manual for Product/Service – Telephone Phrases	1
2.	Reading Cause and Effect Essays-Technical Papers and Case Studies - Sorting out jumbled Sentences in a Paragraph	2
3.	Short Stories - Critical Reading	1

LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	**Topic**	**Hours**
1.	Mind Mapping and Brainstorming on any Social Event/Issue	1
2.	Creating a Blog/Vlog/YouTube Channel –Uploading MP3/MP4 – Practice (Movie/Book/ Gadget Review-General/Tech Talks- Interview with Celebrities)	1
3.	Creating a Product Review Blog.	1

UNIT V- WRITING FOR ENGINEERS	[7+3 hours]
Writing - Application Letters - Resume- Product Description - Essay related to Technical / Social / current topics - Interpretation of Charts - Short Articles on everyday life - letters – Enquiry- Quotation- Order- Claim - Adjustment - Response to complaints - Statement of Purpose (SoP) -Emails - Memos -Notices - Circulars - Minutes of Meetings - Internship - Accident Report - Feasibility Report-Recommendations.	

LIST OF EXERCISES		
LAB ACTIVITIES		
SI. No.	**Topic**	**Hours**
1.	Mind Mapping and Brainstorming on any Social Event/Issue	1
2.	Creating a Blog/Vlog/YouTube Channel –Uploading MP3/MP4 – Practice (Movie/Book/ Gadget Review- General/Tech Talks- Interview with Celebrities)	1
3.	Creating a Product Review Blog.	1

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Identify various grammatical components- build vocabulary and apply expressions for error-free sentences	K3
CO2	Make use of appropriate words to respond by listening to general and technical online contents	K3
CO3	Experiment with the nuances of presentation and speaking skills	K3
CO4	Apply reading skills in various academic contexts	K3
CO5	Construct legible and flawless sentences proficiently with appropriate choice of words and structures for varied professional contexts	K3

COs and POs Mapping:

COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	-	-	-	-	-	-	-	-	-	**3**	-	**3**
CO2	-	-	-	-	-	-	-	-	-	**3**	-	**3**
CO3	-	-	-	-	-	-	-	-	-	**3**	-	**3**
CO4	-	-	-	-	-	-	-	-	-	**3**	-	**3**
CO5	-	-	-	-	-	-	-	-	-	**3**	-	**3**

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max. Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - **Theory**	CIE – I	100	60	100	25
	CIE – II	100			
	Skill Assessment – I (2 Assignments + 1 seminar)	40	40		
	Skill Assessment – II (3Assignments)	40			
Continuous Internal Examination (CIE) - **Laboratory**	Continuous Assessment (Lab activities & exercises)	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**Terminal Examination**
	1	**2**	
Remember	10	10	10
Understand	30	30	30
Apply	60	60	60
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Gangalakshmi- C- Rathika- B- Saranraj- L. Professional English for Engineers. New Delhi: Cengage- 2022.
2. Murphy- Raymond. English Grammar in Use Book with Answers: A Self-study Reference and Practice Book for Intermediate Learners of English. Fourth Edition: Cambridge University Press- 2012.

Reference Books:

1. Raman- Meenakshi and Sangeetha Sharma. Communication Skills. New Delhi: OUP-2018
2. R. C. Sharma_Krishna Mohan - Business Correspondence and Report Writing _ a Practical Approach to Business _ Technical Communication-Mc Graw Hill India (2017)

Web Links and Video Lectures (E-Resources):
MANUALS / SOFTWARE: Open Sources / British Council / Cambridge Websites

Suggested Skill Activities:

1) Listening tests materials [Select podcasts / radio programmes / YouTube videos / audiobooks / materials from British Council] - Cloze tests where students fill in missing words from transcripts – Yes or No Question Answers – one-word answers based on recording – summary of recording
2) Self-introduction / Introduce Colleague
3) Just a Minute talks
4) Extempore
5) Mock GDs
6) Mock Interviews
7) Note Taking of Engineering Lectures
8) Create videos / blogs
9) Present Technical Papers
10) Reading Comprehension Exercises
11) Writing letters – Leave letter – Letter for academic purposes
12) Writing Essays
13) Composing Mails
14) Preparing Statement of Purpose
15) Preparing Covering letter and Resume

Course Code:	**24PH101**	**Course Title:**	**ENGINEERING PHYSICS (Common to ALL Branches)**
Credits:	**4**	**L – T – P**	**3-0-2**

COURSE OBJECTIVES
• To make the students effectively to achieve an understanding of Mechanics • To enable the students to gain knowledge of Elasticity. • To enable the students to gain knowledge of Maxwell’s Equation and Electromagnetic waves. • To introduce the basics of optics and lasers.

• Equipping the students to be successfully understand the importance of quantum physics.
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. Lab experiment videos 3. Blended Mode of Learning 4. Project based Learning 5. Experiential Learning 6. NPTEL and Other Videos 7. Smart Class Room 8. Flipped Class

UNIT- I MECHANICS	**[9 hours]**
Multiparticle dynamics: Center of mass (CM) – Rotation of rigid bodies: Rotational kinematics – Rotational kinetic energy and moment of inertia - Theorems of M .I –M.I of Uniform rod-M.I of a diatomic molecule - Torque– Rotational energy state of a rigid diatomic molecule - Gyroscope – Torsional stress and deformation-Torsional pendulum-Double pendulum.	
Practical Topics: 1. Torsional pendulum – Determination of rigidity modulus of wire and moment ofinertia of disc. 2. Compound pendulum – Determination of rigidity modulus	

UNIT- II ELASTICITY	**[9 hours]**
Elasticity – Factors affecting Elasticity –Different types of Modulus- Moduli of elasticity and its relation -Stress - strain diagram and its applications - Bending of beams - Bending moment – Cantilever - Young’s modulus : Uniform & Non-uniform bending-theory and experiment-I Shaped Girders.	
Practical Topics: 1. Determination of Young’s modulus of a given material- Non uniform bending method 2. Uniform bending – Young’s modulus determination.	

UNIT- III MAXWELL'S EQUATIONS AND ELECTROMAGNETIC WAVES	[9 hours]
The Maxwell's equations - wave equation- Plane electromagnetic waves in vacuum - properties of electromagnetic waves - Producing electromagnetic waves - Energy and momentum in EM waves - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium vacuum interface for normal incidence..	
Practical Topics: 1. Spectrometer – Determination of wavelength of Hg spectrum using grating. 2. Spectrometer – Angle of the prism 3. Spectrometer – Dispersive power of the prism	

UNIT- IV LASERS &FIBER OPTICS	[9 hours]
Lasers:-Einstein coefficients and their relations –-characteristics of laser - Types of Laser - Nd-YAG laser -semiconductor laser- Applications -Industrial, Medical, laser based military weapons Fiber optics: principle and classification of optical fibers – propagation of light in optical fiber - Numerical aperture and Acceptance angle– Fiber optic communication system - Applications - Displacement and pressure sensors – Endoscopy	
Practical Topics: 1. Determination the acceptance angle and numerical aperture of the given optical fiber. 2. Determination of the particle size of the given powder using laser 3. Determination of wavelength of a given laser source - Grating method	

UNIT-V QUANTUM MECHANICS	[9 hours]
Photons and light waves - Electrons and matter waves- Dual Nature of Light –-De Broglie Waves-Compton effect - The Schrodinger equation (Time dependent and time independent forms) - Physical Significance of wave function - Normalization –Free particle - particle in a infinite potential well: 1D,2D and 3D Boxes- Normalization-quantum computation.	
Practical Topics: 1, Young's Double Slit Experiment to demonstrate the wave nature of particles	

Laboratory component: **(30 Hours)**

Any ten experiments have to be completed from the following list ofExperiments

Sl. No	Name of the experiment
1.	Apply parallel axis theorem to find the resultant of system of concurrent coplanar forces.
2.	Torsional pendulum – Determination of rigidity modulus of wire and moment of inertia of disc
3.	Compound pendulum- Determination of moment of inertia of a rigid rod.
4.	Apply the concept of bending of beams to find the Young's modulus of a given material- by Non uniform bending method
5.	Apply the concept of bending of beams to find the Young's modulus of a given material- by Uniform bending method.
6.	Determination of V-I characteristics of a solar cell.
7.	Using Ohm's law verify the laws of resistances .
8.	Using optical fiber find the acceptance angle and numerical aperture.
9.	Make use of the laser source find the particle size of the given powder.
10.	Determination of wavelength of a given laser source - Grating method
11.	Spectrometer – Determination of wavelength of Hg spectrum using grating
12.	Spectrometer – Dispersive power of the prism
13.	Determination of magnetic Induction due to long current carrying conductor.
14.	Make use of the Young's Double Slit Experiment, demonstrate the wave nature of particles.
15.	Spectrometer – Angle of the prism

Course outcomes: On completion of the course, the student will have the ability to:

CO No	Corse Outcomes	Level
CO1	Apply the concepts of Mechanics in materials.	K3
CO2	Apply the concept of elasticity in beams.	K3
CO3	Apply the concept of electromagnetic waves in communication.	K3
CO4	Illustrate the applications of different lasers &Calculate the acceptance angle and numerical aperture of an optical fiber .	K2
CO5	Explain the quantum concepts and quantum computation.	K2

COs and POs Mapping

COs	POs										
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2	2	-			-	-	-	-	-	1
CO2	3	2	2	-	1		-	-	-	-	-	1
CO3	3	2	2	-	1	1	-	-	-	-	-	1
CO 4	3	1	1	-	1	1	-	-	-	-	-	1
CO 5	3	1	1	-			-	-	-	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped

Scheme of Evaluation

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	60	100	25
	CIE – II	100			
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

TEXT BOOKS:

1. D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw Hill Education (Indian Edition), 2017.
2. E.M.Purcell and D.J.Morin, Electricity and Magnetism, Cambridge Univ.Press, 2013.
3. Bhattacharya, D.K. & Poonam, T. "Engineering Physics". Oxford University Press, 2015

REFERENCES:

1. R.Wolfson. Essential University Physics. Volume 1 & 2. Pearson Education (Indian Edition),2009.
2. Paul A. Tipler, Physic – Volume 1 & 2, CBS, (Indian Edition), 2004.
3. K.Thyagarajan and A.Ghatak. Lasers: Fundamentals and Applications, LaxmiPublications,(Indian Edition), 2019.
4. D.Halliday, R.Resnick and J.Walker. Principles of Physics, Wiley (Indian Edition), 2015.

NPTEL COURSE:

Sl.No	Course Name	Course Instructor	Course Conducting Agency
1	Quantum Mechanics	Prof .P.Ramadevi	IIT -Bombay

Web links and Video Lectures (e-Resources):

ELASTICITY

https://youtu.be/eICv1p8WjgI?si=88hhiQw_fld7ZrBU

MAXWELL’S EQUATIONS AND ELECTROMAGNETIC WAVES

https://youtu.be/3IPVZYf7C-U?si=PnP1nupcfGfr1C76

LASERS &FIBER OPTICS

https://youtu.be/Ab1nxxkgjH8?si=KR2GS8iBUFayBwd

pQUANTUM MECHANICS

https://youtu.be/AEedn_NiWN0?si=Y27pAqawlwKmthNO

Skill Assessment:

1. Explain the concept behind the balance a water bottle on a edge.
2. The leaning Tower of Pisa is able to stand tilted without toppling, what is the reason behind it.
3. Apply the elasticity concept to find the fatigue change in plastic fiber and natural fiber
4. Radio antennas emit visible light, Why?
5. What does an opaque substance do when light rays fall on it.
6. Illustrate the things happen when light falls on a piece of black paper.
7. Explain the dual nature of matter.
8. Optical Fiber is used in hard to reach places in mechanical inspection explain it.
9. Is quantum communication faster than the speed of light?
10. Compare electron microscope & tunneling microscope.

Course Code	24CY101	Cours eTitle:	ENGINEERING CHEMISTRY (Common to ALL Branches)
Credits:	4	L – T – P	3-0-2

Course objectives: ➢ To provide a comprehensive understanding of water quality parameters, water treatmenttechniques and wastewater systems. ➢ To use the fundamental science and engineering principles relevant to materials that includescharacterization, properties and processing of engineering materials. ➢ To familiarize with the principles, working and applications of electrochemistry and storagedevices for safe, effective and efficient operations. ➢ To study, measure, monitor, control and prevent corrosion processes, economically andsafely. ➢ To classify different types of fuel and fuel analysis techniques that assists to choose mostconvenient fuel for a process involving combustion.
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. Blended Mode of Learning 3. Experiential Learning 4. NPTEL and Other Videos for theory topics 5. Flipped Class 6. Lab Experiment Videos

UNIT-1 WATER TREATMENT	[9 hours]
Water Sources- Water Quality parameters - Hardness of water – types-units and calcium carbonate equivalent. -Determination of hardness of water by EDTA method. Scale and sludge, caustic embrittlement, priming and foaming and boiler corrosion. Water softening methods – internal and external conditioning –zeolite process and ion exchange process. Desalination – reverse osmosis andelectro dialysis- Municipal water treatment and waste water treatment process.	
Practical Topics: 1. Determination of total hardness by EDTA method. 2. Estimation of alkalinity by Indicator method. 3. Estimation of chlorine content in water sample by Argentometric method. 4. Determination of BOD in water samples.	

UNIT-2 CHEMISTRY OF ENGINEERING MATERIALS	[9 hours]

Adhesives: Introduction- requisites of a good adhesive-adhesive action- industrial applications of adhesives. **Insulating Materials**: Introduction- requirements- Glass and ceramics - preparation, properties andapplications - fabrication of ceramic ware. **Lubricants-**Classification of lubricants with examples-characteristics of a good lubricants - mechanism of lubrication (thick film, thin film and extreme pressure) - properties of lubricants: viscosity, cloud point, pour point, flash point and fire point**.** **Electronic materials:** Introduction-types, properties and applications of semiconducting materials and transistors, materials used in IC's, fibers and cables- properties and applications, organic solar cells - types and applications.
Practical Topics: 1. Determination of viscosity of oils using Oswald viscometer. 2. Determination of cloud point and pour point of oils.

UNIT-3 ELECTROCHEMISTRY	[9 hours]
Introduction – Electrode potential – Nernst equation and problems - Electrochemical series - Conductometric titrations (acid - base & precipitation titration) **Electrodes:** Construction, working and applications of Standard and reference electrode (Hydrogen & Calomel) – Ion selective (glass electrode) – determination of pH using glass electrode. Batteries and Fuel Cells – Types of batteries —dry cell -Lead Storage battery–Nickel-Cadmium Battery – Lithium battery – Battery hazards - Biological Batteries. Fuel Cells – Hydrogen-Oxygen FuelCell.	
Practical Topics: 1. Estimation of strength of hydrochloric acid by pHmetry. 2. Determination of strength of acids in a mixture of acids using conductivity meter. 3. Determination of charging and discharging rate of batteries.	

UNIT-4 CORROSION AND ITS CONTROL	[9 hours]
Corrosion – causes, factors, types, Chemical and Electrochemical Corrosion (Galvanic, Differential aeration) –galvanic series-factors influencing rate of corrosion-measurement of corrosion. Determination of corrosion rate by weight loss method. Control Methods-Electrochemical protection – Sacrificial Anodic method – Impressed Current Cathodic Protection – Corrosion Inhibitors – Bio corrosion Protective Coatings – Paints, Constituents, Functions- Surface coating - Surface preparation for metallic coatings, Electroplating and Electro-lessPlating- ceramic coatings, thermal vaporization coating, HVOF coating	
Practical Topics: 1. Estimation of the Ferrous ions in mild steel by Spectrophotometry. 2. Determination of rate of corrosion of by weight loss method	

UNIT-5 FUELS AND COMBUSTION	[9 hours]
Fuels: Introduction: Classification of fuels; solid fuel -Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Liquid fuels -Manufacture of synthetic petrol –hydrogenation of coal (Bergius process), Knocking – octane number, diesel oil – cetane number; Power alcohol and biodiesel. Combustion of fuels: Introduction: Calorific value – higher and lower calorific values, Theoretical calculation of calorific value by Dulong's formula - Ignition temperature: spontaneous ignition temperature, Explosive range; Flue gas analysis – ORSAT Method.	
Practical Topics: 1. Determination of flash point and fire point of fuels. 2. Determination of charging and discharging rate of batteries.	

Laboratory component: **[30 hours]**

Any ten experiments have to be completed from the following list of experiments

Sl.No.	Name of the experiment
1	Determine the total hardness of water sample by EDTA method.
2	Analyze the alkalinity of water sample by Indicator method.
3	Analyze the chlorine content in water sample by Argentometric method.
4	Determine the BOD of water samples.
5	Describe the procedure to determine the viscosity of oil using an Oswald viscometer.
6	Identify the cloud point and pour point of oils.
7	Make use of glass electrode to determine the strength of hydrochloric acid.
8	Make use of conductivity meter to determine the strength of acids in a mixture of acids.
9	Determine quantitatively the amount of Ferrous ions in mild steel by Spectrophotometry.
10	Determine the of rate of corrosion of by weight loss method.
11	Describe the procedure to determine the flash point and fire point of fuels.
12	Conduct a study to find out the charging and discharging rate of batteries.

Course outcomes: On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest cognitive level
CO1	Analyze the water quality parameters and choose appropriate water treatment methods for use in industries and daily life.	K4
CO2	Make use of the applications of the materials in different engineering disciplines.	K3
CO3	Utilize the principles of electrochemistry and find the materials for energy	K4

	conversion and storage.	
CO4	Determine the corrosion rate to propose suitable protection methods for environmental considerations	K3
CO5	Choose suitable fuels for engineering processes and automobile applications.	K3

COs and POs Mapping

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**Terminal Examination**
	1	**2**	
Remember	10	10	10
Understand	30	30	30
Apply	40	40	40
Analyze	20	20	20
Evaluate	0	0	0
Create	0	0	0

COs	**Highest Cognitive Level**	**POs**											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	K4	2	2				1						
CO2	K3	2	1										
CO3	K4	2	1										
CO4	K3	2	2	1			2	2					
CO5	K3	2	1										

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE) -	CIE – I	100	60	100	25
	CIE – II	100			

Theory	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	**100**

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Jain P.C. and Jain M, Engineering Chemistry, Dhanpat Rai Publishing Company, New Delhi, 17th Edition,2021.
2. Dara S S and Umare S.S, A Text Book of Engineering Chemistry, S.Chand & Company Limited, 20thEdition, 2018.

Reference Books:

1. Benjamin M. M, Water Chemistry, Waveland Press, 2nd Edition, 2019.
2. Cicek V, Corrosion Engineering, Springer Publishing, 1st Edition, 2021.
3. Shahinpoor. M, Fundamentals of Smart Materials, Publisher: Royal Society of Chemistry, 1st Edition,2020.
4. Berg H, Bernhardsson S, and Johansson P, Electric Vehicle Batteries: Moving from Research towardsInnovation, Publisher: Springer, 1st Edition, 2019.
5. B.K.Sharma “Engineering chemistry” Krishna Prakasan Media (P) Ltd., Meerut (2014).

Web links and Video Lectures (e-Resources):

1. Water and wastewater treatment - https://onlinecourses.nptel.ac.in/noc23_ce12/preview
2. SemiconductorDevices and circuits. - https://nptel.ac.in/courses/108108112
3. Corrosion ProtectionMethods - https://onlinecourses.nptel.ac.in/noc2

3_mm01/preview

4. Elementary Electrochemistry - https://onlinecourses.nptel.ac.in/noc23_cy19/preview
5. Fuel and combustionTechnology - https://archive.nptel.ac.in/courses/103/105/103105110/

Suggested Skill Activities:

1. Measure the TDS, PH & electrical conductivity of a home water.
2. Removal of temporary hardness of any water sample by suitable method.
3. Find the charging and discharging rate of mobile batteries when it is use or not.
4. The need of engineering material is essential in our day today life. - Justify the answer.
5. Measure the corrosion rate of iron bar when it is exposed in the environment.
6. List out the recent engineering materials used in emerging field.
7. Calculate the higher and lower calorific value of a fuel by using Dulong's formula.
8. List out the type of coatings applied on materials which are used in our daily life.
9. Improper disposal of batteries leads to environmental hazard. Suggest the suitable disposable method.
10. Pure Iron material undergo corrosion more fast than other materials. Give reasons.

Course Code:	**24ME201**	**Course Title:**	**ENGINEERING GRAPHICS AND DESIGN**
Credits:	**3**	**L – T – P**	**1-0-4**

Course objectives:

To impart knowledge on the

- To enable students to understand the standards and conventions of engineering drawing.
- To enhance the visualization skills to understand objects in the respective positions withrespect to principal planes.
- To comprehend general projection theory, with emphasis on orthographic projection torepresent three-dimensional objects in two-dimensional views.
- To emphasize freehand sketching and pictorial view to aid in the visualization process and toefficiently communicate ideas graphically.
- To Introduce CAD software for the creation of 3D models and 2D engineering drawings.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. NPTEL and Other Videos
3. Smart Class Room
4. Field visit
5. Project based learning
6. Industrial Visit

UNIT I - DRAWING FUNDAMENTALS, GEOMETRIC CONSTRUCTION, PROJECTION OF POINTS, STRAIGHT LINES AND PLANES	**[15 hours]**
Drawing BIS standards – Orthographic projections – First angle projection - Drawing instruments – Sheet layout – Conventions – Lines, Lettering, Numbering and Dimensioning Geometric construction – Construction of regular polygons – Conic sections – Ellipse, Parabola andHyperbola by eccentricity method. Projection of points – Points situated in all four quadrants. Projection of straight lines – Straight lines inclined to both principal planes – Finding true length of the line and true inclinations with respect to principal planes – Rotating line method. Projection of planes – Introduction – Polygonal lamina and Circular lamina - Orientation of planes - Plane parallel to both principal planes, Planes perpendicular to both principal planes and Planes inclined to both principal planes – Rotating object method. Orthographic projection of simple engineering components.	
UNIT II - PROJECTION OF SOLIDS	**[15 hours]**

Projection of solids – Introduction – Types of solids – Polyhedra and solids of revolution - Projectionwith axes inclined to one of the principal planes and parallel to other – Change of Position method. 2D drafting - Basic commands – Coordinate systems, Object section methods. Line, Circle, Polyline,Rectangle, Hatch, Fillet, Chamfer, Trim, Extend, Offset, Dim style – Annotation and Layering – Object snaps - 3D modelling – Basic commands – Extraction of multiple views – Part modelling of simple components - Utensils, Hand tools & Furniture etc. - Drawing views using 3D environment.

UNIT III - DEVELOPMENT OF SURFACES AND PICTORIAL PROJECTION	**[15 hours]**
Development of lateral surfaces of truncated Prisms, Pyramids, Cylinders and Cones– Parallel line methodand Radial line method. Pictorial Projection – Isometric projection – Introduction – Isometric scale – Isometric view of two right regular composite solids – Isometric projection of truncated frustum of solids – Box method. Problems onapplications of Isometric projections of simple objects / engineering components.	

UNIT IV- BASIC COMPUTER AIDED DRAWING APPLICATIONS	**[15 hours]**
Free hand Sketching - Sketching of geometry - multiple view projection from single pictorial view ofobjects – Illustrative examples - True free hand, Guided Free hand, Roads, Buildings, Utensils, Handtools & Furniture's etc. Drawing Simple Mechanisms - Bicycles, Tricycles, Gear trains, Ratchets, two-wheeler cart &Four-wheeler carts to dimensions etc.	

UNIT V- MULTIDISCIPLINARY APPLICATIONS AND PRACTICE	**[15 hours]**
Electric Wiring and lighting diagrams - Like, Automatic fire alarm, Call bell system, UPS system, Basicpower distribution system using suitable software. **Basic Building Drawing -** Draw various types of lines, graphical symbols for materials, doors and windows, symbols for sanitary, water supply and electrical installations and write abbreviations as per IS 962. Like, Architectural floor plan, basic foundation drawing, steel structures- Frames, bridges, trusses using Auto CAD or suitable software, **Electronics Engineering Drawings -** Like, Simple Electronics Circuit Drawings, practice on layers concept. **Graphs & Charts -** Like, Column chart, Pie chart, Line charts, Gantt charts, etc. using Microsoft Excel or any suitable software.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Apply principles of first angle projection in drafting plan and elevation of points, lines, planes,and solids.
CO2	Apply change of position method in the projection of solids and determine the true shape of thesection.
CO3	Apply principles of orthographic projection to extract 2D views from 3D drawing usingfreehand sketching.
CO4	Apply parallel line and radial line methods to develop lateral surfaces of solids so that studentscan understand applications in sheet metal design.
CO5	Apply box method to develop the isometric view of simple, truncated, and composite solids.
CO6	Develop simple part model in 3D and plan, elevation, and section of building using a designatedCAD software.

COs and POs Mapping:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	1	-	-	-	-	-	-	-	2	-	-	1	2	-
CO2	3	1	-	-	-	-	-	-	-	2	-	-	1	2	-
CO3	3	1	-	-	-	-	-	-	-	-	-	-	1	2	-
CO4	3	1	-	-	-	-	-	-	-	2	-	-	1	-	-
CO5	3	1	-	-	-	-	-	-	-	2	-	-	1	2	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	0	0	0
Understand	20	20	20
Apply	40	40	40
Analyze	0	0	0
Evaluate	0	0	0
Create	40	40	40

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. N.D.Bhatt,"Engineering Graphics", Charotor Publishing House, 53RD Edition 2019

2. Natrajan K.V., "A textbook of Engineering Graphics", Dhanalakshmi Publishers, Chennai(2015)

Reference Books:

1. Venugopal K. and Prabhu Raja V., "Engineering drawing + AutoCAD", New Age International (P) Limited (2022)
2. Lakhwinder pal singh, Harwinder Singh, "Engineering Drawing Principles and Applications", Cambridge University Press, 2021.
3. Cecil Johnson, Jay D Helsel and Dennis R Short, "Engineering Drawing and Design",Seventh Edition, McGraw Hill, 2007.
4. Patil, Rajashekar, "Computer Aided Engineering Graphics", New Age International Ltd,2018.
5. Chris Schroder, "Printed Circuit Board Design using AutoCAD", Newnes,1997.
6. K S Sai Ram, "Design of steel structures", Third Edition by Pearson.
7. A S Pabla, "Electrical power distribution", 6th edition, Tata Mcgrawhill.
8. K. R. Gopalakrishna, & Sudhir Gopalakrishna, "Textbook of Computer Aided EngineeringDrawing", 39th Edition, Subash Stores, Bangalore, 2017

Web Links and Video Lectures (E-Resources):

1. **http://nptel.ac.in/courses/112103019**
2. https://archive.nptel.ac.in/courses/112/105/112105294/

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 and 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 and SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 and SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

LABORATORY REQUIREMENTS

SYSTEM REQUIREMENTS (For a batch of 30 Students)

Hardware:

1. Intel i3 core due processor with 4GB ram with 500GB hard disk – 30 Nos.
2. Laser Printer – 1 No.

Software:

Drafting package – AutoCAD – Adequate license (Open source)

Suggested Skill Activities:

1. 2D drafting of plan and elevation of computer CPU.
2. 2D drafting of plan and elevation of a thermos flask.
3. 2D drafting of a plan and elevation of piston and cylinder.
4. Sketching the projections of a bicycle in freehand.
5. Sketching the projections of a stapler.
6. Cut and develop the lateral surface of a funnel.
7. Cut one edges vertically and develop the lateral surface of CPU cabin.
8. Cut and develop the lateral surfaces of elbow of a pipe.
9. Draw the isometric view of a simple bread toaster.
10. Draw the isometric view of the computer table.
11. Sketch the assembled view of the screw jack using the orthographic projections of its components.
12. Draft the plan, elevation and section of your home using CAD.
13. Draft the plan, elevation and section of 2 storey office building using CAD.
14. Develop the 3D model of the (a) and (b).

Course Code:	**24CS201**	**Course Title:**	**PROGRAMMING FOR PROBLEM SOLVING USING C**
Credits:	**4**	**L – T – P**	**2-0-4**

Course objectives:

To impart knowledge on the

- To gain knowledge on problem solving techniques
- To learn how to write simple and modular C programs
- To develop C programs using arrays and strings
- To learn the usage of pointers in accessing and manipulating memory
- To develop applications in C using structures & files

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Classroom
8. Flipped Class

UNIT1 - BASICS OF C PROGRAMMING	[6 hours]
Problem Solving Techniques: Introduction to Algorithm, Pseudo code, Flow Chart, Structure of 'C' program. C Tokens: Keywords, Data Types, Constants, Variables - Declaration - Qualifiers – typedef	
Practical Topics: 1. Steps in Problem Solving Drawing flowchart using yEd tool/Raptor Tool programs using simple statements. 2. Programs to illustrate the use of user-defined data types	

UNIT II – BASIC CONSTRUCTS IN C	[6 hours]
Managing simple Input and Output operations - Operators and Expressions - Decision Making: Branching statements, looping statements - Function: Declaration, Definition - Passing arguments by value - Recursion - Storage classes	
Practical Topics: 1. Programs using decision making statements 2. Programs using looping statements 3. Programs using user defined functions and recursive functions	

UNIT III – ARRAYS AND STRINGS IN C	[6 hours]
Arrays: Initialization - One dimensional, Two dimensional, and Multi-dimensional arrays - String: Basics, declaring and initializing strings, string handling functions: standard and user defined functions	
Practical Topics: 1. Build programs using arrays and array-based operations. 2. Programs using one dimensional and two dimensional arrays. 3. Implementations involving array usage for string operations.	

UNIT IV – POINTERS IN C	[6 hours]
Pointers - Passing arguments by address - Dynamic Memory Allocation - Pointer arithmetic - Pointers and one dimensional array - Pointers and Multi-Dimensional Array: Array of Pointers, Pointer to Pointer, Pointer to an array - void Pointer - Pointer to function	
Practical Topics: 1. Implementations involving pointers for dynamic memory allocation 2. Implementations involving pointers for string manipulation.	

UNIT V – STRUCTURES, UNIONS AND FILE HANDLING IN C	[6 hours]
Structure: Declaration, Definition-Array of Structures - Pointer to Structure – Nested Structures- Union: Defining union, Accessing union members. Files: File Management functions, Random access in file- Working with Text Files and Binary Files	
Practical Topics: 1. Programs to implement structures 2. Programs to implement union 3. Programs to implement various file operations.	

Laboratory Component: **[45 hours]**

Any 12 experiments have to be completed from the following list of experiments.

S.No.	Name of the Experiment
1	Steps in Problem Solving Drawing flowchart using yEd tool/Raptor Tool programs using simple statements
2	Programs to illustrate the use of user-defined data types
3	Programs using decision making statements
4	Programs using looping statements
5	Programs using user defined functions and recursive functions
6	Build programs using arrays and array-based operations.
7	Programs using one dimensional and two dimensional arrays.
8	Implementations involving array usage for string operations.
9	Implementations involving pointers for dynamic memory allocation
10	Implementations involving pointers for string manipulation.
11	Programs to implement structures
12	Programs to implement union
13	Programs to implement various file operations

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Make use of problem solving techniques to solve real world problems & outline the structure of C program
CO2	Identify the appropriate looping and control statements in C and develop applications using these statements
CO3	Make use of arrays & strings in development of simple applications
CO4	Apply the concepts of pointers and develop C programs using pointer
CO5	Develop programs for storing, retrieving and processing data using structures and files.

COs and POs Mapping

COs	**POs**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	**3**	**2**	2	-	1	-	-	-		-	-	1
CO2	**3**	**2**	2	-	1	-	-	-		-	-	1
CO3	**3**	**3**	2	1	1	-	-	-		-	-	1
CO4	**3**	**2**	2	1	1	-	-	-		-	-	1
CO5	**3**	**3**	3	1	1	-	-	-		-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	15	50	50
	Lab Exam	100	35		
				Total	100

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	20	20	20
Understand	20	20	20
Apply	60	60	60
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2015.
2. Pradip Dey, Manas Ghosh, "Programming in C", AICTE Edition, Oxford University Press, 2018

Reference Books:

1. Yashavant P. Kanetkar, "Let Us C : Authentic guide to C programming language", Eighteenth Edition, BPB Publications, 2021

2. Ashok N Kamthane, Programming in C, Pearson, Third Edition, 2020
3. Reema Thareja, "Programming in C", Oxford University Press, Second Edition, 2016.
4. Paul Deitel and Harvey Deitel, "C How to Program with an Introduction to C++", Eighth edition, Pearson Education, 2018.
5. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", 1st Edition, Pearson Education, 2013.
6. E.Balagurusamy, "Programming in ANSI C", seventh edition, Mc Graw Hill Education,2017

Web Links and Video Lectures (E-Resources):

- Introduction To Programming In C By Prof. Satyadev Nandakumar IIT Kanpur
- http://www.cprogramming.com/tutorial/c-tutorial.html
- http://www.tutorialspoint.com/cprogramming/index.htm
- https://www.geeksforgeeks.org/c-programming-language/
- http://www.w3schools.in/c

Suggested Skill Activities:

1. Steps in Problem Solving Drawing flowchart using yEd tool/Raptor Tool
2. Write a Program to calculate and display the volume of a CUBE having its height (h=10cm), width (w=12cm) and depth (8cm).
3. Ramya has bought 50 kg of onion for Rs 40 per kg and 60 kg of potato for Rs 20 per kg. Then she sold out all the stock with the selling price of Rs 60 per kg and Rs 30 per kg for onion and potato respectively. Write a C program which computes the profit gained by her.
4. A Food delivery boy needs to walk down every street in his area in order to deliver the food. Assume that the distances between the streets along the roads are given. The food delivery boy starts at the hotel and returns back to the hotel after delivering all the foods. Implement an algorithm to help the food delivery boy to walk minimum distance for the purpose.
5. Write a program to input name, marks of 5 subjects of a student and display the name of the student, the total marks scored, percentage scored and the class of result.
6. A location in a map is represented by a pair of points as x co-ordinate and y co-ordinate. Person X wants to move towards person Y which is residing in the location L1 and L2 respectively. Write C Program to find the distance between these two person .
7. If a four-digit number is input through the keyboard, write a program to obtain the sum of the first and last digit of this number.
8. Write a program to find GCD (greatest common divisor or HCF) and LCM (least common multiple) of two numbers
9. Write a Program to multiply two 3 X 3 Matrices

10. Write a program to create a structure named company which has name, address, phone and no Of Employee as member variables. Read name of company, its address, phone and no Of Employee. Finally display these members‟ value.
11. Write a program to create array of books. Collect various details of books such as topic, author, department. Collect details for N books and display the details of books based on department name or author
12. A class has strength of N students. The class has two mentors, one person for the odd roll numbers and the other for the rest. Write a C program which reads the roll numbers of all the students and gives two lists of roll numbers corresponding to each advisor
13. Write a C program to maintain the inventory details of items sold in a super market such as item id, name, no of items available, price per item. Perform efficient data storage based on user‟s demand at runtime
14. Write a C program to use binary files for maintaining a telephone directory which includes telephone no, Owner name and address. Here address includes details such as door no, street name, locality, city and pincode. Update the door no of all people belonging to a particular street as follows: Increment the old door no by 10 to get the new door no. (Eg: If the old door no is 13, update it as 23)

பாடநெறி குறியீடு:	**24GE201**	**பாடத்தின் தலைப்பு:**	தமிழரும் தொழில்நுட்பமும்
கிரெடிட்	**1**	**L – T – P**	**1-0-1**

பாடத்திட்டநோக்கங்கள்:

1. சங்ககாலத்து நெசவுத்தொழிலை விவரிப்பதற்கும் மட்பாண்டத்தொழில் நுட்பத்தைக் கண்டறிவதற்கும்.
2. சங்ககால கட்டுமானம், மேடை அமைப்பு, சிற்பங்கள், கோவில்கள், அம்மன்கோவில், திருமலைநாயக்கர் மஹால், செட்டிநாட்டு வீடுகள், இந்தோ - சாரோசெனிக் கட்டிடக்கலை ஆகியவற்றைக் கண்டறிந்து மேற்கோள் காட்ட.
3. கப்பல் கட்டுதல் மற்றும் இரும்புத் தொழிலைக் கண்டறிதல், சிலப்பதிகாரத்தில் நாணயங்கள், மணி தயாரிக்கும் தொழிற்சாலைகள், மணிகளின் வகைகள் ஆகியவற்றைப் படிக்க.
4. நீர்நிலைகளின் முக்கியத்துவத்தைகாட்ட, கால்நடை வளர்ப்பு மற்றும் கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகளை கண்காணிக்க, விவசாயம், மீன்பிடி, முத்து மற்றும் முத்துகலாச்சாரம் மற்றும் கடல் பற்றிய பண்டைய அறிவை அங்கீகரிக்க.

அறிவியல் தமிழின் வளர்ச்சி மற்றும் தமிழ்க்கணிப்பொறியின் வளர்ச்சியைக் கவனிக்க, இணையத்தில் தமிழ்மென்பொருள் மேம்பாடு, தமிழ் அகராதிகளை மேற்கோள் காட்ட.

அலகு I நெசவு மற்றும் பானைத்தொழில்நுட்பம்	[3 hours]
சங்ககாலத்தில் நெசவுத்தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்புபாண்டங்கள் - பண்டங்களில் கீறல் குறியீடுகள்	

அலகு II வடிவமைப்பு மற்றும் கட்டிடத்தொழில்நுட்பம்:	[3 hours]
சங்ககாலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்ககாலத்தில் வீட்டுப்பொருட்களில் வடிவமைப்பு - சங்ககாலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடைஅமைப்பு பற்றியவிவரங்கள் - மாமல்லபுரச்சிற்பங்களும், கோவில்களும் - சோழர்காலத்துப் பெருங்கோவில்கள் மற்றும் வழிபாட்டுத்தலங்கள் - நாயக்கர்காலக்கோயில்கள் மாதிரி கட்டமைப்பு பற்றி அறிதல்,மதுரைமீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலைநாயக்கர்மஹால் - செட்டி நாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ - சாரோசெனிக் கட்டிடக்கலை	

அலகு III உற்பத்தித் தொழில்நுட்பம்	[3 hours]
கப்பல் கட்டும் கலை - உலோகவியல் - இரும்பு தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு வரலாற்றுச்சான்றுகளாக செம்பு மற்றும் தங்கநாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சங்கு மணிகள் - எலும்புத்துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.	

அலகு IV வேளாண்மை மற்றும் நீர்பாசனத்தொழில்நுட்பம்	[3 hours]
அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக்கு குமுழித்தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மைச்சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன் வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்	

அலகு V அறிவியல் தமிழ் மற்றும் கணிதத்தமிழ்	[3 hours]
அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி -தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ்மென்பொருள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.	

பாடநெறி முடிவுகள் (பாமு):

பாடநெறியின் முடிவில், மாணவர் பின்வரும் திறன்களைப் பெறுவர்:

பாமு	**பாடநெறி முடிவுகள்**	**மிக உயர்ந்த அறிவாற்றல் நிலை**
அலகு I பாமு:	சங்க கால ஜவுளி தொழில் மற்றும் மட்பாண்ட தொழில்நுட்பம் பற்றி அறிவார்கள்.	கே 1
அலகு II பாமு:	சங்க கால கட்டுமானம், மேடை அமைப்பு, சிற்பங்கள், கோவில்கள், அம்மன் கோவில், திருமலை நாயக்கர் மஹால், செட்டிநாட்டு வீடுகள், இந்தோ-சராசனிக் கட்டிடக்கலை ஆகியவற்றை விவரிக்க இயலும்.	கே 2
அலகு III பாமு:	கப்பல் கட்டுதல், இரும்புத் தொழில், நாணயம் தயாரித்தல் மற்றும் மணி தயாரிக்கும் தொழில்கள் பற்றி அறிந்து கொள்கிறார்கள்.	கே 1
அலகு IV பாமு:	நீர்நிலைகளின் முக்கியத்துவம், கால்நடை வளர்ப்பு, கிணறு, விவசாயம், மீன்பிடி, முத்து மற்றும் முத்து கலாச்சாரம் மற்றும் கடல் பற்றிய போதுமான அறிவை பெற்றுகொள்கிறார்கள் .	கே 1
அலகு V பாமு:	அறிவியல் தமிழின் வளர்ச்சி, தமிழ்க் கணிப்பொறியின் வளர்ச்சி, இணையத்தில் தமிழ் மென்பொருள் மேம்பாடு, தமிழ் அகராதிகளை சந்தேகம் இன்றி முழுமையாக தெரிந்து கொள்கிறார்கள்.	கே 1

பாடநெறி முடிவுகள் மற்றும் நிரல் முடிவுகள் ஒப்பிடுதல்

பாமுகள்	மிக உயர்ந்த அறிவாற்றல் நிலை	**பாடநெறி முடிவுகள்**											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
பாமு**1**	கே 1	**2**	-	-	-	-	-	-	-	-	-	-	-
பாமு**2**	கே 2	**1**	-	-	-	-	-	-	-	-	-	-	-
பாமு**3**	கே 1	**1**	-	-	-	-	-	-	-	-	-	-	-
பாமு**4**	கே 1	**1**	-	-	-	-	--	-	-	-	-	-	-
பாமு**5**	கே 1	**1**	-	-	-	-	-	-	-	-	-	-	-

நிலை 3- அதிக ஒத்துப்போதல், நிலை 2- மிதமாக ஒத்துப்போதல், நிலை 1- குறைவாக ஒத்துப்போதல், நிலை 0- ஒத்துப்போகவில்லை

மதிப்பீட்டுத் திட்டம்:

கூறுகள்	மதிப்பீட்டின் வகை	அதிகபட்ச மதிப்பெண்கள்	குறைக்கப்பட்ட மதிப்பெண்கள்	இறுதி மதிப்பெண்கள்
தொடர்ச்சியான உள் தேர்வு	தொடர்ச்சியான உள் தேர்வு - I	100	40	40
	தொடர்ச்சியான உள் தேர்வு - II	100	40	
இறுதி பருவ தேர்வு	எழுத்து தேர்வு	100	60	60
மொத்தம்				100

மதிப்பீட்டு முறை

ப்ளூமின் வகை	தொடர்ச்சியான மதிப்பீட்டு சோதனைகள்		இறுதி தேர்வு
	1	2	
நினைவில் கொள்ளுதல்	60	50	60
புரிந்து கொள்ளுதல்	40	50	40
விண்ணப்பித்தல்	0	0	0
பகுப்பாய்வுதல்	0	0	0
மதிப்பிடுதல்	0	0	0
உருவாக்குதல்	0	0	0

இறுதி பருவ தேர்வு: (கேள்வி முறை)

- ஒவ்வொரு யூனிட்டும் இரண்டு 2 மதிப்பெண் வினாக்களையும் ஒரு 16 மதிப்பெண் வினாவையும் (இரண்டில் ஒன்று) கொண்டுள்ளது.
- பதினைந்து கேள்விகளுக்கும் பதிலளிக்க வேண்டும்

CourseCode:	**24GE101**	**Course Title:**	**Heritage of Tamils**
Credits:	**1**	**L – T – P**	**1-0-0**

COURSE OBJECTIVES:

1. To describe the textile industry of the Sangam period and trace the pottery technique.
2. To identify and quote Construction in the Sangam period, platform structure, sculptures, temples, Amman temple, ThirumalaiNayakar Mahal, Chettinad houses, Indo-Saracenic architecture.
3. Finding Shipbuilding and iron industry, to read minting of coins, bell making factories, types of bells in Silapathikaram.
4. To show the Importance of water bodies, to observe Cattle rearing and Wells designed for cattle, to recognize Agriculture, Fisheries, Pearl and pearl culture and Ancient knowledge of the sea.

- To observe Development of Scientific Tamil and Development of Tamil computing, to quote Tamil Software Development, Tamil Dictionaries on the Internet.

UNIT I WEAVING AND CERAMIC TECHNOLOGY	**[3hours]**
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.	

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY	**[3hours]**
Designing and Structural construction House & Designs in household materials during Sangam Age – Building materials and Hero stones of Sangam age – Details of Stage Constructions in	

Silappathikaram – Sculptures and Temples of Mamallapuram – Great Temples of Cholas and other worship places – Temples of Nayaka Period – Type study (Madurai Meenakshi Temple)- ThirumalaiNayakar Mahal – Chetti Nadu Houses, Indo – Saracenic architecture at Madras during British Period.

UNIT III MANUFACTURING TECHNOLOGY	[3hours]
Art of Ship Building – Metallurgical studies – Iron industry – Iron smelting, steel -Copper and gold - Coins as source of history – Minting of Coins – Beads making-industries Stone beads - Glass beads – Terracotta beads -Shell beads/ bone beats – Archeological evidences – Gem stone types described in Silappathikaram	

UNIT IV THINAI CONCEPT OF TAMILS	[3hours]
FloraandFaunaofTamils&AhamandPuramConceptfromTholkappiyamandSangamLiterature – Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports ofSangam Age -ExportandImportduringSangam Age- Overseas Conquestof Cholas.	

UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING	[3hours]
Development of Scientific Tamil – Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.	

Course outcomes:

On completion of the course, the student will have the ability to:

COs	Course Outcomes	Highest cognitive level
CO1	Know about Sangam period textile industry and pottery technology.	K1
CO2	Able to describe Sangam period construction, platform structure, sculptures, temples, Amman temple, Tirumala Nayakkar Mahal, Chettinad houses, Indo-Saracenic architecture.	K2
CO3	Learn about the shipbuilding, iron industry, coinage and bell making industries	K1
CO4	Acquire adequate knowledge about the importance of water bodies, animal husbandry, wells, agriculture, fishing, pearl and pearl culture and the sea	K1
CO5	Learn Scientific Tamil Development, Tamil Computer Development, Tamil Software Development on the Internet, Tamil Dictionaries without a doubt.	K1

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	60	50	60
Understand	40	50	40
Apply	0	0	0
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

COsand POs Mapping

COs	Highest Cognitive Level	POs											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	K1	**2**	-	-	-	-	-	-	-	-	-	-	-
CO2	K2	**1**	-	-	-	-	-	-	-	-	-	-	-
CO3	K1	**1**	-	-	-	-	-	-	-	-	-	-	-
CO4	K1	**1**	-	-	-	-	--	-	-	-	-	-	-
CO5	K1	**1**	-	-	-	-	-	-	-	-	-	-	-

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Final marks
Continuous Internal Examination (CIE)	CIE– I	100	40	40
	CIE–II	100	40	
End Semester Examination (ESE)	Theory Exam	100	60	60
Total				100

End semester Examination:(QPPATTERN)

- Each unit consists of two2 marks questions and one16marks question(either or).
- All the fifteen questions have to be answered.

TEXT BOOKS

1. .தமிழகவரலாறு - மக்களும்பண்பாடும் - கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்).
2. கணினித்தமிழ் - முனைவர்இல. சுந்தரம். (விகடன்பிரசுரம்).
3. கீழடி - வைகைநதிக்கரையில்சங்ககாலநகரநாகரிகம் (தொல்லியல்துறைவெளியீடு)
4. பொருநை - ஆற்றங்கரைநாகரிகம். (தொல்லியல்துறைவெளியீடு)
7. SocialLifeofTamils(Dr.K.K.Pillay)AjointpublicationofTNTB&ESCandRMRL–(inprint)
8. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute ofTamilStudies.

REFERENCEBOOKS

1.Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by:InternationalInstituteof TamilStudies).

2.The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute ofTamilStudies.)

3.Keeladi-‘SangamCityCivilizationonthebanksofriverVaigai’(JointlyPublishedby:Department ofArchaeology&TamilNaduTextBookandEducationalServicesCorporation,TamilNadu)

4.Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: TheAuthor)

5.Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text BookandEducationalServicesCorporation,TamilNadu)

6.JourneyofCivilizationIndustoVaigai(R.Balakrishnan)(Publishedby:RMRL)–ReferenceBook

Course Code:	24MA201	Course Title:	COMPLEX VARIABLES AND TRANSFORMS (COMMON TO ALL BRANCHES)
Credits:	4	L – T – P	3 – 1 – 0

Course objectives:

- To impart analytical ability in solving mathematical problems as applied to the respective branches of Engineering.
- To familiarize the students with complex integration techniques and contour integration techniques which can be used in real integrals.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.

Teaching-Learning Process:

These are sample strategies which teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method does not mean only traditional method, but different type of teaching methods may be adopted to develop the outcomes.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Topics will be introduced in a multiple representation and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT I – COMPLEX DIFFERENTIATION	[12 hours]
Function of a complex variable – Analytic functions – Necessary conditions and sufficient conditions (excluding proof) – Cauchy – Riemann equations — Properties of analytic function – Harmonic conjugate – Construction of Analytic functions - Conformal mapping: w = z+a, az, 1/z, and bilinear transformation.	
UNIT II – COMPLEX INTEGRATION	**[12 hours]**
Statement and application of Cauchy's integral theorem and integral formula – Taylor and Laurent expansions – Isolated singularities – Residues - Cauchy's residue theorem. Applications: Contour integration over unit circle and semicircular contours (excluding poles on axis).	

UNIT III – LAPLACE TRANSFORMS	[12 hours]
Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems – Transforms of derivatives and integrals – Initial and Final Value Theorem – Inverse Laplace Transform – Convolution Theorem (Statement only) – Solution of linear second order Ordinary differential equations with constant coefficients using Laplace transforms.	

UNIT IV – FOURIER SERIES AND FOURIER TRANSFORMS	[12 hours]
Dirichlet's conditions – General Fourier series – Odd and even functions – Half range series – Harmonic analysis - Statement of Fourier integral theorem – Fourier transform pair – Parseval's identity.	

UNIT V – PARTIAL DIFFERENTIAL EQUATION	[12 hours]
Formation of partial differential equations - Classification of partial differential equations - Solutions of one dimensional wave equation, One dimensional heat equation (excluding insulated ends) – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges).	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Construct analytic functions and use their conformal mapping property in Engineering problems.
CO2	Solve real and complex integrals using the Cauchy's integral formula and residue theorem.
CO3	Apply Laplace transforms techniques in system modelling, digital signal processing, process control, solving boundary value problems
CO4	Apply Fourier series to solve the steady state two-dimensional heat equation in cartesian coordinates.
CO5	Apply the effective mathematical tools for solutions of partial differential equations that model physical phenomena and engineering problems.

COs and POs Mapping:

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	2										
CO2	3	2										
CO3	3	2										
CO4	3	2	1									1
CO5	3	2	1									
CO6	3	2	1									1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final marks</th></tr>
<tr><td rowspan="5">Continuous Internal Examination (CIE)</td><td>CIE – I</td><td>100</td><td rowspan="2">50</td><td rowspan="5">100</td><td rowspan="5">40</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>MCQ</td><td>20</td><td>10</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td>End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>60</td><td>60</td><td>60</td></tr>
<tr><td colspan="5">Total</td><td>100</td></tr>
</table>

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	20	20	20
Understand	20	20	20
Apply	60	60	60
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
3. Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012
4. Kandasamy. P., Thilagavathy. K, and Gunavathy. K, Engineering Mathematics Volume I & II, S. Chand & Co, New Delhi, 2005.Reference Books:

Equivalent NPTEL/SWAYAM Courses

S. No.	Course Title	Course Instructor	Host Institute
1	Partial Differential Equations	Prof. Sivaji Ganesh	IIT Bombay
2	Introduction to Fourier Analysis	Prof. Parasar Mohanty	IIT Kanpur
3	Complex Analysis	Prof. Pranav Haridas	IIT Madras

Web Links and Video Lectures (E-Resources):

1. Analytic Functions, C-R Equations:
   https://www.nptelvideos.com/lecture.php?id=13416
2. Laplace Transform and its Existence:
   https://www.nptelvideos.com/lecture.php?id=13433
3. Taylor's, Laurent Series of f(z) and Singularities:
   https://www.nptelvideos.com/lecture.php?id=13431
4. Applications of Fourier Transform to PDEs:
   https://www.nptelvideos.com/lecture.php?id=13442

Course Code	**24PH202**	**Course Title:**	**APPLIED MATERIAL SCIENCE (Common to Mech, Civil & Agri)**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

- To study the electrical properties of materials including electron theory of metals.
- To familiarize with the properties of semiconductors, determination of charge carriers and device applications.
- Equipping the students to understand the applications of magnetic materials and dielectric materials.
- To impart knowledge on the processing and applications of new engineering materials
- To motivate the students towards the different material testing methods

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I CONDUCTING MATERIALS	[9 hours]
Classical free electron theory - Expression for electrical conductivity - Thermal conductivity, Wiede- Mann Franz law, Merits & Demerits of classical free Electron Theory - Quantum free electron theory - Electron in a metal – degenerate and non-degenerate states – Fermi-Dirac statistics– Density of energy states – Energy bands in solids – Electron effective mass.	

UNIT II SEMICONDUCTING MATERIALS	[9 hours]
Direct and indirect band gap semiconductors – Intrinsic Semiconductors - Carrier concentration in intrinsic semiconductors - Variation of Fermi level with temperature – extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors – Variation of Fermi level with temperature – Hall effect and devices- Ohmic contacts– Schottky diode.	

UNIT III MAGNETIC AND DIELECTRIC MATERIALS	[9 hours]
Magnetic materials – Classification (Dia , Para & Ferro) – Hysteresis – Ferrites - BaTiO3 – Application of Nd-FeB magnets. Electric polarization – Different types of polarization – Temperature and frequency dependence –Dielectric loss and dielectric breakdown – dielectric materials applications - capacitors and transformers	

UNIT IV SMART MATERIALS	[9 hours]
Metallic glasses - Shape memory alloys - Composites - Definition and Classification - Fiber reinforced plastics (FRP) and fiber reinforced metals (FRM) - Ceramics - Classification - Crystalline - Non Crystalline - Bonded - ceramics, Manufacturing methods - Slip casting - Isostatic pressing - Gas pressure bonding - Properties - thermal, mechanical, electrical and chemical ceramic fiber- Applications of ceramics in electronics.	

UNIT V MATERIALS TESTING	[9 hours]
Microscope-Magnification Power-Resolving Power-Optical & Electron Microscope-Difference between optical & Electron Microscope-Tunneling - Scanning Electron Microscope-Transmission Electron Microscope- Scanning Tunneling Microscope-hardness - Rockwell and Brinell hardness - Knoop and Vickers Micro hardness- spot test techniques	

Course outcomes: On completion of the course, the student will have the ability to:

CO No	Corse Outcomes	Blooms Level
CO1	Explain the electrical properties of materials.	K2
CO2	Apply the properties of semiconducting materials in electronics.	K3
CO3	Infer the properties of magnetic and dielectric materials for relevant electrical and electronics engineering applications.	K2
CO4	Utilize the smart materials in the field of Engineering..	K3
CO5	Make use of different testing methods for analyzing the properties of materials.	K3

COs and POs Mapping

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	2	1	1	-	-	-	-	-	-	-	-	1
CO2	3	2	1	-	-	-	-	-	-	-	-	1
CO3	2	1	1	-	-	-	-	-	-	-	-	1
CO4	3	2	1	-	-	-	-	-	-	-	-	1
CO5	3	2	1	-	-	-	-	-	-	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- NotMapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final marks</th></tr>
<tr><td rowspan="5">Continuous Internal Examination (CIE) - Theory</td><td>CIE – I</td><td>100</td><td rowspan="2">50</td><td rowspan="5">100</td><td rowspan="5">40</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>MCQ</td><td>20</td><td>10</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td>End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>60</td><td>60</td><td>60</td></tr>
<tr><td colspan="5">Total</td><td>100</td></tr>
</table>

Assessment Pattern

<table>
<tr><th rowspan="2">Bloom's Category</th><th colspan="2">Continuous Internal Examination</th><th rowspan="2">End semester Examination</th></tr>
<tr><th>1</th><th>2</th></tr>
<tr><td>**Remember**</td><td>20</td><td>20</td><td>20</td></tr>
<tr><td>**Understand**</td><td>60</td><td>40</td><td>40</td></tr>
<tr><td>**Apply**</td><td>20</td><td>40</td><td>40</td></tr>
<tr><td>**Analyze**</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>**Evaluate**</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>**Create**</td><td>0</td><td>0</td><td>0</td></tr>
</table>

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered

TEXT BOOKS:

1. S.O. Kasap. Principles of Electronic Materials and Devices, McGraw Hill Education(Indian Edition), 2020.
2. R.F.Pierret. Semiconductor Device Fundamentals. Pearson (Indian Edition), 2006.

3. O.P.Khanna. “Materials Science and metallurgy: Dhanpat Rai Publications,2011

REFERENCE BOOKS:

1. Jasprit Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw- HillEducation (Indian Edition), 2019.
2. Charles Kittel, Introduction to Solid State Physics, Wiley India Edition, 2019.
3. Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, Concepts of Modern Physics, McGrawHill (Indian Edition), 2017.

NPTEL COURSE:

Sl.No	Course Name	Course Instructor	Course Conducting Agency
1	Solid state Physics	Prof. Amal Kumar Das	IIT Kharagpur

WEB LINKS AND VIDEO LECTURES (E-RESOURCES):

1. Electrical Conductivity: https://www.youtube.com/watch?v=QvPSVwzU-8A
2. Band Theory of solids: https://www.youtube.com/watch?v=qcE2Wcpm05k&ab_channel=nptelhrd
3. Intrinsic semiconductor: https://www.youtube.com/watch?v=JZN3DAaeOB8
4. Brinell Hardness Test: https://www.youtube.com/watch?v=TM487F4p-YM
5. FRP: https://www.youtube.com/watch?v=tyKtUoQo9VM&list=PLbMVogVj5nJTnVBY4n3KHSPJsPDy38QS

Suggested Skill Activities:

1. As you look at materials and objects around your house Which do you think are conductors and insulators?
2. Identify the change when you connect a light bulb to battery using conductive materials?
3. What will happen if you connect a light bulb to battery using insulating materials?
4. List the usage of alphanumerical displays in day to life.
5. Compute the size variation and efficiency of the nano materials.
6. Illustrate the role of semiconductors in renewable energy technologies.
7. Explain the reason for using smart materials like SMA in retractable roofs.
8. List out 10 uses of magnetic materials in house.
9. Explain the testing methodology used in aerospace technology.
10. Discuss about the role of semiconductor in temperature sensors which is air conditioner.

Course Code:	**24CY401**	**Course Title:**	**ENVIRONMENTAL SCIENCE AND ENGINEERING**
Credits:	**2**	**L – T – P**	**2-0-0**

Course objectives:

To impart knowledge on the

- To gain in-depth knowledge on natural processes and resources that sustain life and govern economy.
- To know the importance of water resources which are important socially, economicallyviable and environmentally sustainable.
- To impart the Knowledge of pollution and its control methods.
- To mitigate the environmental and health risks associated with indiscriminate waste and find the suitable methodologies for waste management.
- To balance ecological, economic and social goals, such as reducing carbon emissions,promoting renewable energy and ensuring equitable resource access.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. NPTEL and Other Videos
3. Smart Class Room
4. Field visit
5. Project based learning
6. Industrial Visit

UNIT I - ECOLOGY AND BIODIVERSITY	**[6 hours]**
Definition, scope and importance of environment – need for public awareness – conceptof an ecosystem - Biodiversity and its values- Biodiversity at global, national and local level- India as a mega-diversity nation – hotspots of biodiversity – threats to biodiversity – endangered and endemic speciesof India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.	
UNIT II - WATER RESOURCES AND ENVIRONMENT MICROBIOLOGY	**[6 hours]**
Water resources: Use and over- utilization of surface and groundwater – dams benefits and problems, conflicts over water –Water availability at global level, surface level, ground level-Sources-Hydro phonics -Classification of microorganism –Role of microorganism in waste water treatment-Bacterial nutrition and growth.	

UNIT III -AIR AND NOISE POLLUTION	[6 hours]
Sources and classification of air pollutants and their effect on human health-Ambient airquality and emission standards-Air pollutants-Particulate matters-Control equipments- Gravity separator-Centrifugal separator-fabric filter-Electrostatic separator, Catalytic convertors– Noise pollution-causes – Consequences-Control measures- modern tools used in pollution mitigation measures-sustainable activity of pollution control- recent case studies - Environmental Protection Act.	

UNIT IV- SOLID WASTE AND HAZARDOUS WASTE MANAGEMENT	[6 hours]
Soil contaminants–sources and management methods of -Solid Waste Hazardous waste – Plastic waste- -Biomedical waste- Hazardous waste& E-waste management -Case studies on Occupational Health and Safety Management system (OHASMS).	

UNIT V-ENVIRONMENTAL MANAGEMENT AND SUSTAINABLE DEVELOPMENT	[6 hours]
Renewable and non-renewable energy Sources- Energy Polices- Development, GDP, Sustainability- concept, needs and challenges-economic, social and aspects of sustainability- Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment-Sustainable goals -Sustainable habitat- Green buildings, Green materials, Energy efficiency, Sustainable transports. Carbon emission-Carbon footprint- Carbon Sequestration.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Illustrate the important features of environment and its conservation.	K2
CO2	Explain the need of water resources and its application to meet the modern requirements and the necessity of its conservation.	K2
CO3	Identify the causes, effects of environmental pollution and explain the control techniques for particulate, gaseous emissions and contribute to the preventive measures in the society.	K3
CO4	Identify the different management methods of solid and hazardous waste.	K3

CO5	Explain the sustainability practices and identify green materials for sustainable development.	K2

COs and POs Mapping:

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	2					1	1					
CO2	1	1				1	1					
CO3	2					1	2	1				
CO4	1					2	2	1				
CO5	1					1	2	1				

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	60	100	40
	CIE – II	100			
	Skill Assessment – I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	20	20	30
Understand	60	40	30
Apply	20	40	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or)
- All the fifteen questions have to be answered.

Text Books:

1. Benny Joseph,Environmental Science and Engineering ‘, Tata McGraw-Hill, New Delhi, (2014).
2. Miguel Fischer,“Environmental Management: Ecosystems, Competitiveness and Waste Management” Nova Science Publishers, (2021)

Reference Books:

1. Dharmendra S.Sengar, ‘Environmental law ‘, Prentice hall of India Pvt Ltd, New Delhi, (2007).
2. Erach Bharucha, “Textbook of Environmental Studies”, Universities Press Pvt, Ltd, Hydrabad, (2015).
3. G.TylerMiller,Scott E.Spoolman,“Environmental Science”,Cengag Learning India Pvt.Ltd,Delhi, (2014).
4. Mahuabasu, Xavier saverimuthu, “Fundamentals of Environmental Studies”, Cambridge university press,(2017)
5. Anubha Kaushik , C.P. Kaushik, “Perspectives in Environmental Studies”, New Age International Pvt. Ltd, New Delhi, (2004). 6. Frank R. Spellman, “Handbook of EnvironmentalEngineering”, CRC Press, (2015).

Web Links and Video Lectures (E-Resources):

1. Ecology and Society**:** https://onlinecourses.nptel.ac.in/noc24_hs149/preview
2. Sustainable Power Generation Systems**:** https://onlinecourses.nptel.ac.in/noc24_ge54/preview
3. Environment and Development**:** https://onlinecourses.nptel.ac.in/noc24_hs150/preview

Suggested Skill Activities:

1. Why is it beneficial to follow a student centered and participatory process for environmental education?
2. Identify the endemic species of flora and fauna found nearest to your locality.
3. List the major arguments cited against the construction of dams.

4. Discuss how the symbiotic relationship between algae and bacteria is useful in the treatment of sewage in an oxidation pond.
5. List the various ways in which an individual can contribute towards pollution prevention in the society.
6. Mention any four hazardous wastes originating from households and explain their management strategies.
7. Conduct a survey and find out how chemicals and various material are distributed /cycled in your campus.
8. List the common organic materials that are suitable and unsuitable for composting.
9. List the advantages of recycling of MSW with examples.
10. What are the major obstacles in the implementation of incineration technology in developing countries

Course Code:	**24EE202**	**Course Title:**	**FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING**
Credits:	**4**	**L – T – P**	**3-0-2**

Course objectives: To impart knowledge on the • Basics of DC electric circuits and its analysis • Analysis of AC circuits and magnetic circuits • Working principles and application of DC machines and transformers • Digital devices and their characteristics • Functional elements and working of sensors and actuators used for smart systems.
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. Lab experiment videos 3. Blended Mode of Learning 4. Project based Learning 5. Experiential Learning 6. NPTEL and Other Videos 7. Smart Class Room 8. Flipped Class

UNIT I –DC CIRCUITS	[9 hours]
Introduction to DC Circuits – Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws –Nodal Analysis, Mesh analysis with independent sources only – Appliances.	
Practical Topics: 1. Model an electrical circuit and simulate it to verify Ohms Law. 2. Model an electrical circuit and simulate it to verify Kirchhoff's Voltage Law. 3. Model an electrical circuit and simulate it to verify Kirchhoff's Current Law.	

UNIT II – AC CIRCUITS AND MAGNETIC CIRCUITS	[9 hours]
Introduction to poly-phase circuits - Representation of sinusoidal waveform – peak and rms values, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations – Converters: rectifiers and inverters; Basics of magnetic circuits – Flux – Flux density – Magnetic resonance – Self-inductance – mutual-inductance – Coupling.	
Practical Topics: 1. Demonstrate the measurement of power in an RLC circuit using wattmeter method. 2. Interpret the DC output of an RLC circuit using half wave rectifier. 3. Interpret the DC output of an RLC circuit using full wave rectifier.	

UNIT III – DC MACHINES AND TRANSFORMERS	[9 hours]
Construction, principle of operation, characteristic and application – DC Motor and DC Generator, Types of DC motors and generators – Application: Electric Vehicle – Structure of electric power system – Introduction to single phase transformers – Construction, principle of operation, characteristics and application.	
Practical Topics: 1. Conduct the load test on DC shunt motor to outline its characteristics. 2. Outline the study on the starting methods of DC series motor. 3. Conduct a study on transformer construction for real-time applications.	

UNIT IV – DIGITAL ELECTRONICS	[9 hours]
Introduction to digital systems – Number system – Boolean Algebra – POS and SOP – Logic gates – K-map simplification – Flip Flops – Combinational logic circuits: adders – subtractors.	
Practical Topics: 1. Experiment with the logic gates to verify its truth table. 2. Make use of the logic gates to verify the functioning of half and full adders. 3. Make use of the logic gates to verify the functioning of half and full subtractors.	

UNIT V – SENSORS AND ITS APPLICATIONS	[9 hours]
Sensors in IoT – Mobile based sensors, Resistance Temperature sensor, Humidity sensor –Medical sensor – Neural sensor – Motion sensor – PIR sensor, Piezoelectric sensor, Air quality sensor – CO_2 Sensor, RFID sensor, Water leakage detection sensor, Light sensors - Introduction to actuators in automation – Applications: smart homes – smart cities – smart parking system.	

Practical Topics:

1. Utilize Arduino and Bluetooth module for automating home appliances.
2. UtilizeESP8266 processorfor automating home appliances.
3. Construct an Arduino based solar tracker for solar irradiation measurement.

Laboratory Component: **[30 hours]**

Any 12experiments have to be completed from the following list of experiments.

S.No.	Name of the Experiment
1	Model an electrical circuit and simulate it to verify Ohms Law.
2	Model an electrical circuit and simulate it to verify Kirchhoff's Voltage Law.
3	Model an electrical circuit and simulate it to verify Kirchhoff's Current Law.
4	Demonstrate the measurement of power in an RLC circuit using wattmeter method.
5	Interpret the DC output of an RLC circuit using half wave rectifier.
6	Interpret the DC output of an RLC circuit using full wave rectifier.
7	Conduct the load test on DC shunt motor to outline its characteristics.
8	Outline the study on the starting methods of DC series motor.
9	Conduct a study on transformer construction for real-time applications.
10	Experiment with the logic gates to verify its truth table.
11	Make use of the logic gates to verify the functioning of half and full adders.
12	Make use of the logic gates to verify the functioning of half and full subtractors.
13	Utilize Arduino and Bluetooth module for automating home appliances.
14	UtilizeESP8266 processorfor automating home appliances.
15	Construct an Arduino based solar tracker for solar irradiation measurement.

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Apply the circuit laws and theorems to compute the electrical parameters of domestic and industrial appliances.
CO2	Compare the behavior of AC circuits & magnetic circuits for a given input.
CO3	Explain the construction, working, and application of electrical machine and transformer to infer its characteristics.
CO4	Apply the semiconductor principles using diodes, transistors, thyristors and displays for developing electronic switches and displays.
CO5	Identify the sensors for applications in Engineering.

COs and POs Mapping:

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	2	1	1	2	-	-	-	2	-	-	1
CO2	2	1	1	-	2	-	-	-	2	-	-	1
CO3	2	1	1	-	2	-	-	-	2	-	-	1
CO4	3	2	1	1	2	-	-	-	2	-	-	1
CO5	3	2	1	1	2	-	-	-	2	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max. Marks</th><th>Reduced Marks</th><th>Total</th><th>Final marks</th></tr>
<tr><td rowspan="4">Continuous Internal Examination (CIE) - Theory</td><td>CIE – I</td><td>100</td><td rowspan="2">60</td><td rowspan="4">100</td><td rowspan="4">25</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>Skill Assessment – I (2 Assignments + 1 seminar)</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment – II (3Assignments)</td><td>40</td></tr>
<tr><td rowspan="2">Continuous Internal Examination (CIE) - Laboratory</td><td>Continuous Assessment (Lab activities & exercises)</td><td>75</td><td>75</td><td rowspan="2">100</td><td rowspan="2">25</td></tr>
<tr><td>Model Lab Exam</td><td>25</td><td>25</td></tr>
<tr><td rowspan="2">End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>35</td><td rowspan="2">50</td><td rowspan="2">50</td></tr>
<tr><td>Lab Exam</td><td>100</td><td>15</td></tr>
<tr><td colspan="5" align="right">Total</td><td>100</td></tr>
</table>

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	60	40	40
Apply	20	40	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or)
- All the fifteen questions have to be answered.

Text Books:

1. D P Kothari and I.J Nagarath, "Basic Electrical and Electronics Engineering," McGraw Hill Education (India)Private Limited, Second Edition, 2020
2. A.K.Sawhney and PuneetSawhney,"A Course in Electrical & Electronic Measurements & Instrumentation,"DhanpatRai and Co, 2015.

Reference Books:

1. John Bird, "Electrical Circuit theory and technology", Routledge; 2017.
2. Muthusubramanian R and Salivahanan S, "Basic Electrical and Electronics Engineering,"McGraw Hill, NewDelhi,2009.
3. Nagsarkar T K and Sukhija M S, "Basics of Electrical Engineering," Oxford University press, 2012.
4. V K Mehta, Rohitmehta "Principles of Electronics," S.Chand& Company Ltd, 2015.
5. Mahmood Nahvi and Joseph A.Edminister, "Electric Circuits," Schaum' Outline Series, McGraw Hill, 2009.
6. H.S. Kalsi, "Electronic Instrumentation," Tata McGraw-Hill, New Delhi, 2010.
7. Ian Sinclair, "Sensors and Transducers," Elsevier Science, 3rd Edition, 2000.
8. Perry Lea, "Internet of things for architects," Packt, 2018.

9. V N Mittle and Arvind Mittle "Basic Electrical Engineering," McGraw Hill, New Delhi, 2005.
10. R.S. Sedha, "A Textbook of Applied Electronics," S. Chand & Co., 2008.
11. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry and Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017.

Web Links and Video Lectures (E-Resources):

4. A Basic Course on Electric and Magnetic Circuits https://onlinecourses.nptel.ac.in/noc24_ee125/preview
5. Basic Electrical Circuits: https://onlinecourses.nptel.ac.in/noc24_ee112/preview
6. Digital Circuits: https://onlinecourses.nptel.ac.in/noc24_ee147/preview
7. Electrical Machines – I: https://onlinecourses.nptel.ac.in/noc24_ee103/preview
8. Sensor Technologies: Physics, Fabrication and Circuits: https://onlinecourses.nptel.ac.in/noc24_ee83/preview
9. Semiconductor Devices and Circuits: https://onlinecourses.nptel.ac.in/noc24_ee143/preview

Suggested Skill Activities:

1. List the different electrical loads available in home, college and prepare their rating chart.
2. Design the residential house wiring using fuse, switch, indicator, lamp, circuit breaker, energy meter and apply Thevenin's theorem to find the current in particular branch.
3. Take a room in your home and replace the fluorescent lamp to LED lamp to calculate the monthly electrical charge and compare with the previous month.
4. Write the parts of the fan and electric mixer in home and draw the wiring diagram for fan and electric mixer.
5. Visit the nearby substation and list out the details of safety measures followed by electrical engineers.
6. List out the rating of electrical machines used in home appliances.
7. Identify the semiconductor devices in electronic appliances.

8. Develop IOT based solutions for engineering applications.
9. Draw the wiring diagram of EV and mentions its parts.
10. Visit nearby power plant and demonstrate the various components, working, power generation and distribution in power plant as a report.

Course Code:	**24AG201**	**Course Title:**	**Crop Production Technology**
Credits:	**3**	**L – T – P**	**2-0-2**

Course objectives:

To impart knowledge on the

- To impart knowledge in the basics of agriculture crop production technology.
- To acquire knowledge in seasonal selection of crops its establishments.
- To introduce about the management of crops in all aspects.
- To study the cultivation practices of major field crops.
- To get an idea about the production practices of cash crops.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – Agriculture And Crop Production	[6 hours]
Introduction to agriculture and its crop production sub-sectors - field crop production and horticulture; Factors affecting crop growth and production: genetic (internal) and environmental (external) factors; Crop management through environmental modification and adaptation of crops to the existing environment through crop cultural practices.	
Practical Topics: 1. Identification of field and horticultural crops. 2. Field Preparations studies.	

UNIT II – Crop Selection And Establishment	[6 hours]
Regional and seasonal selection of crops; Systems of crop production; Competition among crop plants; Spacing and arrangement of crop plants; Field preparation for crops including systems of tillage; Establishment of an adequate crop stand and ground cover, including selection and treatment of seed, and nursery growing	
Practical Topics: 1. Seeds, estimation of seed rate, germination of seeds. 2. Nursery, demonstration on different types in field.	

UNIT III – Crop Management	[6 hours]
Crop water Management; Crop nutrition management - need for supplementation to soil supplied nutrients, sources, generalized recommendations, methods and timing of application of supplemental nutrients; Crop protection including management of weeds, pests and pathogens; Integrated methods of managing water, nutrients and plant protection; Types and methods of harvest.	
Practical Topics: 1 . Fertilizers type, estimation of recommended dose. 2. Weeds, identification of major weed type, demonstration on simple weeding implements.	

UNIT IV – Production Practices of Agriculture Crops	[6 hours]
Generalized management and cultivation practices for important groups of field crops in Tamil Nadu: cereal crops, grain legumes, oil seed crops, sugarcane, and fiber crops, and special purpose crops such as those grown for green manure.	
Practical Topics: 1. Weedicide uses and caution 2. Pest identification and control, demonstration of IPM methods.	

UNIT V – Production Practices of Horticulture crops	[6 hours]
Important groups of horticultural crops in Tamil Nadu such as vegetable crops, fruit crops, flower crops; Cultivation practices of representatives of each group; Special features of production of horticultural crops - green house cultivation.	
Practical Topics: 1. Harvesting methods for various field and horticultural crops and implements used. 2. Observing in demonstration field, cultivation of wet land, dry land and garden land crops and documenting of growth stage and recording of biometric observations.	

Laboratory Component: [30 hours]

All 10 experiments have to be completed from the following list of experiments.

S.No.	Name of the Experiment
1	Identification of field and horticultural crops.
2	Field Preparations studies.
3	Seeds - estimation of seed rate, germination of seeds.
4	Nursery, demonstration on different types in field.
5	Fertilizers-type, estimation of recommended dose.
6	Weeds, identification of major weed type, demonstration on simple weeding implements.
7	Weedicide uses and caution.

8	Pest identification and control, demonstration of IPM methods.
9	Harvesting methods for various field and horticultural crops and implements used.
10	Observing in demonstration field, cultivation of wet land, dry land and garden land crops and documenting of growth stage and recording of biometric observations.

Course outcomes:

On completion of the course, the student will have the ability to:

CO No	Corse Outcomes	Cognitive Level
CO1	Understand the knowledge on the basic principles of crop production.	K2
CO2	Classify the suitable crops and decide upon its establishment procedures	K2
CO3	Relate the knowledge on the different crop management practices.	K2
CO4	Cite the required knowledge in the area of production of agricultural and horticultural crops.	K2
CO5	Relate the knowledge to delineate their role in relation to various crop production practices	K2

COs and POs Mapping:

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	2	-	-	-	-	-	3	-	-	-	-	1
CO2	3	1	-	-	-	-	1	-	-	-	-	1
CO3	2	1	-	-	-	-	3	-	-	-	-	1
CO4	2	1	-	-	-	-	-	-	-	-	-	1
CO5	2	1	-	-	-	-	3	-	-	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	80	80	80
Apply	0	0	0
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Rajendra Prasad, Text Book of Field Crop Production. Directorate of

Information and Publication, Krishi Anusandhan Bhavan, Pusa, New Delhi, 2020.

2. Reddy T. Sankara G.H. Yellamanda Reddi, Principles of Agronomy, Kalyani Publishers, New Delhi, 2021.

Reference Books:

1. Crop Production Technologies for Sustainable Use and Conservation Physiological and Molecular Advances, Münir Öztürk, PhD, DSc Professor Emeritus, Department of Botany, Ege University, Izmir, Turkey 2019.
2. Crop Production Guide, Tamil Nadu Agricultural University Publication, Coimbatore. 2020
3. Agronomy of Field Crops: By Kalyani Publishers, New Delhi, 2019.
4. Kumar, N.," Introduction to Horticulture", Rajalakshmi Publications. Nagercoil, 7th edition, 2020.
5. Modern Techniques of Raising Field Crops: By Singh, C., Singh, P., and Singh, R., published in 2020 by Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Web Links and Video Lectures (E-Resources):

1. Importance of Crop production, https://www.nifa.usda.gov/topics/crop-production
2. Crop Production Guide Agriculture, http://www.agritech.tnau.ac.in
3. Optimization techniques for crop planning, https://epubs.icar.org.in/index.php/IJAgS/article/download/85423/35050
4. Crop nutrient management, https://agritech.tnau.ac.in/agriculture/agri_nutrientmgt_integrntrientmgt.html
5. Sowing and planting equipment, https://icar.org.in/sowing-and-planting-equipment-aicrp-farm-implements-and- machinery

Activity-Based Learning /Practical-Based Learning:

1. https://agritech.tnau.ac.in/govt_schemes_services/ffs.html
2. https://education.icar.gov.in/pdf/Guidelines%20Experimental%20Learning%20(ELP).pdf.

Suggested Skill Activities:

1. Soil preparation, sowing, adding manure, irrigation, protection from weeds in field
2. Management of tea, coffee and rubber plantations crops are cultivatable in sloppy region
3. Growing of field crops, fruits, nuts, seeds and vegetables in nursery gardens
4. Manufacturing of organic fertilizers in their garden land
5. Cultivation of fruits and vegetables in roof garden
6. Techniques of harvesting, storage of crops in agriculture field
7. Seed treatments can do before the sowing of seeds for a healthy seed germination
8. Apply the organic and in organic fertilizer for the crops
9. Produce quality fruits and vegetables through organic farming

10 Select suitable season for the suitable varieties & suitable crops

Course Code:	**24GE231**	**Course Title:**	**WORKSHOP PRACTICE (Common to All Branches)**
Credits:	**1.5**	**L – T – P**	**0-0-3**

Course objectives:

To provide hands on training to the students in:

- Applying basic techniques to measure a field, infer masonry work and install plumbing design.
- Fabricating carpentry, foundry, sheet metal and welding works to practice on workshop tradesand making end products.
- Utilizing machining processes like turning, drilling, tapping in parts and 3D printing forperforming the jobs.
- Designing electrical wiring layout with MCBs and RCCBs, developing staircase wiring andillumination design circuits for buildings.
- Assembling simple electronic components on PCB by soldering and desoldering and testingwith IoT based interfaces.
- Developing blogs and website design for the complete access over the network.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Project based learning
2. Industrial Visit

GROUP – A (Civil and Mechanical)

PART I - CIVIL ENGINEERING PRACTICES	[5 hours]
1. FIELD MEASUREMENT, MASONRY WORK AND PLUMBING a. Calculate the area of a built-up space and a small parcel of land-use standard measuring tape anddigital distance measuring devices. b. Visit a nearby site where construction is at initial stage and observe for following (if necessary,visit two/three times with a gap of a week). If drawings are available relate/match activities with the drawings. i. Digging and filling. ii. Foundation preparations. iii. Brick/stone masonry. iv. Concrete laying and curing. v. Laying of sewerage/sanitary lines. vi. Bar bending and bar laying for columns, beams and ceiling. vii. Onsite testing for quality. viii. Onsite preparation for construction work. ix. Erection and removal of form work, scaffolding, centering/shuttering. Prepare a brief report on the construction activities, methods, tools, equipment and materials being used. c. Installation of water lines for wash basin and showers faucet.	

PART II MECHANICAL ENGINEERING PRACTICES	[5 hours]
2. CARPENTRY, FOUNDRY, WELDING AND SHEET METAL a. Carpentry: Prepare T/L/Lap Joint from given wooden work piece and make a Box/Tray out ofplywood using modern power tools. b. Welding: Make a Butt/Lap of MS plate using Arc welding process. c. Casting: Demonstration of Pattern making by sand moulding. d. Sheet Metal: Fabrication of Sheet Metal Tray and Funnels. 3. LATHE, DRILLING MACHINE AND 3D PRINTER a. Designing a driller component using radial machine. b. Perform a job using facing and turning in lathe. c. Printing simple 3D geometric shapes using SLA printer.	

GROUP – B (ELECTRICAL, ELECTRONICS AND IT)

PART III ELECTRICAL ENGINEERING PRACTICES	[3 hours]
4. ELECTRICAL WIRING a. Design a wiring circuit integrating energy meter, MCBs and RCCBs. b. Develop fluorescent lamp wiring, staircase wiring and electric fan wiring circuits.	

PART IV ELECTRONICS ENGINEERING PRACTICES	**[4 hours]**
5. IOT BASED SOLUTIONS AND PCB a. Design a single layer PCB layout structure. b. Fabricate single layer PCB printing. c. Assembling, soldering and desoldering practice on single layer PCB. d. GPIO programming in ESP8266, sensor and actuator interfacing with internet enabledmicrocontroller device. e. Integration of microcontroller-based system with Cloud platform.	

PART V COMPUTER SCIENCE AND ENGINEERING PRACTICES	**[3 hours]**
6. INTERACTIVE DYNAMIC WEBSITE a. Design a website for an application using HTML and CSS. b. Convert the designed website into responsive website using Bootstrap. c. Add dynamism to the website by using JavaScript and embed the social media components to thewebsite. d. Incorporate the database interaction with the website. e. Deploy the developed website in the server.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Apply basic techniques for field measurements, masonry work and plumbing.
CO2	Make use of workshop trades like carpentry, foundry, sheet metal and welding for practicing on manufacturing of components.
CO3	Develop simple components using Lathe, Drilling Machine and 3D Printer.
CO4	Construct the electrical wiring circuits for buildings based on their requirement.
CO5	Develop IoT based solutions and PCB for real world use cases.
CO6	Build and host an interactive dynamic website.

COs and POs Mapping:

CO/PO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	2	1	1	2	-	-	-	1	1	-	1	3	2	1
CO2	3	2	1	1	2	-	-	-	1	1	-	1			
CO3	3	2	1	1	2	-	-	-	1	1	-	1			
CO4	3	2	1	1	2	-	-	-	1	1	-	1	1	-	-
CO5	3	2	1	1	2	-	-	-	1	1	-	1			
CO6	3	2	1	1	2	-	-	-	1	1	-	1	-	1	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

The weightage of Continuous Internal Evaluation (CIE) is 60% and for End Semester Examination (ESE) is 40%

S.No	Component	Type of Assessment	Max Marks	Reduced Marks	Total	Final Marks
1.	**Continuous Internal Examination(CIE) - Laboratory**	Continuous Assessment	75	75	100	60
2.		Model Lab Exam	25	25		
3.	**End Semester Examination (ESE)**	Lab Exam	100	40	40	40
					Total	100

Assessment Pattern

Bloom's Category	Terminal Examination
Remember	0
Understand	0
Apply	100
Analyze	0
Evaluate	0
Create	0

Reference Books:

1. AICTE's Prescribed Textbook: Workshop / Manufacturing Practices (with Lab Manual) ISBN: 978-93-91505-332
2. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
3. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4 th edition,Pearson Education India Edition, 2002.
4. Gowri P. Hariharan and A. Suresh Babu," Manufacturing Technology – I" Pearson Education, 2008.
5. Roy A. Lindberg, "Processes and Materials of Manufacture", 4 th edition, Prentice Hall India, 1998.
6. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House, 2017.

Course Code:	24EN231	Course Title:	PRESENTATION AND COMMUNICATION SKILLS LABORATORY (Common to AI& amp;DS, AE,BME,CE,CSE,CSE(AI& amp; ML),EEE, ECE,MECH)
Credits:	**1.5**	**L – T – P**	**0-0-3**

Course objectives:

- To apply critical listening skills.
- To make use of critical thinking skills.
- To apply stress as well as tonal variation.
- Make use of language skills to produce error free sentences
- To experiment with presentation skills.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Lab experiment videos
2. Blended Mode of Learning
3. Project based Learning
4. Smart Classroom
5. Flipped Class

	UNIT I	**[12 hours]**
	LIST OF EXERCISES	
LAB ACTIVITIES		
Sl. No.	Topic	Hours
1.	Listening to Audio (Podcasts, Audiobooks, Radio Program) and Practice Exercises, making a critical appreciation of Audio content	3
2.	Listening to BBC news	2
3.	Listening to British council/ Cambridge English (Selected topics)	2
CLASSROOM ACTIVITIES		
1.	Speaking Current issues (Selected topics)	2

2.	Making Conversation at work place, Public speaking based on a festival, Celebrations	3

UNIT II		**[12 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl.No.	Topic	Hours
1	English Movie clips and software in the Lab C (Globe Rena)	3
2	Vocabulary Development through movies/ short films/ Documentaries	2
CLASSROOM ACTIVITIES		
1	Speaking- Just a minute talk and expressions for plans and decisions	2
2	Marketing of a Product	2
3	Describing a process in industry	2
4	Writing- Writing a Complaint Letter about a manufacturing defect of a product	1

UNIT III		**[12 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	Topic	Hours
1.	Listening to TED talks, scientific lectures.	3
2.	Reading Comprehension strategies	2
3.	Reading- Editorials	2
CLASSROOM ACTIVITIES		
1.	Speaking- Introduction to Phonetics- Speech sounds- Vowels and Consonants- Stress- Rising/ Falling Tone	2
2.	Writing- A day in my life	2
3.	Writing- Situational Dialogues	1

UNIT IV		**[12 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	Topic	Hours

1.	Reading Popular Blogs	3
2.	Creating a Blog	2
CLASSROOM ACTIVITIES		
1.	Errors in Pronunciation. Error detection	3
2.	Writing- Terminology for Engineers. Writing- Preparing day today scripts.	2 2

	UNIT V	**[12 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	Topic	Hours
1.	Prepare power Point presentation for topics, selected by the students	3
2.	Reading newspaper articles	2
CLASSROOM ACTIVITIES		
1.	Present the selected topic.	3
2.	Making a short speech- Extempore	2
3.	Writing- Expanding a Proverb Writing Instructions	2

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Build communicative competence through critical listening skills.
CO2	Make use of critical thinking skills to express plans and opinions.
CO3	Apply stress as well as tonal variations for effective communication.
CO4	Make use of language skills to produce error free sentences.
CO5	Experiment with presentation skills to address confidently.

COs and POs Mapping:

COs	**POs**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1						-	-	-	-	3	-	3
CO2						-	-	-	-	3	-	3
CO3						-	-	-	-	-	-	3
CO4						-	-	-	-	-	-	3
CO5						-	-	-	-	3	-	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Name of the Test	Marks	Total	Reduced to
Continuous Assessment (Experiments 1-10)	50	100	50
Model Examination	50		
End Semester Lab Exam	100	100	50
		TOTAL	**100 MARKS**

Textbooks:

1. Raman, Meenakshi and Sangeetha Sharma. Professional Communication. Oxford University Press, Oxford, 2014.
2. Dr. Chellammal. V. Learning to Communicate. Allied Publishers, New Delhi, 2003.
3. Mohan, Krishna. And Meera Bannerjee. Developing Communication Skills. Macmillan India Ltd. 1990.

Reference Books:

1. Murphy – Raymond. English Grammar in Use BOOK with Answers: A Self-Study. Reference and Practice Book for Intermediate Learners of English. Fourth edition: Cambridge University Press – 2012.

MANUALS/ SOFTWARE: Open Sources / Websites

Course Code:	**24CS301**	**Course Title:**	**PROGRAMMING FOR PROBLEM SOLVING USING PYTHON**
Credits:	**1.5**	**L – T – P**	**0-0-3**

Course objectives:

To impart knowledge on the

- To explain basic concepts in Python
- To implement programs using functions, loops, and conditional statements.
- To demonstrate the concepts of data structures
- To make use of strings and exception handling in Python
- To demonstrate file handling and python modules

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Lab experiment videos
2. Project based Learning

Laboratory Component: **[20 hours]**

S.No	**Name of the Experiment**
1	Develop simple python programs using basic data types
2	Develop simple python programs using operators and expressions
3	Develop Python programs using conditional statements
4	Develop Python programs using various Loops
5	Develop python programs using Functions.
6	Develop programs to demonstrate the use of List, and Tuples
7	Develop programs to demonstrate the use of Dictionaries
8	Demonstrate the various string manipulation functions
9	Develop programs to show Exception Handling in tasks
10	Execute programs using Numpy in Jupiter notebook
11	Python program using File I/O, random access file handling methods and Zipping and Unzipping of files
12	Develop Python programs using packages

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Develop basic programs using fundamental data types	K3
CO2	Solve the given problem statement using programming concepts such as operators, conditional and looping statements and functions.	K3
CO3	Make use of data structures such as lists, tuples, and dictionaries to manage and manipulate data in development of simple applications	K3
CO4	Create programs using string handling functions and apply exception handling, and make use of NumPy to solve problems	K3
CO5	Make use of file operations and packages in development of simple applications	K3

COs and POs Mapping

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	3	3	-	1	-	-	-		-	-	1
CO2	3	3	3	-	1	-	-	-		-	-	1
CO3	3	2	2	1	1	-	-	-		-	-	1
CO4	3	2	2	1	1	-	-	-		-	-	1
CO5	3	3	3	1	1	-	-	-		-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

The weightage of Continuous Internal Evaluation (CIE) is 60% and for End Semester Examination (ESE) is 40%.

<table>
<tr><th>S.No</th><th>Component</th><th>Type of Assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final Marks</th></tr>
<tr><td>1.</td><td rowspan="2">Continuous Internal Examination(CIE)-Laboratory</td><td>Continuous Assessment</td><td>75</td><td>75</td><td rowspan="2">100</td><td rowspan="2">60</td></tr>
<tr><td>2.</td><td>Model Lab Exam</td><td>25</td><td>25</td></tr>
<tr><td>3.</td><td>End Semester Examination (ESE)</td><td>Lab Exam</td><td>100</td><td>40</td><td>40</td><td>40</td></tr>
<tr><td colspan="6" align="right">Total</td><td>100</td></tr>
</table>

Assessment Pattern

Bloom's Category	Terminal Examination
Remember	0
Understand	0
Apply	100
Analyze	0
Evaluate	0
Create	0

Text Books:

1. Reema Thareja, "Python Programming: Using Problem Solving Approach", Oxford University Press, 2017.

2. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.

Reference Books:

1. Guido van Rossum, Fred L. Drake Jr., "An Introduction to Python – Revised and Updated for Python 3.2", Network Theory Ltd., 2011.
2. John V Guttag, "Introduction to Computation and Programming Using Python", Revised and Expanded Edition, MIT Press , 2013
3. Charles Dierbach, "Introduction to Computer Science using Python", Wiley India Edition, 2016.
4. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd., 2015.
5. Kenneth A. Lambert, "Fundamentals of Python: First Programs", Cengage Learning, 2012.
6. Vijay Kumar Sharma, Vimal Kumar, Swati Sharma, Shashwat Pathak, "Python Programming – A Practical Approach", CRC Press, First Edition, 2022

ROHINI **COLLEGE OF ENGINEERING AND TECHNOLOGY**

(AUTONOMOUS)

(Anjugramam-Kanyakumari Main Road, Palkulam,Variyoor P.O.-629 401, K.K.Dist.)

Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai

Accredited with A+ Grade by NAAC

B.Tech. Artificial Intelligence and Data Science

(B.Tech AI&DS)

Curriculum & Syllabus

(*2024-2025 Admitted Students Onwards*)

Vision Statement of RCET

To be an academic institute of continuous excellence towards education and research in rural regime and provide service to nation in terms of nurturing potentially higher social, ethical and engineering companion graduands.

Mission Statement of RCET

To foster and promote technically competent graduands by imparting the state of art Engineering education in rural regime.

To enunciate research assisted scientific learning by dissemination of knowledge towards science, agriculture, industry and national security.

Vision of the Department

To become a leading centre in the field of Artificial Intelligence and Data Science, focusing on research, education, and innovation, with the aim of benefiting the nation.

Mission of the Department

To produce skilled professionals in Artificial Intelligence and Data Science who are capable of addressing complex challenges in various domains, while also considering ethical and social implications.

To promote students' professional growth by instilling ethical and leadership skills with nation support

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1 Excel in professional career with technical skills to build intelligent systems and applications in the area of Artificial Intelligence and Data Science to identify new opportunities

PEO2 Equip themselves to adapt with new technologies for developing solutions to real world problems individually or as a team with ethical and social responsibilities for the upliftment of society

PEO3 Embrace lifelong learning to produce wider opportunities in research and product development in future

PROGRAMME OUTCOMES (POs)

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6 Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life- long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO1 Apply analytical knowledge to develop intelligent systems by extracting knowledge from data to formulate design and solve real time problems.

PSO2 Apply data science techniques and project development skills to provide solutions for complex problems

PSO3 Employ artificial intelligence & data science techniques for developing innovative solution to any applications addressing the computing needs of the society.

CREDIT INFO		
SI.No	Category	Credits
1	Humanities and Social Science (HSS)	13
2	Basic Science Courses (BSC)	25
3	Engineering Science Courses (ESC)	25
4	Professional Core Course(PCC)	59
5	Professional Electives Courses (PEC)	18
6	Open Electives Courses (OEC)	12
7	Employability Enhancement Courses (EEC)	17
8	Mandatory Courses (MNC)	-
Total Credits		169

Humanities and Social Science (HSS)							
Sl.no	Course Code	Course Title	Course Type	L	T	P	Credit
1	24GE101	Heritage of Tamils	HSS	1	0	0	1`
2	24EN101	English For Engineers	HSS	2	0	1	2.5
3	24GE201	Tamil and Technology	HSS	1	0	0	1`
4	24EN231	Presentation And Language Skills Laboratory	HSS	0	0	3	1.5
5	24MG601	Product Innovation & Entrepreneurship	HSS	2	0	0	2
6	24GE701	Professional Ethics and Human Values	HSS	2	0	0	2
7	24MG701	Economics for Engineers	HSS	3	0	0	3
Basic Science Courses (BSC)							
Sl.no	Course Code	Course Title	Course Type	L	T	P	Credit
1	24MA101	Matrices and Calculus	BSC	3	1	0	4
2	24PH101	Engineering Physics	BSC	3	0	2	4
3	24CY101	Engineering Chemistry	BSC	3	0	2	4
4	24MA201	Complex Variables and Transforms	BSC	3	1	0	4
5	24CY401	Environmental Science and Engineering	BSC	2	0	0	2
6	24MA301	Probability,Statistics and Numerical methods	BSC	4	0	0	4
7	24MA401	Discrete Mathematics	BSC	3	0	0	3
Engineering Science Courses (ESC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24ME201	Engineering Graphics & Design	ESC	1	0	4	3
2	24CS201	Programming for Problem Solving using C	ESC	2	0	4	4
3	24CS301	Programming for problem solving using python	ESC	0	0	3	1.5
4	24EE202	Basics of Electrical and Electronics engineering	ESC	3	0	2	4
5	24EC302	Digital Logic Circuits and Design	ESC	3	0	2	4
6	24GE231	Workshop Practices	ESC	0	0	3	1.5
7	24EE404	IoT - Sensors and Devices	ESC	3	0	2	4
8	24CS301	Data Structures and Algorithms	ESC	2	0	2	3
Professional Core Courses(PCC)							

S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24AI301	Architectures for Management of Large Datasets	PCC	3	0	2	4
2	24AI401	Data Warehousing and Mining	PCC	3	0	0	3
3	24CS403	Theory of Computation	PCC	3	0	0	3
4	24CS405	Software Engineering and Package Development	PCC	3	0	2	4
5	24AI302	Introduction to Artificial Intelligence	PCC	3	0	2	4
6	24CS403	Computer Networks	PCC	2	0	2	3
7	24AI404	Introduction to Data Exploration and Visualization	PCC	3	0	2	4
8	24CS404	Operating Systems	PCC	3	0	0	3
9	24AI402	Applied Machine Learning	PCC	3	0	2	4
10	24AI502	Deep Learning	PCC	3	0	2	4
11	24AI501	Big Data Analytics	PCC	3	0	2	4
12	24AI403	Basics of data science	PCC	4	0	0	4
13	24AI601	Data and Internet Security	PCC	3	0	0	3
14	24AI701	Augmented Reality,Virtual Reality with AI	PCC	3	0	2	4
15	24AI602	Image Processing and Computer Vision	PCC	3	0	2	4
16	24AI603	Soft Computing	PCC	2	0	2	3
17	24AI531	Application Development Laboratory	PCC	0	0	2	1
Professional Electives Courses I (PEC)							
DATA SCIENCE							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24AI571	Exploratory Data Analysis	PEC	3	0	0	3
2	24AI572	Recommender Systems	PEC	3	0	0	3
3	24AI573	Data Analytics and Computing	PEC	3	0	0	3
4	24AI574	Neural Networks and Deep Learning	PEC	3	0	0	3
5	24AI575	Natural Language Processing	PEC	3	0	0	3
6	24AI576	Advanced Data Science	PEC	3	0	0	3
Professional Electives Courses II (PEC)							
INTELLIGENCE ANALYTICS							
1	24AI581	Reinforcement Learning	PEC	3	0	0	3

2	24AI582	Soft computing and Evolutionary AI	PEC	3	0	0	3
3	24AI583	Brain Computer Interaction	PEC	3	0	0	3
4	24AI584	Social Network Analytics	PEC	3	0	0	3
5	24AI585	Data Science in Bioinformatics	PEC	3	0	0	3
6	24AI586	Text and Speech Analysis	PEC	3	0	0	3
Professional Electives Courses III (PEC)							
CLOUD COMPUTING AND DATA CENTERTECHNOLOGIES							
1	24CS671	Virtualization in Cloud Computing	PEC	2	0	2	3
2	24CS672	Cloud Services and Data Management	PEC	2	0	2	3
3	24CS673	Cloud Storage Technologies	PEC	2	0	2	3
4	24CS674	Cloud Automation Tools andApplications	PEC	2	0	2	3
5	24CS675	Software Defined Networks	PEC	2	0	2	3
6	24CS676	Security and Privacy in Cloud	PEC	2	0	2	3
Professional Electives Courses IV (PEC)							
CYBER SECURITY AND DATA PRIVACY							
1	24CS681	Machine Learning for Cyber Security	PEC	2	0	2	3
2	24CS682	Modern Cryptography	PEC	2	0	2	3
3	24CS683	Cyber Forensics	PEC	2	0	2	3
4	24CS684	Ethical Hacking	PEC	2	0	2	3
5	24CS685	Crypto currency and Block chain Technologies	PEC	2	0	2	3
6	24CS686	Malware Analysis	PEC	2	0	2	3
Professional Electives Courses V (PEC)							
AI AND ROBOTICS							
1	24AI771	Mobile Robot	PEC	3	0	0	3
2	24AI772	Intelligent Robots And Drone Technology	PEC	3	0	0	3
3	24AI773	Intelligent TransportationSystem	PEC	3	0	0	3
4	24AI774	Expert Systems	PEC	3	0	0	3
5	24AI775	Edge Computing	PEC	3	0	0	3
6	24AI776	Applications Of Artificial Intelligence In Healthcare	PEC	3	0	0	3
Professional Electives Courses VI (PEC)							
Data Analytics							

1	24AI781	Bio Medical Image Analysis	PEC	3	0	0	3
2	24AI782	Video Analytics	PEC	3	0	0	3
3	24AI783	Cyber Threat Analytics	PEC	3	0	0	3
4	24AI784	Business Analytics	PEC	3	0	0	3
5	24AI785	Digital Marketing And Techniques	PEC	3	0	0	3
6	24AI786	Quantum Computing	PEC	3	0	0	3
Open Electives Courses I (OEC)							
Electronics and Communication Engineering							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24EC501	Nano Electronics	OEC	3	0	0	3
2	24EC503	Digital Signal Processing	OEC	3	0	0	3
3	24EC504	Fuzzy Logic Systems and ANN	OEC	3	0	0	3
4	24EC505	Consumer Electronics	OEC	3	0	0	3
5	24EC506	Electronic System Design	OEC	3	0	0	3
6	24EC507	Electronic Packaging	OEC	3	0	0	3
Open Electives Courses II (OEC)							
Civil and Agricultural Engineering							
1	24AG601	Principles of Crop Production	OEC	3	0	0	3
2	24AG602	Dairy and Food Engineering	OEC	3	0	0	3
3	24AG603	Past Harvest Technology	OEC	3	0	0	3
4	24AG604	Agricultural Finance, Banking and Co-operation	OEC	3	0	0	3
5	24CI601	Rural Development	OEC	3	0	0	3
6	24CI602	Geographic Information System	OEC	3	0	0	3
7	24CI603	Water Resources Management	OEC	3	0	0	3
8	24CI604	Climate Change and its Impact	OEC	3	0	0	3
Open Electives Courses III (OEC)							
Bio Medical and Electrical Engineering							
1	24BM701	Wearable Devices	OEC	3	0	0	3
2	24BM702	Telemedicine and Healthcare Delivery	OEC	3	0	0	3
3	24BM703	Medical Informatics	OEC	3	0	0	3
4	24BM704	Basics of Human Anatomy and Physiology	OEC	3	0	0	3
5	24EE701	Robot Process Automation	OEC	3	0	0	3

6	24EE702	Electric vehicle Technology	OEC	3	0	0	3
7	24EE703	Smart Grid	OEC	3	0	0	3
8	24EE704	Energy Conservation and Management	OEC	3	0	0	3
Open Electives Courses IV (OEC)							
Mechanical and Management							
1	24ME701	Additive Manufacturing	OEC	3	0	0	3
2	24ME702	Rocket Propulsion	OEC	3	0	0	3
3	24ME703	Industrial Safety	OEC	3	0	0	3
4	24ME704	Marine Vehicles	OEC	3	0	0	3
5	24MG701	Digital Marketing	OEC	3	0	0	3
6	24MG702	Industrial Psychology	OEC	3	0	0	3
7	24MG703	Logistics and Supply chain Management	OEC	3	0	0	3
8	24MG704	Corporate Social Responsibility	OEC	3	0	0	3
Employability Enhancement Courses (EEC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24AI351	Mini project-I (Introduction to Innovative Projects)	EEC	0	0	2	1
2	24AI451	Mini project-II (Design and development of the product)	EEC	0	0	2	1
3	24EN451	Soft skills development	EEC	0	0	2	1
4	24AI551	Mini project-III (Community based Project)	EEC	0	0	2	1
5	24EN651	Business and Managerial communications	EEC	0	0	2	1
6	24GE551	Quantitative and reasoning skills-I	EEC	0	0	2	1
7	24AI651	Mini project- IV(Micro Project)	EEC	0	0	2	1
8	24GE651	Quantitative and reasoning skills-II	EEC	0	0	2	1
9	24AI751	PROJECT WORK PHASE-I(DESIGN & ANALYSIS)	EEC	0	0	4	2
10	24AI752	INDUSTRIAL TRAINING/INTERNSHIP	EEC	0	0	0	2
11	24AI851	Project Work Phase II	EEC	0	0	10	5
Mandatory Courses (MNC)							

S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24MC101	Induction Programming	MNC	THREE WEEKS			
2	24MC201	Sports And Yoga For Youth Empowerment - II	MNC	0	0	2	0
3	24MC202	Ncc Credit Course Level - I	MNC	1	0	2	1#
4	24MC301	Sports And Yoga For Youth Empowerment - II	MNC	0	0	2	0
5	24MC401	Ncc Credit Course Level - Ii	MNC	1	0	0	1#
6	24MC601	Disaster Management	MNC	1	0	0	0
7	24MC701	Constitution Of India	MNC	1	0	0	0

SCHEME OF INSTRUCTION FOR FIRST YEAR B.Tech.

Ist SEMESTER

S.no	Course code	Course Title	Category	L	T	P	C
THEORY COURSES							
1	24GE101	Heritage of Tamils	HSS	1	0	0	1`
2	24MA101	Matrices and Calculus	BSC	3	1	0	4
THEORY COURSE WITH LABORATORY COMPONENT							
3	24EN101	English for Engineers	HSS	2	0	1	2.5
4	24PH101	Engineering Physics	BSC	3	0	2	4
5	24CY101	Engineering Chemistry	BSC	3	0	2	4
6	24ME201	Engineering graphics & design	ESC	1	0	4	3
7	24CS201	Programming for problem solving using c	ESC	2	0	4	4
MANDATORY COURSES							
8	24MC101	Induction programming	MNC	THREE WEEKS			
TOTAL				14	1	15	22.5

IInd SEMESTER

S.n o	Cours e code	Course Title	Category	L	T	P	C
THEORY COURSES							
1	24GE201	Tamil and technology	HSS	1	0	0	1`
2	24MA201	Complex Variables and Transforms	BSC	3	1	0	4
THEORY COURSE WITH LABORATORY COMPONENT							
4	24EC302	Digital logic circuits and design	ESC	3	0	2	4
5	24EE202	Basics of Electrical and Electronics engineering	ESC	3	0	2	4
6	24EE404	IoT - Sensors and Devices	ESC	3	0	2	4
LABORATORY COURSES							
7	24CS301	Programming for problem solving using python	ESC	0	0	3	1.5
8	24GE231	Workshop practices	ESC	0	0	3	1.5
9	24EN231	Presentation and language Skills laboratory	HSS	0	0	3	1.5
MANDATORY COURSES							
10	24MC201	Sports and yoga for youth empowerment - II	MNC	0	0	2	0
11	24MC202	NCC CREDIT COURSE LEVEL - I	MNC	1	0	2	1#
TOTAL				13	1	15	21.5

பாடநெறி குறியீடு:	24GE101	பாடத்தின் தலைப்பு:	தமிழர்மரபு (Common to AI&DS,AE,BME,CE,CSE,CSE (AI&ML),EEE,ECE,MECH)
கிரெடிட்	1	L – T – P	1-0-0

பாடத்திட்ட நோக்கங்கள்:
தமிழின் மதச்சார்பற்ற தன்மை, இந்திய மொழிக் குடும்பத்தின் திராவிட மொழி, திருக்குறளின் கருத்துக்கள், சமயங்களின் தாக்கம், நவீன இலக்கிய வளர்ச்சி ஆகியவற்றை நினைவு கூர்தல். தமிழர்களின் சமூக மற்றும் பொருளாதார வாழ்வில் நடுகல், சிற்பங்கள், சிலைகள் மற்றும் அழகிய கைவினைப் பொருட்கள், இசைக்கருவிகள் ஆகியவற்றின் தொடர்புடைய அறிவைக் கோடிட்டுக் காட்டுதல். தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகளை மனதில் பதிய வைத்தல். தமிழ்நாட்டின் தாவரங்கள் மற்றும் விலங்கினங்கள், சங்க நகரங்கள் மற்றும் துறைமுகங்கள், சங்க காலத்தின் ஏற்றுமதி மற்றும் இறக்குமதிகளை நினைவுபடுத்துதல், வெளிநாடுகளில் சோழர் படையெடுப்பைக் கண்டறிதல். இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கைக் கண்டறிதல், இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்குக்கு இணையாக இந்தியாவின் பிற பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கத்தை அடையாளம் காணுதல்.

அலகு I மொழி மற்றும் இலக்கியம்:	[3hours]
இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம்- பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும்	

பாரதிதாசன் ஆகியோரின் பங்களிப்பு.	
அலகு II மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக்கலை:	**[3hours]**
நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.	

அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:	**[3hours]**
தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.	

அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள்:	**[3hours]**
தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறைமுகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி.	

அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு:	**[3hours]**
இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தங்கங்களின் அச்சு வரலாறு.	

பாடநெறி முடிவுகள் (பாமு):

பாடநெறியின் முடிவில், மாணவர் பின்வரும் திறன்களைப் பெறுவர்:

பாமு	பாடநெறி முடிவுகள்	மிக உயர்ந்த அறிவாற்றல் நிலை
அலகு I பாமு:	தமிழின் மதச்சார்பற்ற தன்மை, திராவிட மொழியின் பங்கு, திருக்குறளின் கருத்துக்கள், சமயங்களின் தாக்கம், நவீன இலக்கிய வளர்ச்சி ஆகியவற்றையும் தெரிந்துகொள்கிறார்கள்.	கே 1
அலகு II பாமு:	தமிழர்களின் சமூக மற்றும் பொருளாதார வாழ்வில் நடுகல், சிற்பங்கள், சிலைகள் மற்றும் அழகிய கைவினைப் பொருட்கள், இசைக்கருவிகள் ஆகியவற்றை விவரிக்கும் ஆற்றலை பெறுகிறார்கள்.	கே 2
அலகு III பாமு:	தமிழர்களின் பாரம்பரிய விளையாட்டுகளை தெரிந்து கொள்ளுவதால் விளையாட வேண்டும் ஏன்ற ஆர்வத்தை பெறுகிறார்கள்.	கே 1
அலகு IV பாமு:	தமிழ்நாட்டின் தாவரங்கள் மற்றும் விலங்கினங்கள் பற்றிய அறிவையும், சங்க கால கட்டிடக்கலை, ஏற்றுமதி மற்றும் இறக்குமதி தொழில் நுட்ப அறிவை பெறுகிறார்கள்..	கே 1
அலகு V பாமு:	இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கையும், இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு இணையாக இருப்பதையும், தெரிந்து கொள்கிறார்கள்.	கே 1

பாடநெறி முடிவுகள் ***மற்றும் நிரல் முடிவுகள் ஒப்பிடுதல்***

பாமுகள்	மிக உயர்ந்த அறிவாற்றல் நிலை	பாடநெறி முடிவுகள்											
		1	2	3	4	5	6	7	8	9	10	11	12
பாமு1	கே 1	2	-	-	-	-	-	-	-	-	-	-	-
பாமு2	கே 2	1	-	-	-	-	-	-	-	-	-	-	-
பாமு3	கே 1	1	-	-	-	-	-	-	-	-	-	-	-
பாமு4	கே 1	1	-	-	-	-	-	-	-	-	-	-	-
பாமு5	கே 1	1	-	-	-	-	-	-	-	-	-	-	-

நிலை 3- அதிக ஒத்துப்போதல், நிலை 2- மிதமாக ஒத்துப்போதல், நிலை 1- குறைவாக ஒத்துப்போதல், நிலை 0- ஒத்துப்போகவில்லை

மதிப்பீட்டுத் திட்டம்:

கூறுகள்	மதிப்பீட்டின் வகை	அதிகபட்ச மதிப்பெண்கள்	குறைக்கப்பட்ட மதிப்பெண்கள்	இறுதி மதிப்பெண்கள்
தொடர்ச்சியான உள் தேர்வு	தொடர்ச்சியான உள் தேர்வு - I	100	40	40
	தொடர்ச்சியான உள் தேர்வு - II	100	40	
இறுதி பருவ தேர்வு	எழுத்து தேர்வு	100	60	60
			மொத்தம்	100

இறுதி பருவ தேர்வு: (கேள்வி முறை)

- ஒவ்வொரு யூனிட்டும் இரண்டு 2 மதிப்பெண் வினாக்களையும் ஒரு 16 மதிப்பெண் வினாவையும் (இரண்டில் ஒன்று) கொண்டுள்ளது.
- பதினைந்து கேள்விகளுக்கும் பதிலளிக்க வேண்டும்.

மதிப்பீட்டு முறை

ப்ளூமின் வகை	தொடர்ச்சியான மதிப்பீட்டு சோதனைகள்		இறுதி தேர்வு
	1	2	
நினைவில் கொள்ளுதல்	60	50	60
புரிந்து கொள்ளுதல்	40	50	40
விண்ணபப்பித்தல்	0	0	0
பகுப்பாய்வுதல்	0	0	0
மதிப்பிடுதல்	0	0	0
உருவாக்குதல்	0	0	0

TEXT BOOKS:

1. தமிழகவரலாறு - மக்களும்பண்பாடும் - கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்).
2. கணினித்தமிழ் - முனைவர்இல. சுந்தரம். (விகடன்பிரசுரம்).
3. கீழடி - வைகைநதிக்கரையில்சங்ககாலநகரநாகரிகம் (தொல்லியல்துறைவெளியீடு)
4. பொருநை - ஆற்றங்கரைநாகரிகம். (தொல்லியல்துறைவெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.

REFERENCE BOOKS:

1. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
2. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
3. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department ofArchaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
4. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
5. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
6. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Course Code:	24MA101	Course Title:	**Matrices and calculus** (Common to AI&DS,AE,BME,CE,CSE,CSE(AI&ML),EEE, ECE,MECH)
Credits:	**4**	**L – T – P**	**3 – 1 – 0**
Pre-requisite			**NIL**

Course objectives:

- To provide the basic tools of calculus mainly for the purpose of modeling the engineering problems mathematically and obtaining solutions.
- To learn the concept of eigenvalues and eigenvectors and to reduce the quadratic form to canonical form.
- To learn the foundation course of Single Variable and multivariable calculus plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

Teaching-Learning Process:

These are sample strategies which teachers can use to accelerate the attainment of the various course outcomes.

Lecture method does not mean only traditional method, but different type of teaching methods may be adopted to develop the outcomes.

Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.

Topics will be introduced in a multiple representation and encourage the students to come up with their own creative ways to solve them.

Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT I – Matrices	**[12 hours]**

Eigenvalues and Eigenvectors and their properties – Diagonalization of a matrix (Symmetric matrix) – Cayley - Hamilton theorem (without proof) – Inverse and Power of a matrix by Cayley - Hamilton theorem – Quadratic forms and Nature of quadratic forms.

Application: Reduction of a quadratic form to canonical form by orthogonal transformation.

UNIT II – Differential Calculus	[12 hours]
Functions – Limit – Continuity – Derivatives – Differentiation rule – Product and quotient rules – Chain rules – Implicit differentiation – Logarithmic differentiation. Application: Maxima and Minima of functions of one variable	

UNIT III – Functions of Several Variables	[12 hours]
Partial differentiation – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables. Application: Maxima and Minima of functions of two variables using MATLAB - Lagrange's method of undetermined multipliers.	

UNIT IV – Integral Calculus	[12 hours]
Definite and Indefinite integrals - Substitution rule - Techniques of Integration: Bernoulli's theorem (without proof) – Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals. Application: Area between simple closed curves.	

UNIT V – Multiple Integrals	[12 hours]
Double integrals –Double integrals in cartesian and polar coordinates – Change of order of integration– Area enclosed by plane curves – Triple integrals – Change of variables in double and triple integrals. Application: Volume of solids, Mass of Lamina	

Course outcomes:

On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Apply the matrix algebraic techniques for eigen value related applications	K3
CO2	Understand the concepts of limit and continuity of functions	K2
CO3	Compute the derivatives and the extreme points and solve engineering problems	K3

CO4	Use the partial derivatives to find the maxima and minima of multivariable functions	K3
CO5	Use fundamental theorem of calculus to evaluate definite integrals	K3
CO6	Apply the concepts of multiple integrals to find the areas and volumes of geometrical shapes	K3

COs and POs Mapping:

COs	**POs**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	2	1	-	2	-	-	-	-	-	-	2
CO2	2	1	1	-	-	-	-	-	-	-	-	1
CO3	3	2	1	-	2	-	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	-
CO6	3	2	1	-	1	-	-	-	-	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or choice).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	20	20	20
Understand	40	20	20
Apply	40	60	60
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
3. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 2015. [For Units II & IV - Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8]

Reference Books:

1. Muthusubramanian R and Salivahanan S, "Basic Electrical and Electronics Engineering," McGraw Anton. H, Bivens. I and Davis. S, " Calculus ", Wiley, 10th Edition, 2016
2. Bali. N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
3. Jain. R.K. and Iyengar. S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition, 2016.
4. Narayanan. S. and Manicavachagom Pillai. T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.
5. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.Hill, NewDelhi, 2009.

Equivalent NPTEL/SWAYAM Courses

SI.No.	Course Title	Course Instructor	Host Institute
1	Matrix Analysis with Applications	Prof. S. K. Gupta Prof. Sanjeev Kumar	IIT Roorkee
2	Calculus of One Real Variable	Prof. Joydeep Dutta	IIT Kanpur

Web Links and Video Lectures (E-Resources):

1. System of Linear Equations, Eigenvalues and Eigenvectors: https://www.nptelvideos.com/lecture.php?id=13416
2. Concept of Domain, Limit, Continuity and Differentiability: https://www.nptelvideos.com/lecture.php?id=13422
3. Matrix Diagonalization: https://www.nptelvideos.com/lecture.php?id=13481

Course Code:	**24EN101**	**Course Title:**	**ENGLISH FOR ENGINEERS** (Common to AI&DS, AE,BME,CE,CSE,CSE(AI&ML),EEE, ECE,MECH)
Credits:	**2.5**	**L – T – P**	**1-0-3**
Pre-requisite			**NIL**

Course Objectives:

- To develop an understanding of Basic English Grammar.
- To enhance listening skills and select appropriate responses.
- To practise presentation and speaking techniques.
- To develop a quest for reading.
- To practise professional writing.

Teaching-Learning Process:
Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. Language learning softwares / Language Lab 3. Online Resources 4. Smart Class Room 5. Flipped classrooms 6. Project based Collaborative Experiential learning 7. Expert Lecture sessions

UNIT I - BASIC GRAMMAR- VOCABULARY AND EXPRESSIONS	**[8 hours]**
Grammar: Parts of speech - Types of sentences: Assertive - Imperative - Interrogative & Exclamatory - Affirmative - Negative - Gerunds & Infinitives - Tenses - Voices- Impersonal passives- Prepositions -Articles & Determiners- Cause and effect expressions - Vocabulary: Affixes- Synonyms & Antonyms - Homonyms - Homophones- Compound Nouns.	

UNIT II - ACTIVE LISTENING - RESPONDING		**[15 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
SI. No.	**Topic**	**Hours**
1.	Listening to Audio (Podcasts- Audiobooks- Radio Program) and Practice Exercise-Answering Cloze Test Based on Listening	3
2.	Listening to native speaker’s Telephone Conversations– Analyzing a Product	3
3.	Listening to Job Interviews - Sports Commentaries /	3

	Animated stories / Anecdotes / Event narration	
4.	Video Comprehension – Brainstorming and Note-Taking	3
	CLASSROOM ACTIVITIES	
1.	Listening to Statistical Information and Follow-up Exercises. - Form Filling Exercises	1
2.	Debate and reviewing the performance of each participant - Panel Discussion	2

UNIT III: SPEAKING AND PRESENTATION SKILLS		**[15 hours]**
	LIST OF EXERCISES	
	LAB ACTIVITIES	
SI. No.	**Topic**	**Hours**
1.	Speaking Development through English software S-net or Globarena and Online Content (Tenses- Voices- SV Agreement- Prepositions- Coherence Markers- Relative Clauses- Modals- Punctuation)	5
	CLASSROOM ACTIVITIES	
1.	Self-Introduction - Sharing Childhood Experiences- Talking about Favorite Personalities	1
2.	Describing Recent Innovation in Technology	1
3.	Interviewing Celebrities and Entrepreneurs	1
4.	Situational Conversations (Meeting a friend in a cafe) - Narrating Personal Experience	1
5.	Group Communication- Discussing Social Issues- Current Affairs and Debate	1
6.	Role-Play- Picture/Movie Description	1
7.	Presentation – I (Book /Movie Review- Story Telling- General	2

	Presentations)	
8.	Presentation – II (Technical Presentations)	2

UNIT IV: READING BETWEEN LINES		**[12 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
SI. No.	**Topic**	**Hours**
1.	Reading Comprehension - skimming - scanning (General / Technical passages	2
2.	Reading Longer Texts with Time Frame	2
3.	Reading Data using different types of Texts- Magazines and Internet Materials	2
4.	Reading Research Papers-- Editing/Proofreading	2
CLASSROOM ACTIVITIES		
1.	Job Advertisements – Manual for Product/Service – Telephone Phrases	1
2.	Reading Cause and Effect Essays-Technical Papers and Case Studies - Sorting out jumbled Sentences in a Paragraph	2
3.	Short Stories - Critical Reading	1

UNIT V- WRITING FOR ENGINEERS	**[7+3 hours]**
Writing - Application Letters - Resume- Product Description - Essay related to Technical / Social / current topics - Interpretation of Charts - Short Articles on everyday life - letters – Enquiry- Quotation- Order- Claim - Adjustment - Response to complaints - Statement of Purpose (SoP) -Emails - Memos -Notices - Circulars - Minutes of Meetings - Internship - Accident Report - Feasibility Report- Recommendations.	

LIST OF EXERCISES

LAB ACTIVITIES		
SI. No.	**Topic**	**Hours**
1.	Mind Mapping and Brainstorming on any Social Event/Issue	1
2.	Creating a Blog/Vlog/YouTube Channel –Uploading MP3/MP4 – Practice (Movie/Book/ Gadget Review- General/Tech Talks- Interview with Celebrities)	1
3.	Creating a Product Review Blog.	1

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Domain
CO1	Identify various grammatical components- build vocabulary and apply expressions for error-free sentences	K3
CO2	Make use of appropriate words to respond by listening to general and technical online contents	K3
CO3	Experiment with the nuances of presentation and speaking skills	K3
CO4	Apply reading skills in various academic contexts	K3
CO5	Construct legible and flawless sentences proficiently with appropriate choice of words and structures for varied professional contexts	K3

COs and POs Mapping:

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	-	-	-	-	-	-	-	-	-	3	-	3
CO2	-	-	-	-	-	-	-	-	-	3	-	3
CO3	-	-	-	-	-	-	-	-	-	3	-	3
CO4	-	-	-	-	-	-	-	-	-	3	-	3
CO5	-	-	-	-	-	-	-	-	-	3	-	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max. Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - **Theory**	CIE – I	100	60	100	25
	CIE – II	100			
	Skill Assessment I (2 Assignments + 1 seminar)	40	40		
	Skill Assessment II (3 Assignments)	40			
Continuous Internal Examination (CIE) - **Laboratory**	Continuous Assessment (Lab activities & exercises)	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**Terminal Examination**
	1	**2**	
Remember	10	10	10
Understand	30	30	30
Apply	60	60	60
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Gangalakshmi- C- Rathika- B- Saranraj- L. Professional English for Engineers. New Delhi: Cengage- 2022.

2. Murphy- Raymond. English Grammar in Use Book with Answers: A Self-study Reference and Practice Book for Intermediate Learners of English. Fourth Edition: Cambridge University Press- 2012.

Reference Books:

1. Raman- Meenakshi and Sangeetha Sharma. Communication Skills. New Delhi: OUP- 2018
2. R. C. Sharma_ Krishna Mohan - Business Correspondence and Report Writing _ a Practical Approach to Business _ Technical Communication-Mc Graw Hill India (2017)

Web Links and Video Lectures (E-Resources):

MANUALS / SOFTWARE: Open Sources / British Council / Cambridge Websites

Suggested Skill Activities:

1) Listening tests materials [Select podcasts / radio programmes / YouTube videos / audiobooks / materials from British Council] - Cloze tests where students fill in missing words from transcripts – Yes or No Question Answers – one-word answers based on recording – summary of recording
2) Self-introduction / Introduce Colleague
3) Just a Minute talks
4) Extempore
5) Mock GDs
6) Mock Interviews
7) Note Taking of Engineering Lectures
8) Create videos / blogs
9) Present Technical Papers
10) Reading Comprehension Exercises
11) Writing letters – Leave letter – Letter for academic purposes

12) Writing Essays

13) Composing Mails

14) Preparing Statement of Purpose

15) Preparing Covering letter and Resume

Course Code:	**24PH101**	**Course Title:**	**ENGINEERING PHYSICS**
Credits:	**4**	**L – T – P**	**3-0-2**
Pre-requisite			**NIL**

Course Objectives:

- To make the students effectively to achieve an understanding of Mechanics
- To enable the students to gain knowledge of Elasticity.
- To enable the students to gain knowledge of Maxwell's Equation and Electromagnetic waves.
- To introduce the basics of optics and lasers.
- Equipping the students to successfully understand the importance of quantum physics.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I -MECHANICS	[9 hours]
Multiparticle dynamics: Center of mass (CM) – Rotation of rigid bodies: Rotational kinematics – Rotational kinetic energy and moment of inertia - Theorems of M .I –M.I of Uniform rod-M.I of a diatomic molecule - Torque– Rotational energy state of a rigid diatomic molecule - Gyroscope – Torsional stress and deformation-Torsional pendulum- Double pendulum.	
Practical Topics: 1. Torsional pendulum – Determination of rigidity modulus of wire and moment of inertia of disc. 2. Compound pendulum – Determination of rigidity modulus	

UNIT II - ELASTICITY	[9 hours]
Elasticity – Factors affecting Elasticity –Different types of Modulus- Moduli of elasticity and its relation -Stress - strain diagram and its applications - Bending of beams - Bending moment – Cantilever - Young's modulus : Uniform & Non-uniform bending-theory and experiment-I Shaped Girders.	
Practical Topics: 1. Determination of Young's modulus of a given material- Non uniform bending method 2. Uniform bending – Young's modulus determination.	

UNIT III - MAXWELL'S EQUATIONS AND ELECTROMAGNETIC WAVES	[9 hours]
The Maxwell's equations - wave equation- Plane electromagnetic waves in vacuum - properties of electromagnetic waves - Producing electromagnetic waves - Energy and momentum in EM waves - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium vacuum interface for normal incidence..	
Practical Topics: 1. Spectrometer – Determination of wavelength of Hg spectrum using grating. 2. Spectrometer – Angle of the prism 3. Spectrometer – Dispersive power of the prism	

UNIT IV - LASERS &FIBER OPTICS	[9 hours]
Lasers:-Einstein coefficients and their relations –-characteristics of laser - Types of Laser - Nd-YAG laser -semiconductor laser- Applications -Industrial, Medical, laser based military weapons Fiber optics: principle and classification of optical fibers – propagation of light in optical fiber - Numerical aperture and Acceptance angle– Fiber optic communication system - Applications - Displacement and pressure sensors – Endoscopy	
Practical Topics: 1. Determination the acceptance angle and numerical aperture of the given optical fiber. 2. Determination of the particle size of the given powder using laser 3. Determination of wavelength of a given laser source - Grating method	

UNIT V - QUANTUM MECHANICS	[9 hours]
Photons and light waves - Electrons and matter waves- Dual Nature of Light –-De Broglie Waves-Compton effect - The Schrodinger equation (Time dependent and time independent forms) - Physical Significance of wave function - Normalization –Free particle - particle in a infinite potential well: 1D,2D and 3D Boxes- Normalization-quantum computation.	
Practical Topics: 1, Young's Double Slit Experiment to demonstrate the wave nature of particles	

Laboratory component: **30 Hours**

Any ten experiments have to be completed from the following list ofExperiments

SI.No	Name of the experiment
1.	Apply parallel axis theorem to find the resultant of system of concurrent coplanar forces.
2.	Torsional pendulum – Determination of rigidity modulus of wire and moment of inertia of disc
3.	Compound pendulum- Determination of moment of inertia of a rigid rod.

4.	Apply the concept of bending of beams to find the Young's modulus of a given material- by Non uniform bending method
5.	Apply the concept of bending of beams to find the Young's modulus of a given material- by Uniform bending method.
6.	Determination of V-I characteristics of a solar cell.
7.	Using Ohm's law verify the laws of resistances .
8.	Using optical fiber find the acceptance angle and numerical aperture.
9.	Make use of the laser source find the particle size of the given powder.
10.	Determination of wavelength of a given laser source - Grating method.
11.	Spectrometer – Determination of wavelength of Hg spectrum using grating.
12.	Spectrometer – Dispersive power of the prism.
13.	Determination of magnetic Induction due to long current carrying conductor.
14.	Make use of the Young's Double Slit Experiment, demonstrate the wave nature of particles.
15.	Spectrometer – Angle of the prism

Course outcomes: On completion of the course, the student will have the ability to:

CO No	**Corse Outcomes**	**Cognitive Domain**
CO1	Apply the concepts of Mechanics in materials.	K3
CO2	Apply the concept of elasticity in beams.	K3
CO3	Apply the concept of electromagnetic waves in communication.	K3
CO4	Illustrate the applications of different lasers &Calculate the acceptance angle and numerical aperture of an optical fiber .	K2
CO5	Explain the quantum concepts and quantum computation.	K2

COs and POs Mapping:

COs	**POs**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	**3**	**2**	**2**	-	-	-	-	-	-	-	-	**1**
CO2	**3**	**2**	**2**	-	**1**	-	-	-	-	-	-	**1**
CO3	**3**	**2**	**2**	-	**1**	**1**	-	-	-	-	-	**1**
CO 4	**3**	**1**	**1**	-	**1**	**1**	-	-	-	-	-	**1**
CO 5	**3**	**1**	**1**	-	-	-	-	-	-	-	-	**1**

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	60	100	25
	CIE – II	100			
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

Assessment Pattern:

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

TEXT BOOKS:

1. D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw HillEducation (Indian Edition), 2017.
2. E.M.Purcell and D.J.Morin, Electricity and Magnetism, Cambridge Univ.Press,
3. 2013.
4. Bhattacharya, D.K. & Poonam, T. "Engineering Physics". Oxford University Press, 2015

REFERENCES:

1. R.Wolfson. Essential University Physics. Volume 1 & 2. Pearson Education(Indian Edition),2009.

2. Paul A. Tipler, Physic – Volume 1 & 2, CBS, (Indian Edition), 2004.

3. K.Thyagarajan and A.Ghatak. Lasers: Fundamentals and Applications, LaxmiPublications,(Indian Edition), 2019.

4. D.Halliday, R.Resnick and J.Walker. Principles of Physics, Wiley (IndianEdition), 2015.

Equivalent NPTEL/SWAYAM Courses:

SI.No	Course Name	Course Instructor	Course Conducting Agency
1	Quantum Mechanics	Prof .P.Ramadevi	IIT -Bombay

Web links and Video Lectures (e-Resources):

1. ELASTICITY

   https://youtu.be/eICv1p8WjgI?si=88hhiQw_fld7ZrBU

2. **MAXWELL'S EQUATIONS AND ELECTROMAGNETIC WAVES**

   https://youtu.be/3IPVZYf7C-U?si=PnP1nupcfGfr1C76

3. **LASERS &FIBER OPTICS**

   https://youtu.be/Ab1nxxkgjH8?si=KR2GS8iBUFayBwdp

4. **QUANTUM MECHANICS**

   https://youtu.be/AEedn_NiWN0?si=Y27pAqawlwKmthNO

Skill Assessment:

1. Explain the concept behind the balance a water bottle on a edge.
2. The leaning Tower of Pisa is able to stand tilted without toppling, what is the reason behind it.
3. Apply the elasticity concept to find the fatigue change in plastic fiber and natural fiber

4. Radio antennas emit visible light, Why
5. What does an opaque substance do when light rays fall on it.
6. Illustrate the things happen when light falls on a piece of black paper.
7. Explain the dual nature of matter.
8. Optical Fiber is used in hard to reach places in mechanical inspection explain it.
9. Is quantum communication faster than the speed of light
10. Compare electron microscope & tunneling microscope.

Course Code:	**24CY101**	**CourseTitle:**	**Engineering Chemistry** (Common to AI&DS,AE,BME,CE,CSE,CSE(AI&ML),EEE, ECE,MECH)
Credits	**4**	**L – T – P**	**3-0-2**
Pre-requisite			**NIL**

Course objectives:

- To provide a comprehensive understanding of water quality parameters, water treatment techniques and wastewater systems.
- To use the fundamental science and engineering principles relevant to materials that includes characterization, properties and processing of engineering materials.
- To familiarize with the principles, working and applications of electrochemistry and storage devices for safe, effective and efficient operations.
- To study, measure, monitor, control and prevent corrosion processes, economically andsafely.
- To classify different types of fuel and fuel analysis techniques that assists to choose mostconvenient fuel for a process involving combustion.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Blended Mode of Learning
3. Experiential Learning
4. NPTEL and Other Videos for theory topics
5. Flipped Class
6. Lab Experiment Videos

UNIT I - WATER TREATMENT	[9 hours]
Water Sources- Water Quality parameters - Hardness of water – types-units and calcium carbonate equivalent. -Determination of hardness of water by EDTA method. Scale and sludge, caustic embrittlement, priming and foaming and boiler corrosion. Water softening methods – internal and external conditioning –zeolite process and ion exchange process. Desalination – reverse osmosis and electro dialysis- Municipal water treatment and waste water treatment process.	
Practical Topics: 1. Determination of total hardness by EDTA method. 2. Estimation of alkalinity by Indicator method. 3. Estimation of chlorine content in water sample by Argentometric method. 4. Determination of BOD in water samples.	

UNIT II - CHEMISTRY OF ENGINEERING MATERIALS	[9 hours]
Adhesives: Introduction- requisites of a good adhesive-adhesive action- industrial applications of adhesives. Insulating Materials: Introduction- requirements- Glass and ceramics - preparation, properties andapplications - fabrication of ceramic ware. Lubricants-Classification of lubricants with examples-characteristics of a good lubricants - mechanism of lubrication (thick film, thin film and extreme pressure) - properties of lubricants: viscosity, cloud point, pour point, flash point and fire point. Electronic materials: Introduction-types, properties and applications of semiconducting materials and transistors, materials used in IC's, fibers and cables- properties and applications, organic solar cells - types and applications.	
Practical Topics: 1. Determination of viscosity of oils using Oswald viscometer. 2. Determination of cloud point and pour point of oils.	

UNIT III -ELECTROCHEMISTRY	[9 hours]
Introduction – Electrode potential – Nernst equation and problems - Electrochemical series - Conductometric titrations (acid - base & precipitation titration) Electrodes: Construction, working and applications of Standard and reference electrode (Hydrogen & Calomel) – Ion selective (glass electrode) – determination of pH using glass electrode.Batteries and Fuel Cells – Types of batteries —dry cell -Lead Storage battery–Nickel-Cadmium Battery – Lithium battery – Battery hazards - Biological Batteries. Fuel Cells – Hydrogen-Oxygen FuelCell.	
Practical Topics: 1. Estimation of strength of hydrochloric acid by pHmetry. 2. Determination of strength of acids in a mixture of acids using conductivity meter.	

3. Determination of charging and discharging rate of batteries.

UNIT IV -CORROSION AND ITS CONTROL	**[9 hours]**

Corrosion – causes, factors, types, Chemical and Electrochemical Corrosion (Galvanic, Differential aeration) –galvanic series-factors influencing rate of corrosion-measurement of corrosion. Determination of corrosion rate by weight loss method.
Control Methods-Electrochemical protection – Sacrificial Anodic method – Impressed Current Cathodic Protection – Corrosion Inhibitors – Bio corrosion Protective Coatings – Paints, Constituents, Functions- Surface coating - Surface preparation for metallic coatings, Electroplating and Electro-lessPlating- ceramic coatings, thermal vaporization coating, HVOF coating

Practical Topics:

1. Estimation of the Ferrous ions in mild steel by Spectrophotometry.
2. Determination of rate of corrosion of by weight loss method

UNIT V- FUELS AND COMBUSTION	**[9 hours]**

Fuels: Introduction: Classification of fuels; solid fuel -Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Liquid fuels -Manufacture of synthetic petrol –hydrogenation of coal (Bergius process), Knocking – octane number, diesel oil – cetane number; Power alcohol and biodiesel.
Combustion of fuels: Introduction: Calorific value – higher and lower calorific values, Theoretical calculation of calorific value by Dulong's formula - Ignition temperature: spontaneous ignition temperature, Explosive range; Flue gas analysis – ORSAT Method.

Practical Topics:

1. Determination of flash point and fire point of fuels.

Laboratory component: **30 Hours**

Any ten experiments have to be completed from the following list of experiments

SI.No.	Name of the experiment
1	Determine the total hardness of water sample by EDTA method.
2	Analyze the alkalinity of water sample by Indicator method.
3	Analyze the chlorine content in water sample by Argentometric method.
4	Determine the BOD of water samples.
5	Describe the procedure to determine the viscosity of oil using an Oswald viscometer.
6	Identify the cloud point and pour point of oils.
7	Make use of glass electrode to determine the strength of hydrochloric acid.
8	Make use of conductivity meter to determine the strength of acids in a mixture of acids.
9	Determine quantitatively the amount of Ferrous ions in mild steel by Spectrophotometry.
10	Determine the of rate of corrosion of by weight loss method.
11	Describe the procedure to determine the flash point and fire point of fuels.
12	Conduct a study to find out the charging and discharging rate of batteries.

Course outcomes: On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Level
CO1	Analyze the water quality parameters and choose appropriate water treatment methods for use in industries and daily life.	K4
CO2	Make use of the applications of the materials in different engineering disciplines.	K3
CO3	Utilize the principles of electrochemistry and find the materials for energy conversion and storage.	K4
CO4	Determine the corrosion rate to propose suitable protection methods for environmental considerations	K3
CO5	Choose suitable fuels for engineering processes and automobile applications.	K3

COs and POs Mapping

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

COs	**POs**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	**3**	**2**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO4	**2**	**1**	**1**	**-**	**-**	**1**	**2**	**-**	**-**	**-**	**-**	**-**
CO5	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE) - Theory	CIE – I	100	60	100	25
	CIE – II	100			
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**Terminal Examination**
	1	**2**	
Remember	10	10	10
Understand	30	30	30
Apply	40	40	40
Analyze	20	20	20
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Jain P.C. and Jain M, Engineering Chemistry, Dhanpat Rai Publishing Company, New Delhi, 17th Edition,2021.
2. Dara S S and Umare S.S, A Text Book of Engineering Chemistry, S.Chand & Company Limited, 20thEdition, 2018.

Reference Books:

1. Benjamin M. M, Water Chemistry, Waveland Press, 2nd Edition, 2019.
2. Cicek V, Corrosion Engineering, Springer Publishing, 1st Edition, 2021.
3. Shahinpoor. M, Fundamentals of Smart Materials, Publisher: Royal Society of Chemistry, 1st Edition,2020.
4. Berg H, Bernhardsson S, and Johansson P, Electric Vehicle Batteries: Moving from Research towardsInnovation, Publisher: Springer, 1st Edition, 2019.
5. B.K.Sharma "Engineering chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2014).

Web links and Video Lectures (e-Resources):

1. Water and wastewater treatment - https://onlinecourses.nptel.ac.in/noc23_ce12/preview
2. SemiconductorDevices and circuits. - https://nptel.ac.in/courses/108108112
3. Corrosion ProtectionMethods - https://onlinecourses.nptel.ac.in/noc23_mm01/preview
4. Elementary Electrochemistry - https://onlinecourses.nptel.ac.in/noc23_cy19/preview
5. Fuel and combustionTechnology -https://archive.nptel.ac.in/courses/103/105/103105110/

Suggested Skill Activities:

1. Measure the TDS, PH & electrical conductivity of a home water.
2. Removal of temporary hardness of any water sample by suitable method.
3. Find the charging and discharging rate of mobile batteries when it is use or not.
4. The need of engineering material is essential in our day today life. - Justify the answer.
5. Measure the corrosion rate of iron bar when it is exposed in the environment.
6. List out the recent engineering materials used in emerging field.
7. Calculate the higher and lower calorific value of a fuel by using Dulong's formula.

8. List out the type of coatings applied on materials which are used in our daily life.
9. Improper disposal of batteries leads to environmental hazard. Suggest the suitable disposable method.
10. Pure Iron material undergo corrosion more fast than other materials. Give reasons.

Course Code:	**24ME201**	**Course Title:**	**Engineering Graphics and Design**
Credits:	**3**	**L – T – P**	**1-0-4**
Pre-requisite			**NIL**

Course objectives:

To impart knowledge on the

- To enable students to understand the standards and conventions of engineering drawing.
- To enhance the visualization skills to understand objects in the respective positions with respect to principal planes.
- To comprehend general projection theory, with emphasis on orthographic projection to represent three-dimensional objects in two-dimensional views.
- To emphasize freehand sketching and pictorial view to aid in the visualization process and to efficiently communicate ideas graphically.
- To Introduce CAD software for the creation of 3D models and 2D engineering drawings.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. NPTEL and Other Videos
3. Smart Class Room
4. Project based learning

UNIT I - DRAWING FUNDAMENTALS, GEOMETRIC CONSTRUCTION, PROJECTION OF POINTS, STRAIGHT LINES AND PLANES	[15 hours]
Drawing BIS standards – Orthographic projections – First angle projection - Drawing instruments – Sheet layout – Conventions – Lines, Lettering, Numbering and Dimensioning Geometric construction – Construction of regular polygons – Conic sections – Ellipse, Parabola and Hyperbola by eccentricity method.Projection of points – Points situated in all four quadrants. Projection of straight lines – Straight lines inclined to both principal planes – Finding true length of the line and true inclinations with respect to principal planes – Rotating line method. Projection of planes – Introduction – Polygonal lamina and Circular lamina - Orientation of planes - Plane parallel to both principal planes, Planes perpendicular to both principal planes and Planes inclined to both principal planes – Rotating object method.Orthographic projection of simple engineering components.	

UNIT II - PROJECTION OF SOLIDS	[15 hours]
Projection of solids – Introduction – Types of solids – Polyhedra and solids of revolution - Projection with axes inclined to one of the principal planes and parallel to other – Change of Position method. 2D drafting - Basic commands – Coordinate systems, Object section methods. Line, Circle, Polyline, Rectangle, Hatch, Fillet, Chamfer, Trim, Extend, Offset, Dim style – Annotation and Layering – Object snaps - 3D modelling – Basic commands – Extraction of multiple views – Part modelling of simple components - Utensils, Hand tools & Furniture etc. - Drawing views using 3D environment.	

UNIT III - DEVELOPMENT OF SURFACES AND PICTORIAL PROJECTION	[15 hours]
Development of lateral surfaces of truncated Prisms, Pyramids, Cylinders and Cones– Parallel line method and Radial line method. Pictorial Projection – Isometric projection – Introduction – Isometric scale – Isometric view of two right regular composite solids – Isometric projection of truncated frustum of solids – Box method. Problems on applications of Isometric projections of simple objects / engineering components.	

UNIT IV- BASIC COMPUTER AIDED DRAWING APPLICATIONS	[15 hours]
Free hand Sketching - Sketching of geometry - multiple view projection from single pictorial view of objects – Illustrative examples - True free hand, Guided Free hand, Roads, Buildings, Utensils, Hand tools & Furniture's etc.Drawing Simple Mechanisms - Bicycles, Tricycles, Gear trains, Ratchets, two-wheeler cart &Four-wheeler carts to dimensions etc.	

UNIT V- MULTIDISCIPLINARY APPLICATIONS AND PRACTICE	[15 hours]
Electric Wiring and lighting diagrams - Like, Automatic fire alarm, Call bell system, UPS system, Basic power distribution system using suitable software. Basic Building Drawing - Draw various types of lines, graphical symbols for materials, doors and windows, symbols for sanitary, water supply and electrical installations and write abbreviations as per IS 962. Like, Architectural floor plan, basic foundation drawing, steel structures- Frames, bridges, trusses using Auto CAD or suitable software, Electronics Engineering Drawings - Like, Simple Electronics Circuit Drawings, practice on layers concept. Graphs & Charts - Like, Column chart, Pie chart, Line charts, Gantt charts, etc. using Microsoft Excel or any suitable software.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Level
CO1	Apply principles of first angle projection in drafting plan and elevation of points, lines, planes, and solids.	K3
CO2	Apply change of position method in the projection of solids and determine the true shape of the section.	K3
CO3	Apply principles of orthographic projection to extract 2D views from 3D drawing using freehand sketching.	K3
CO4	Apply parallel line and radial line methods to develop lateral surfaces of solids so that students can understand applications in sheet metal design.	K3
CO5	Apply box method to develop the isometric view of simple, truncated, and composite solids.	K3

CO6	Develop simple part model in 3D and plan, elevation, and section of building using a designated CAD software.	K6

COs and POs Mapping:

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	-	-	-	-	-	-	-	2	-	-	1	2	-
CO2	3	1	-	-	-	-	-	-	-	2	-	-	1	2	-
CO3	3	1	-	-	-	-	-	-	-	-	-	-	1	2	-
CO4	3	1	-	-	-	-	-	-	-	2	-	-	1	-	-
CO5	3	1	-	-	-	-	-	-	-	2	-	-	1	2	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final marks</th></tr>
<tr><td rowspan="5">Continuous Internal Examination (CIE) - Theory</td><td>CIE – I</td><td>100</td><td rowspan="2">50</td><td rowspan="5">100</td><td rowspan="5">25</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>MCQ</td><td>20</td><td>10</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td rowspan="2">Continuous Internal Examination (CIE) - Laboratory</td><td>Continuous Assessment</td><td>75</td><td>75</td><td rowspan="2">100</td><td rowspan="2">25</td></tr>
<tr><td>Model Lab Exam</td><td>25</td><td>25</td></tr>
<tr><td>End Semester Examination (ESE)</td><td>Lab Exam</td><td>100</td><td>50</td><td>50</td><td>50</td></tr>
<tr><td colspan="5" align="right">Total</td><td>100</td></tr>
</table>

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. N.D.Bhatt,“Engineering Graphics”, Charotor Publishing House, 53RD Edition 2019
2. Natrajan K.V., “A textbook of Engineering Graphics”, Dhanalakshmi Publishers, Chennai (2015)

Reference Books:

1. Venugopal K. and Prabhu Raja V., “Engineering drawing + AutoCAD”, New Age International (P) Limited (2022)
2. Lakhwinder pal singh, Harwinder Singh, “Engineering Drawing Principles and Applications”, Cambridge University Press, 2021.
3. Cecil Johnson, Jay D Helsel and Dennis R Short, “Engineering Drawing and Design”, Seventh Edition, McGraw Hill, 2007.
4. Patil, Rajashekar, “Computer Aided Engineering Graphics”, New Age International Ltd,2018.
5. Chris Schroder, “Printed Circuit Board Design using AutoCAD”, Newnes,1997.
6. K S Sai Ram, “Design of steel structures”, Third Edition by Pearson.
7. A S Pabla, “Electrical power distribution”, 6th edition, Tata Mcgrawhill.
8. K. R. Gopalakrishna, & Sudhir Gopalakrishna, “Textbook of Computer Aided Engineering Drawing”, 39th Edition, Subash Stores, Bangalore, 2017

Web Links and Video Lectures (E-Resources):

1. **http://nptel.ac.in/courses/112103019**
2. https://archive.nptel.ac.in/courses/112/105/112105294/

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 and 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 and SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 and SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

LABORATORY REQUIREMENTS

SYSTEM REQUIREMENTS (For a batch of 30 Students)

Hardware:

1. Intel i3 core due processor with 4GB ram with 500GB hard disk – 30 Nos.
2. Laser Printer – 1 No.

Software:

Drafting package – AutoCAD – Adequate license (Open source)

Suggested Skill Activities:

1. 2D drafting of plan and elevation of computer CPU.
2. 2D drafting of plan and elevation of a thermos flask.
3. 2D drafting of a plan and elevation of piston and cylinder.
4. Sketching the projections of a bicycle in freehand.
5. Sketching the projections of a stapler.
6. Cut and develop the lateral surface of a funnel.
7. Cut one edges vertically and develop the lateral surface of CPU cabin.
8. Cut and develop the lateral surfaces of elbow of a pipe.
9. Draw the isometric view of a simple bread toaster.
10. Draw the isometric view of the computer table.
11. Sketch the assembled view of the screw jack using the orthographic projections of its components.
12. Draft the plan, elevation and section of your home using CAD.
13. Draft the plan, elevation and section of 2 storey office building using CAD.
14. Develop the 3D model of the (a) and (b).

Course Code:	24CS201	Course Title:	PROGRAMMING FOR PROBLEM SOLVING USING C
Credits:	4	L – T – P	2-0-4
Pre-requisite			NIL

Course objectives:

To impart knowledge on the

- To gain knowledge on problem solving techniques
- To learn how to write simple and modular C programs
- To develop C programs using arrays and strings
- To learn the usage of pointers in accessing and manipulating memory
- To develop applications in C using structures & files

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Classroom
8. Flipped Class

UNIT I - BASICS OF C PROGRAMMING	[6 hours]
Problem Solving Techniques: Introduction to Algorithm, Pseudo code, Flow Chart, Structure of 'C' program. C Tokens: Keywords, Data Types, Constants, Variables - Declaration - Qualifiers – typedef	

Practical Topics:

1. Steps in Problem Solving Drawing flowchart using yEd tool/Raptor Tool programs using simple statements.

2. Programs to illustrate the use of user-defined data types

UNIT II – BASIC CONSTRUCTS IN C	[6 hours]
Managing simple Input and Output operations - Operators and Expressions - Decision Making: Branching statements, looping statements - Function: Declaration, Definition - Passing arguments by value - Recursion - Storage classes	
Practical Topics: 1. Programs using decision making statements 2. Programs using looping statements 3. Programs using user defined functions and recursive functions	

UNIT III – ARRAYS AND STRINGS IN C	[6 hours]
Arrays: Initialization - One dimensional, Two dimensional, and Multi-dimensional arrays - String: Basics, declaring and initializing strings, string handling functions: standard and user defined functions	
Practical Topics: 1. Build programs using arrays and array-based operations. 2. Programs using one dimensional and two dimensional arrays. 3. Implementations involving array usage for string operations.	

UNIT IV – POINTERS IN C	[6 hours]
Pointers - Passing arguments by address - Dynamic Memory Allocation - Pointer arithmetic - Pointers and one dimensional array - Pointers and Multi-Dimensional Array: Array of Pointers, Pointer to Pointer, Pointer to an array - void Pointer - Pointer to function	
Practical Topics: 1. Implementations involving pointers for dynamic memory allocation 2. Implementations involving pointers for string manipulation.	

UNIT V – STRUCTURES, UNIONS AND FILE HANDLING IN C	[6 hours]
Structure: Declaration, Definition-Array of Structures - Pointer to Structure – Nested Structures- Union: Defining union, Accessing union members. Files: File Management functions, Random access in file- Working with Text Files and Binary Files	
Practical Topics: 1. Programs to implement structures 2. Programs to implement union 3. Programs to implement various file operations.	

Laboratory Component: **[45 hours]**

Any 12 experiments have to be completed from the following list of experiments.

S.No.	Name of the Experiment
1	Steps in Problem Solving Drawing flowchart using yEd tool/Raptor Tool programs using simple statements
2	Programs to illustrate the use of user-defined data types
3	Programs using decision making statements
4	Programs using looping statements
5	Programs using user defined functions and recursive functions
6	Build programs using arrays and array-based operations.
7	Programs using one dimensional and two dimensional arrays.
8	Implementations involving array usage for string operations.
9	Implementations involving pointers for dynamic memory allocation
10	Implementations involving pointers for string manipulation.
11	Programs to implement structures
12	Programs to implement union
13	Programs to implement various file operations

Course outcomes:

On completion of the course, the student will have the ability to:

CO No	Corse Outcomes	Cognitive Domain
CO1	Make use of problem solving techniques to solve real world problems & outline the structure of C program	K3
CO2	Identify the appropriate looping and control statements in C and develop applications using these statements	K3
CO3	Make use of arrays & strings in development of simple applications	K3
CO4	Apply the concepts of pointers and develop C programs using pointer	K3
CO5	Develop programs for storing, retrieving and processing data using structures and files.	K3

COs and POs Mapping

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	**3**	**3**	2	-	1	-	-	-		-	-	1
CO2	**3**	**3**	2	-	1	-	-	-		-	-	1
CO3	**3**	**3**	2	1	1	-	-	-		-	-	1
CO4	**3**	**3**	2	1	1	-	-	-		-	-	1
CO5	**3**	**3**	3	1	1	-	-	-		-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	15	50	50
	Lab Exam	100	35		
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	20	20	20
Understand	20	20	20
Apply	60	60	60
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2015.
2. Pradip Dey, Manas Ghosh, "Programming in C", AICTE Edition, Oxford University Press, 2018

Reference Books:

1. Yashavant P. Kanetkar, “Let Us C : Authentic guide to C programming language”, Eighteenth Edition, BPB Publications, 2021
2. Ashok N Kamthane, Programming in C, Pearson, Third Edition, 2020
3. Reema Thareja, "Programming in C", Oxford University Press, Second Edition, 2016.
4. Paul Deitel and Harvey Deitel, "C How to Program with an Introduction to C++", Eighth edition, Pearson Education, 2018.
5. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", 1st Edition, Pearson Education, 2013.
6. E.Balagurusamy, "Programming in ANSI C", seventh edition, Mc Graw Hill Education,2017

Suggested Skill Activities:

1. Steps in Problem Solving Drawing flowchart using yEd tool/Raptor Tool
2. Write a Program to calculate and display the volume of a CUBE having its height (h=10cm), width (w=12cm) and depth (8cm).
3. Ramya has bought 50 kg of onion for Rs 40 per kg and 60 kg of potato for Rs 20 per kg. Then she sold out all the stock with the selling price of Rs 60 per kg and Rs 30 per kg for onion and potato respectively. Write a C program which computes the profit gained by her.
4. A Food delivery boy needs to walk down every street in his area in order to deliver the food. Assume that the distances between the streets along the roads are given. The food delivery boy starts at the hotel and returns back to the hotel after delivering all the foods. Implement an algorithm to help the food delivery boy to walk minimum distance for the purpose.
5. Write a program to input name, marks of 5 subjects of a student and display the name of the student, the total marks scored, percentage scored and the class of result.
6. A location in a map is represented by a pair of points as x co-ordinate and y co-ordinate. Person X wants to move towards person Y which is residing in the location

L1 and L2 respectively. Write C Program to find the distance between these two person .

7. If a four-digit number is input through the keyboard, write a program to obtain the sum of the first and last digit of this number.
8. Write a program to find GCD (greatest common divisor or HCF) and LCM (least common multiple) of two numbers
9. Write a Program to multiply two 3 X 3 Matrices.
10. Write a program to create a structure named company which has name, address, phone and no Of Employee as member variables. Read name of company, its address, phone and no Of Employee. Finally display these members‟ value.
11. Write a program to create array of books. Collect various details of books such as topic, author, department. Collect details for N books and display the details of books based on department name or author
12. A class has strength of N students. The class has two mentors, one person for the odd roll numbers and the other for the rest. Write a C program which reads the roll numbers of all the students and gives two lists of roll numbers corresponding to each advisor
13. Write a C program to maintain the inventory details of items sold in a super market such as item id, name, no of items available, price per item. Perform efficient data storage based on user‟s demand at runtime
14. Write a C program to use binary files for maintaining a telephone directory which includes telephone no, Owner name and address. Here address includes details such as door no, street name, locality, city and pincode. Update the door no of all people belonging to a particular street as follows: Increment the old door no by 10 to get the new door no. (Eg: If the old door no is 13, update it as 23)

பாடநெறி குறியீடு:	**24GE201**	**பாடத்தின் தலைப்பு:**	**தமிழரும்தொழில்நுட்பமும்**
கிரெடிட்	**1**	**L – T – P**	**1-0-0**

பாடத்திட்டநோக்கங்கள்:

1. சங்ககாலத்து நெசவுத்தொழிலை விவரிப்பதற்கும் மட்பாண்டத்தொழில் நுட்பத்தைக் கண்டறிவதற்கும்.
2. சங்ககால கட்டுமானம், மேடை அமைப்பு, சிற்பங்கள், கோவில்கள், அம்மன்கோவில், திருமலைநாயக்கர் மஹால், செட்டிநாட்டு வீடுகள், இந்தோ - சாரோசெனிக் கட்டிடக்கலை ஆகியவற்றைக் கண்டறிந்து மேற்கோள் காட்ட.
3. கப்பல் கட்டுதல் மற்றும் இரும்புத் தொழிலைக் கண்டறிதல், சிலப்பதிகாரத்தில் நாணயங்கள், மணி தயாரிக்கும் தொழிற்சாலைகள், மணிகளின் வகைகள் ஆகியவற்றைப் படிக்க.
4. நீர்நிலைகளின் முக்கியத்துவத்தைகாட்ட, கால்நடை வளர்ப்பு மற்றும் கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகளை கண்காணிக்க, விவசாயம், மீன்பிடி, முத்து மற்றும் முத்துகலாச்சாரம் மற்றும் கடல் பற்றிய பண்டைய அறிவை அங்கீகரிக்க.
5. அறிவியல் தமிழின் வளர்ச்சி மற்றும் தமிழ்க்கணிப்பொறியின் வளர்ச்சியைக் கவனிக்க, இணையத்தில் தமிழ்மென்பொருள் மேம்பாடு, தமிழ் அகராதிகளை மேற்கோள் காட்ட.

அலகு I நெசவு மற்றும் பானைத்தொழில்நுட்பம்:	**[3 hours]**
சங்ககாலத்தில் நெசவுத்தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்புபாண்டங்கள் - பண்டங்களில் கீறல் குறியீடுகள்.	

அலகு II வடிவமைப்பு மற்றும் கட்டிடத்தொழில்நுட்பம்:	**[3 hours]**
சங்ககாலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்ககாலத்தில் வீட்டுப்பொருட்களில் வடிவமைப்பு - சங்ககாலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடைஅமைப்பு பற்றியவிவரங்கள் - மாமல்லபுரச்சிற்பங்களும், கோவில்களும் - சோழர்காலத்துப் பெருங்கோவில்கள் மற்றும் வழிபாட்டுத்தலங்கள் - நாயக்கர்காலக்கோயில்கள் மாதிரி கட்டமைப்பு பற்றி அறிதல்,மதுரைமீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலைநாயக்கர்மஹால் - செட்டி நாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ - சாரோசெனிக் கட்டிடக்கலை.	

அலகு III உற்பத்தித் தொழில்நுட்பம்	[3 hours]
கப்பல் கட்டும் கலை - உலோகவியல் - இரும்பு தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு வரலாற்றுச்சான்றுகளாக செம்பு மற்றும் தங்கநாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சங்கு மணிகள் - எலும்புத்துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.	

அலகு IV வேளாண்மை மற்றும் நீர்பாசனத்தொழில்நுட்பம்	[3 hours]
அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக்கு குமுழித்தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மைச்சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன் வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்.	

அலகு V அறிவியல் தமிழ் மற்றும் கணிதத்தமிழ்:	[3 hours]
அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி -தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ்மென்பொருள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.	

பாடநெறி முடிவுகள் (பாமு):

பாடநெறியின் முடிவில், மாணவர் பின்வரும் திறன்களைப் பெறுவார்:

பாமு	பாடநெறி முடிவுகள்	மிக உயர்ந்த அறிவாற்றல் நிலை
அலகு I பாமு:	சங்க கால ஜவுளி தொழில் மற்றும் மட்பாண்ட தொழில்நுட்பம் பற்றி அறிவார்கள்.	கே 1
அலகு II பாமு:	சங்க கால கட்டுமானம், மேடை அமைப்பு, சிற்பங்கள், கோவில்கள், அம்மன் கோவில், திருமலை நாயக்கர் மஹால், செட்டிநாட்டு வீடுகள், இந்தோ-சராசனிக் கட்டிடக்கலை ஆகியவற்றை விவரிக்க இயலும்.	கே 2

அலகு III பாமு:	கப்பல் கட்டுதல், இரும்புத் தொழில், நாணயம் தயாரித்தல் மற்றும் மணி தயாரிக்கும் தொழில்கள் பற்றி அறிந்து கொள்கிறார்கள்.	கே 1
அலகு IV பாமு:	நீர்நிலைகளின் முக்கியத்துவம், கால்நடை வளர்ப்பு, கிணறு, விவசாயம், மீன்பிடி, முத்து மற்றும் முத்து கலாச்சாரம் மற்றும் கடல் பற்றிய போதுமான அறிவை பெற்றுகொள்கிறார்கள் .	கே 1
அலகு V பாமு:	அறிவியல் தமிழின் வளர்ச்சி, தமிழ்க் கணிப்பொறியின் வளர்ச்சி, இணையத்தில் தமிழ் மென்பொருள் மேம்பாடு, தமிழ் அகராதிகளை சந்தேகம் இன்றி முழுமையாக தெரிந்து கொள்கிறார்கள்.	கே 1

பாடநெறி முடிவுகள் ***மற்றும் நிரல் முடிவுகள் ஒப்பிடுதல்***

பாமு கள்	**மிக உயர்ந்த அறிவாற்றல் நிலை**	**பாடநெறி முடிவுகள்**											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
பாமு **1**	கே 1	**2**	-	-	-	-	-	-	-	-	-	-	-
பாமு **2**	கே 2	**1**	-	-	-	-	-	-	-	-	-	-	-
பாமு **3**	கே 1	**1**	-	-	-	-	-	-	-	-	-	-	-
பாமு **4**	கே 1	**1**	-	-	-	-	-	-	-	-	-	-	-
பாமு **5**	கே 1	**1**	-	-	-	-	-	-	-	-	-	-	-

நிலை 3- அதிக ஒத்துப்போதல், நிலை 2- மிதமாக ஒத்துப்போதல், நிலை 1- குறைவாக ஒத்துப்போதல், நிலை 0- ஒத்துப்போகவில்லை

மதிப்பீட்டுத் திட்டம்:

கூறுகள்	மதிப்பீட்டின் வகை	அதிகபட்ச மதிப்பெண்கள்	குறைக்கப்பட்ட மதிப்பெண்கள்	இறுதி மதிப்பெண்கள்
தொடர்ச்சியான உள் தேர்வு	தொடர்ச்சியான உள் தேர்வு - I	100	40	40
	தொடர்ச்சியான உள் தேர்வு - II	100	40	
இறுதி பருவ தேர்வு	எழுத்து தேர்வு	100	60	60
மொத்தம்				100

இறுதி பருவ தேர்வு: (கேள்வி முறை)

- ஒவ்வொரு யூனிட்டும் இரண்டு 2 மதிப்பெண் வினாக்களையும் ஒரு 16 மதிப்பெண் வினாவையும் (இரண்டில் ஒன்று) கொண்டுள்ளது.
- பதினைந்து கேள்விகளுக்கும் பதிலளிக்க வேண்டும்.

மதிப்பீட்டு முறை

ப்ளூமின் வகை	தொடர்ச்சியான மதிப்பீட்டு சோதனைகள்		இறுதி தேர்வு
	1	2	
நினைவில் கொள்ளுதல்	60	50	60
புரிந்து கொள்ளுதல்	40	50	40
விண்ணப்பித்தல்	0	0	0
பகுப்பாய்வுதல்	0	0	0
மதிப்பிடுதல்	0	0	0
உருவாக்குதல்	0	0	0

TEXT BOOKS

1. தமிழகவரலாறு - மக்களும்பண்பாடும் - கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்).

2. கணினித்தமிழ் - முனைவர்இல. சுந்தரம். (விகடன்பிரசுரம்).

3. கீழடி - வைகைநதிக்கரையில்சங்ககாலநகரநாகரிகம் (தொல்லியல்துறைவெளியீடு)

4. பொருநை - ஆற்றங்கரைநாகரிகம். (தொல்லியல்துறைவெளியீடு)

5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)

6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).

REFERENCE BOOKS

1. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).

2. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)

3. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

4. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)

5. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)

6. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Course Code:	**24MA201**	**Course Title:**	**Complex Variables and Transforms** (Common to Common to AI&DS,AE,BME,CE,CSE,CSE(AI&ML),EEE, ECE,MECH)
Credits:	**4**	**L – T – P**	**3 – 1 – 0**
Pre-requisite			**24MA101- Matrices and Calculus**

Course objectives:

- To impart analytical ability in solving mathematical problems as applied to the respective branches of Engineering.
- To familiarize the students with complex integration techniques and contour integration techniques which can be used in real integrals.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.

Teaching-Learning Process:

These are sample strategies which teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method does not mean only traditional method, but different type of teaching methods may be adopted to develop the outcomes.
- Adopt Problem Based Learning (PBL), which fosters students’ Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Topics will be introduced in a multiple representation and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT I – Complex Differentiation	[12 hours]
Function of a complex variable – Analytic functions – Necessary conditions and sufficient conditions (excluding proof) – Cauchy – Riemann equations –– Properties of analytic function – Harmonic conjugate – Construction of Analytic functions - Conformal mapping: w = z+a, az, 1/z, and bilinear transformation.	
UNIT II – Complex Integration	**[12 hours]**
Statement and application of Cauchy’s integral theorem and integral formula – Taylor and Laurent expansions – Isolated singularities – Residues - Cauchy’s residue theorem. Applications: Contour integration over unit circle and semicircular contours (excluding poles on axis).	

UNIT III – Laplace Transforms	[12 hours]
Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems – Transforms of derivatives and integrals – Initial and Final Value Theorem – Inverse Laplace Transform – Convolution Theorem (Statement only) – Solution of linear second order Ordinary differential equations with constant coefficients using Laplace transforms.	

UNIT IV – Fourier Series and Fourier Transforms	[12 hours]
Dirichlet’s conditions – General Fourier series – Odd and even functions – Half range series – Harmonic analysis - Statement of Fourier integral theorem – Fourier transform pair – Parseval’s identity.	

UNIT V – Partial Differential Equation	[12 hours]
Formation of partial differential equations - Classification of partial differential equations - Solutions of one dimensional wave equation, One dimensional heat equation (excluding insulated ends) – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges).	

Course outcomes:

On completion of the course, the student will have the ability to:

CO	Course Outcome	Cognitive domain
CO1	Construct analytic functions and use their conformal mapping property in Engineering problems.	K3
CO2	Solve real and complex integrals using the Cauchy's integral formula and residue theorem.	K3
CO3	Apply Laplace transforms techniques in system modelling, digital signal processing, process control, solving boundary value problems	K3
CO4	Apply Fourier series to solve the steady state two-dimensional heat equation in cartesian coordinates.	K3
CO5	Apply the effective mathematical tools for solutions of partial differential equations that model physical phenomena and engineering problems.	K3

COs and POs Mapping:

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	1
CO5	3	2	1	-	-	-	-	-	-	-	-	-
CO6	3	2	1	-	-	-	-	-	-	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	20	20	20
Understand	20	20	20
Apply	60	60	60
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
3. Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012
4. Kandasamy. P., Thilagavathy. K, and Gunavathy. K, Engineering Mathematics Volume I & II, S. Chand & Co, New Delhi, 2005.Reference Books:

Equivalent NPTEL/SWAYAM Courses

S. No.	Course Title	Course Instructor	Host Institute
1	Partial Differential Equations	Prof. Sivaji Ganesh	IIT Bombay
2	Introduction to Fourier Analysis	Prof. Parasar Mohanty	IIT Kanpur
3	Complex Analysis	Prof. Pranav Haridas	IIT Madras

Web Links and Video Lectures (E-Resources):

1. Analytic Functions, C-R Equations: https://www.nptelvideos.com/lecture.php?id=13416
2. Laplace Transform and its Existence: https://www.nptelvideos.com/lecture.php?id=13433
3. Taylor's, Laurent Series of f(z) and Singularities: https://www.nptelvideos.com/lecture.php?id=13431
4. Applications of Fourier Transform to PDEs: https://www.nptelvideos.com/lecture.php?id=13442

Course Code:	**24EC302**	**Course Title:**	**Digital Logic Circuits and Design**
Credits:	**4**	**L – T – P**	**3-0-2**
Pre-requisite			**24MA101- Matrices and Calculus** **24PH101 – Engineering Physics**

Course objectives:

To impart knowledge on the

- To Study the fundamentals of Boolean Algebra and simplification of logic gates.
- To Study the design of various combinational circuits and logic family.
- To study the design procedure of Sequential circuits
- To study the design procedures for State Machines
- To learn the programmable logic and Memory devices

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Project based Learning
3. Experiential Learning
4. NPTEL and Other Videos
5. Smart Class Room

6. Flipped Class
7. Experimental Learning
8. NPTEL and Other Videos
9. Smart Class Room

UNIT I – Boolean Algebra And Logic Gates	[9 hours]
Basic gates and truth table, De-Morgan's theorem, SOP and POS, K Map up to five variables, Two bits and three bits binary addition and Subtraction.	
Practical Topics: 1. To Verify the truth tables of various logic gates. 2. To Implement the Given Boolean Function using Logic Gates. 3. To Verify and Study NAND and NOR gate as Universal Gates.	

UNIT II – Combinational Circuits And Logic Family	[9 hours]
Code converters, Magnitude comparator, Multiplexers and DE multiplexers, Decoders, Encoders, Priority Encoder, Combinational Circuits design-RTL, DTL, TTL & CMOS logic families	
Practical Topics: 1.To study binary to gray and gray to binary converter and verify it for all possible combinations. 2. To implement and verify the truth table of 4x1 Multiplexer and 1x4 De multiplexer. 3. To implement and verify the truth table of Encoders and Decoders.	

UNIT III – Sequential Logic	[9 hours]
74xx series Integrated Circuits, Flip-Flops, Triggering of Flip-Flops, Design of Clocked Sequential Circuits Moore and Melay model- Flip-Flop Excitation Tables , Master Slave Flip-flop , Shift Registers and Counters.	
Practical Topics: 1. Flip-flop: assemble, test and investigate operation of SR, D and JK Flip-flops 2. Shift Register: Design and investigate the operation of all type of shift registers with parallel load. 3. Counters: Design, assemble and test various ripple and synchronous counters-decimal counter, Binary counter with parallel load.	

UNIT IV – State Machine Design	[9 hours]
ASM Chart, State table , State condition and Diagrams, State minimization and hazards – analysis of asynchronous sequential logic circuits	
Practical Topics: 1. Clock-pulse generator: design, implement and test. 2. Develop an Health track monitor App to measure any 3 parameters heart rate , pressure and temperature monitoring system.	

UNIT V – Programmable Logic And Memory Devices	[9 hours]
Introduction PLA and PAL, CPLDs and FPGA - Memory Devices - ROM, RAM- Volatile and Non Volatile RAM, SDRAM,DRAM, PROM,EPROM,EEPROM, FRAM,ASIC	
Practical Topics: Investigate the behavior of RAM unit and its storage capacity -16 X 4 RAM: testing, simulating and memory expansion.	

Laboratory Component **30 hours**

S.No.	Name of the Experiment
1	To Verify the truth tables of various logic gates.
2	To Implement the Given Boolean Function using Logic Gates.
3	To Verify and Study NAND and NOR gate as Universal Gates.
4	To study binary to gray and gray to binary converter and verify it for all possible combinations.
5	To implement and verify the truth table of 4x1 Multiplexer and 1x4 DE multiplexer.
6	To implement and verify the truth table of Encoders and Decoders.
7	Flip-flop: assemble, test and investigate operation of SR, D and JK Flip-flop.
8	Shift Register: Design and investigate the operation of all type of shift registers with parallel load.
9	Counters: Design, assemble and test various ripple and synchronous counters with parallel load.
10	Clock-pulse generator: design, implement and test.
11	Develop an Health track monitor App to measure any 3 parameters heart rate , pressure and temperature monitoring system

12	Investigate the behavior of RAM unit and its storage capacity -16 X 4 RAM: testing, simulating and memory expansion Using HDL/VHDL/ Pspice Simulators

Course outcomes: On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Domain
CO1	Illustrate the concepts of Boolean Algebra and its Simplification procedures relevant to digital logic gates.	K2
CO2	Construct combinational logic circuits to perform various operations on data .	K3
CO3	Apply the concepts of sequential logic circuit to make state Machines .	K3
CO4	Construct an ASM chart to describe the sequential operations of a digital circuit.	K3
CO5	Interpret the concepts of Programmable Logic And Memory Devices to build digital circuits .	K2

COs and POs Mapping:

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2	1	-	-	-	-	-	2	-	-	1
CO2	3	2	1	1	-	-	-	-	2	-	-	1
CO3	3	2	1	-	1	-	-	-	2	-	-	1
CO4	3	2	1	1	1	-	-	-	2	-	-	1
CO5	3	2	1	1	1	-	-	-	2	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

Assessment Pattern:

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	40	40	40
Apply	40	40	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions.
- One 16 marks question (either or) will be from any one of the five units.
- All the fifteen questions have to be answered.

TEXT BOOKS

1. M. Morris Mano and Michael D. Ciletti, 'Digital Design', Pearson, 6th Edition, 2018.

REFERENCE BOOKS

1. Charles H. Roth, Jr, 'Fundamentals of Logic Design', Jaico Books, 4th Edition, 2002.
2. William I. Fletcher, "An Engineering Approach to Digital Design", Prentice- Hall of India, 1980.
3. Floyd T.L., "Digital Fundamentals", Charles E. Merril publishing company,1982.

4. John. F. Wakerly, "Digital Design Principles and Practices", Pearson Education, 4 th Edition,2007.
5. Donald D. Givone (2002), Digital Principles and Design, Tata McGraw Hill, India

WEB LINKS AND VIDEO LECTURES (E-RESOURCES):

1. Introduction To Digital Circuits : https://nptel.ac.in/courses/117106086/
2. Combinational Circuits https : https://nptel.ac.in/courses/117106086/
3. Code Converters : https://nptel.ac.in/courses/117106086/
4. S,R,JK, D Flip Flops :https://nptel.ac.in/courses/117106086/
5. Design of Synchronous Sequential Circuits : https://nptel.ac.in/courses/117106086
6. Programmable Logic Devices : https://nptel.ac.in/courses/117106086

SKILLED BASED ASSESSMENTS

1. Design a fingerprint attendance system circuit, using a Fingerprint Sensor module to authenticate a true person or employee by taking their finger input in the system Employ 4 push buttons to enrol, Delete, UP/Down. ENROLL and DEL key has triple features.
2. Design a Touchless heart rate, pulse rate monitoring and image recognition app to detect changes in face's reflectivity for automobilist safety, based on cutting-edge research and science conducted at the MIT Media Lab and there by allowing the app to calculate a persons heart rate.
3. Design an Obstacle Avoiding Robot Car Using an Ultrasonic Sensor by interfacing three ultrasonic sensors with arduino uno. Run an algorithm according to which you are going to manipulate your desire distance for obstacle detection then you are going to control your motor rotation direction for movement of your bot. 50cm (Front), 15cm (Each Side).
4. Design and implement a Digital code lock System using Arduino. Employ a LCD display which is used
to interface with the project to output lock status to be used in places where we need more security.
5. Design a Luggage Security System using GSM to inform about the status of the luggage to the owner, by making of an integrated IR Transmitter Receiver circuit and IR diodes which sense any object about certain range. Make the algorithm tailor-made to the specific requirements of the user.

Course Code:	24EE202	Course Title:	Basics of Electrical and Electronics Engineering
Credits:	4	L – T – P	3-0-2
Pre-requisite			NIL

Course objectives:

To impart knowledge on the

- Basics of DC electric circuits and its analysis
- Analysis of AC circuits and magnetic circuits
- Working principles and application of DC machines and transformers
- Digital devices and their characteristics
- Functional elements and working of sensors and actuators used for smart systems.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I –DC Circuits	[9 hours]
Introduction to DC Circuits – Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws –Nodal Analysis, Mesh analysis with independent sources only – Appliances.	
Practical Topics: 1. Model an electrical circuit and simulate it to verify Ohms Law. 2. Model an electrical circuit and simulate it to verify Kirchhoff's Voltage Law. 3. Model an electrical circuit and simulate it to verify Kirchhoff's Current Law.	

UNIT II – AC Circuits and Magnetic Circuits	[9 hours]
Introduction to poly-phase circuits - Representation of sinusoidal waveform – peak and rms values, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations – Converters: rectifiers	

and inverters; Basics of magnetic circuits – Flux – Flux density – Magnetic resonance – Self-inductance – mutual-inductance – Coupling.
Practical Topics: 1. Demonstrate the measurement of power in an RLC circuit using wattmeter method. 2. Interpret the DC output of an RLC circuit using half wave rectifier. 3. Interpret the DC output of an RLC circuit using full wave rectifier.

UNIT III – DC Machines and Transformers	**[9 hours]**
Construction, principle of operation, characteristic and application – DC Motor and DC Generator, Types of DC motors and generators – Application: Electric Vehicle – Structure of electric power system – Introduction to single phase transformers –Construction, principle of operation, characteristics and application.	
Practical Topics: 1. Conduct the load test on DC shunt motor to outline its characteristics. 2. Outline the study on the starting methods of DC series motor. 3. Conduct a study on transformer construction for real-time applications.	

UNIT IV – Electronic Devices	**[9 hours]**
Introduction to semiconductor – PN Diode – Zener Diode – BJT and its configurations – CE, CB, CC – SCR – Optoelectronic devices – LED – OLED – Seven segment displays.	
Practical Topics: 1. Experiment with PN junction diode in an AC circuit to verify its characteristics. 2. Experiment with Zener diode in an AC circuit to verify its characteristics. 3. Experiment with SCRin an AC circuit to verify its characteristics.	

UNIT V – Sensors and its Applications	**[9 hours]**
Sensors in IoT – Mobile based sensors, Resistance Temperature sensor, Humidity sensor –Medical sensor – Neural sensor – Motion sensor – PIR sensor, Piezoelectric sensor, Air quality sensor – CO_2 Sensor, RFID sensor, Water leakage detection sensor, Light sensors - Introduction to actuators in automation – Applications: smart homes – smart cities – smart parking system.	
Practical Topics: 1. Utilize Arduino and Bluetooth module for automating home appliances. 2. UtilizeESP8266 processorfor automating home appliances. 3. Construct an Arduino based solar tracker for solar irradiation measurement.	

Laboratory Component: **[30 hours]**

Any 12experiments have to be completed from the following list of experiments.

S.No	Name of the Experiment
1	Model an electrical circuit and simulate it to verify Ohms Law.
2	Model an electrical circuit and simulate it to verify Kirchhoff's Voltage Law.
3	Model an electrical circuit and simulate it to verify Kirchhoff's Current Law.
4	Demonstrate the measurement of power in an RLC circuit using wattmeter method.
5	Interpret the DC output of an RLC circuit using half wave rectifier.
6	Interpret the DC output of an RLC circuit using full wave rectifier.
7	Conduct the load test on DC shunt motor to outline its characteristics.
8	Outline the study on the starting methods of DC series motor.
9	Conduct a study on transformer construction for real-time applications.
10	Experiment with PN junction diode in an AC circuit to verify its characteristics.
11	Experiment with Zener diode in an AC circuit to verify its characteristics
12	Experiment with SCR in an AC circuit to verify its characteristics.
13	Utilize Arduino and Bluetooth module for automating home appliances.
14	UtilizeESP8266 processorfor automating home appliances.
15	Construct an Arduino based solar tracker for solar irradiation measurement.

Course outcomes:

On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Apply the circuit laws and theorems to compute the electrical parameters of domestic and industrial appliances.	**K3**
CO2	Compare the behavior of AC circuits & magnetic circuits for a given input.	**K2**
CO3	Explain the construction, working, and application of electrical machine and transformer to infer its characteristics.	**K2**
CO4	Apply the semiconductor principles using diodes, transistors, thyristors and displays for developing electronic switches and displays.	**K3**
CO5	Identify the sensors for applications in Engineering.	**K3**

COs and POs Mapping:

COs	POs										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	2	1	1	2	-	-	-	2	-	-	1
CO2	2	1	1	-	2	-	-	-	2	-	-	1
CO3	2	1	1	-	2	-	-	-	2	-	-	1
CO4	3	2	1	1	2	-	-	-	2	-	-	1
CO5	3	2	1	1	2	-	-	-	2	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Typeof assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

Assessment Pattern

Bloom's Category	Internal Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	60	40	40
Apply	20	40	40
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. D P Kothari and I.J Nagarath, "Basic Electrical and Electronics Engineering," McGraw Hill Education (India)Private Limited, Second Edition, 2020
2. A.K.Sawhney and PuneetSawhney,"A Course in Electrical & Electronic Measurements & Instrumentation,"DhanpatRai and Co, 2015.

Reference Books:

1. John Bird, "Electrical Circuit theory and technology", Routledge; 2017.
2. Muthusubramanian R and Salivahanan S, "Basic Electrical and Electronics Engineering,"McGraw Hill, NewDelhi,2009.
3. Nagsarkar T K and Sukhija M S, "Basics of Electrical Engineering," Oxford University press, 2012.
4. V K Mehta, Rohitmehta "Principles of Electronics," S.Chand& Company Ltd, 2015.
5. Mahmood Nahvi and Joseph A.Edminister, "Electric Circuits," Schaum' Outline Series, McGraw Hill, 2009.
6. H.S. Kalsi, "Electronic Instrumentation," Tata McGraw-Hill, New Delhi, 2010.
7. Ian Sinclair, "Sensors and Transducers," Elsevier Science, 3rd Edition, 2000.
8. Perry Lea, "Internet of things for architects," Packt, 2018.
9. V N Mittle and Arvind Mittle "Basic Electrical Engineering," McGraw Hill, New Delhi, 2005.
10. R.S. Sedha, "A Textbook of Applied Electronics," S. Chand & Co., 2008.
11. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry and Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017.

Web Links and Video Lectures (E-Resources):

1. A Basic Course on Electric and Magnetic Circuits : https://onlinecourses.nptel.ac.in/noc24_ee125/preview
2. Basic Electrical Circuits: https://onlinecourses.nptel.ac.in/noc24_ee112/preview
3. Digital Circuits: https://onlinecourses.nptel.ac.in/noc24_ee147/preview
4. Electrical Machines – I: https://onlinecourses.nptel.ac.in/noc24_ee103/preview
5. Sensor Technologies: Physics, Fabrication and Circuits: https://onlinecourses.nptel.ac.in/noc24_ee83/preview
6. Semiconductor Devices and Circuits: https://onlinecourses.nptel.ac.in/noc24_ee143/preview

Suggested Skill Activities:

1. List the different electrical loads available in home, college and prepare their rating chart.
2. Design the residential house wiring using fuse, switch, indicator, lamp, circuit breaker, energy meter and apply Thevenin's theorem to find the current in particular branch.
3. Take a room in your home and replace the fluorescent lamp to LED lamp to calculate the monthly electrical charge and compare with the previous month.
4. Write the parts of the fan and electric mixer in home and draw the wiring diagram for fan and electric mixer.
5. Visit the nearby substation and list out the details of safety measures followed by electrical engineers.
6. List out the rating of electrical machines used in home appliances.
7. Identify the semiconductor devices in electronic appliances.
8. Develop IOT based solutions for engineering applications.
9. Draw the wiring diagram of EV and mentions its parts.
10. Visit nearby power plant and demonstrate the various components, working, power generation and distribution in power plant as a report.

Course Code:	24EE404	Course Title:	IOT - SENSORS AND DEVICES
Credits:	**4**	**L – T – P**	**3-0-2**
Pre-requisite			**NIL**

Course objectives:

To impart knowledge on the

- Basic electronic components and Sensors.
- Fundamental concepts of Microcontrollers
- Different types of Microcontrollers
- Different protocols for communication
- Interfacing of Arduino microcontrollers with different applications.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Interactive Simulations
4. Lab experiment videos
5. Blended Mode of Learning
6. Project based Learning
7. Experiential Learning
8. NPTEL and Other Videos
9. Smart Class Room
10. Flipped Class

UNIT I - Sensors for IoT	[6 hours]
Active and Passive Sensors, Different Types of Sensors such as Capacitive, Resistive, and Surface Acoustic Wave Sensors for Pressure, Humidity, Toxic Gas; Sensors for Water (pH) quality, Accelerometer, Gyroscope, Moisture, Hall effect and Humidity	

Practical Topics:

1. Building basic circuit diagrams using breadboard and Working of a Multimeter.
2. Simple circuit using IC on breadboard.
3. Simple Relay circuit design for ON-OFF condition.

UNIT II: Microcontroller	[6 hours]
Introduction to microcontrollers and microprocessors, Different microcontrollers, Arduino:Types, UNO Architecture, ADC, DAC, Data acquisition	
Practical Topics: 1. Switch on an LED if a button is pressed. 2. Changing brightness of LED using potentiometer.	

UNIT III: Arduino Programming	[6 hours]
Digital Pins as Input and Output, Reading Analog Quantities, PWM Pin- Arduino's Serial Port and Serial Communication. Interfacing of DC Motor and Relay	
Practical Topics: 1. Change the brightness of LED (Fade in/ Fade out) using PWM 2. DC motor speed control using serial communication.	

UNIT IV – IoT System	[6 hours]
Basics of IoT, IoT Levels, Things and Connections, Building Blocks of IoT connectivity(Client-Server, Web Interface, and API: Qualitative Analysis only), Protocols and Communication (Zigbee, Bluetooth, Wi-Fi, MQTT: Qualitative Analysis only), Bluetooth and Wi-Fi Modules for Arduino	
Practical Topics: 1.Interfacing Wi-Fi module with Arduino 2.Design a simple circuit to measure the pH value of wastewater. 3.Design a simple circuit to apply Hall effect sensor	

UNIT V – IoT Applications	[6 hours]
Application of IoT in the industry, buildings, smart city, logistics, environment, health care, agriculture, and lifestyle product	
Practical Topics: 1. Sending information about the patient in home to the doctor's PC/mobile. 2. Develop an IoT System for smart home applications	

Laboratory Component **30 hours**

SI.No.	Name of the Experiment
1	Building basic circuit diagrams using breadboard and Working of a Multimeter.
2	Simple circuit using IC on breadboard.
3	Simple Relay circuit design for ON-OFF condition.
4	Switch on an LED if a button is pressed.
5	Changing brightness of LED using potentiometer.
6	Change the brightness of LED (Fade in/ Fade out) using PWM.
7	DC motor speed control using serial communication.
8	Interfacing Wi-Fi module with Arduino.
9	Design a simple circuit to measure the pH value of wastewater.
10	Design a simple circuit to apply Hall effect sensor
11	Sending information about the patient in home to the doctor's PC/mobile.
12	Develop an IoT System for real time applications.

Course outcomes:

On completion of the course, the student will have the ability to:

CO	Course Outcome	Cognitive domain
CO1	Illustrate the working principles of different types of sensors.	**K2**
CO2	Describe the basic concepts of the different types of Microcontrollers.	**K2**
CO3	Apply the knowledge of PWM and Serial communication in different circuits.	**K3**
CO4	Explain the working of Wi-Fi module and different protocols for communication for usage in IoT.	**K2**
CO5	Apply the sensor to build an IoT System for Real time applications.	**K3**

COs and POs Mapping:

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	2	1	2	2	-	-	-	-	-	-	-	-
CO2	2	1	2	3	-	-	-	-	-	-	-	-
CO3	3	2	3	3	1	-	-	-	1	-	-	-
CO4	2	2	1	2	1	-	-	-	1	-	-	-
CO5	3	2	1	2	1	-	-	-	1	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

Assessment Pattern

Bloom's Category	Internal Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	60	40	40
Apply	20	40	40
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books

1. Peter Dalmaris, "Basic Electronics for Arduino Makers", Packt Publishing, 2017.
2. Tim Pulver, "Hands-On Internet of Things with MQTT: Build Connected IoT Devices with Arduino and MQ Telemetry Transport (MQTT)", Packt Publishing, 2019.
3. Marco Schwartz, "Internet of Things with Arduino Cookbook", Packt Publishing, 2016.

Reference Books:

1. Jody Culkin, Eric Hagan, “Learn Electronics with Arduino: An Illustrated Beginner's Guide to Physical Computing” Make Community, LLC, 2017.
2. Michael Margolis, "Arduino Cookbook" O’Reilly, 2011.
3. Julien Bayle, “C Programming for Arduino”, Packt Publishing Ltd., 2013.

Web Links and Video Lectures (E-Resources):

1. Sensors for IoT- https://youtube.com/watch?v=njgixrZOT1E
2. Microcontroller- https://www.youtube.com/watch?v=l9DC9ZpQ5yo
3. Arduino Programming- https://www.youtube.com/watch?v=QO_Jlz1qpDw
4. IoT System- https://www.youtube.com/watch?v=9KlHDeW6bO4
5. IoT Applications- https://www.youtube.com/watch?v=91aXs9E0qAI

Online Courses:

1. http://nptel.ac.in
2. https://swayam.gov.in

Suggested Skill Activities:

1.How to control multiple LEDs / Traffic LEDs using tinker cad software
2.Sending Data to LCD Display using tinker cad software
3.Design a simple circuit to Measure Heart Rate and SpO2
4.Design a simple circuit to maintain the CO2 level inside the room
5.Rainfall Monitoring Using Arduino

Course Code:	24CS301	Course Title:	PROGRAMMING FOR PROBLEM SOLVING USING PYTHON
Credits:	**1.5**	**L – T – P**	**0-0-3**
Pre-requisite			**NIL**

Course objectives:

To impart knowledge on the

- To explain basic concepts in Python
- To implement programs using functions, loops, and conditional statements.
- To demonstrate the concepts of data structures
- To make use of strings and exception handling in Python
- To demonstrate file handling and python modules

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

9. Lab experiment videos
10. Project based Learning

Laboratory Component: **[20 hours]**

SI.No	Name of the Experiment
1	Develop simple python programs using basic data types
2	Develop simple python programs using operators and expressions
3	Develop Python programs using conditional statements
4	Develop Python programs using various Loops
5	Develop python programs using Functions.
6	Develop programs to demonstrate the use of List, and Tuples
7	Develop programs to demonstrate the use of Dictionaries
8	Demonstrate the various string manipulation functions
9	Develop programs to show Exception Handling in tasks
10	Execute programs using Numpy in Jupiter notebook
11	Python program using File I/O, random access file handling methods and Zipping and Unzipping of files
12	Develop Python programs using packages

Course outcomes:

On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Develop basic programs using fundamental data types	K3
CO2	Solve the given problem statement using programming concepts such as operators, conditional and looping statements and functions.	K3
CO3	Make use of data structures such as lists, tuples, and dictionaries to manage and manipulate data in development of simple applications	K3
CO4	Create programs using string handling functions and apply exception handling, and make use of NumPy to solve problems	K3
CO5	Make use of file operations and packages in development of simple applications	K3

COs and POs Mapping

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	3	3	-	1	-	-	-		-	-	1
CO2	3	3	3	-	1	-	-	-		-	-	1
CO3	3	2	2	1	1	-	-	-		-	-	1
CO4	3	2	2	1	1	-	-	-		-	-	1
CO5	3	3	3	1	1	-	-	-		-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

The weightage of Continuous Internal Evaluation (CIE) is 60% and for End Semester Examination (ESE) is 40%.

<table>
<tr><th>S.No</th><th>Component</th><th>Type of Assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final Marks</th></tr>
<tr><td>1.</td><td rowspan="2">Continuous Internal Examination(CIE)-Laboratory</td><td>Continuous Assessment</td><td>75</td><td>75</td><td rowspan="2">100</td><td rowspan="2">60</td></tr>
<tr><td>2.</td><td>Model Lab Exam</td><td>25</td><td>25</td></tr>
<tr><td>3.</td><td>End Semester Examination (ESE)</td><td>Lab Exam</td><td>100</td><td>40</td><td>40</td><td>40</td></tr>
<tr><td colspan="6">Total</td><td>100</td></tr>
</table>

Course Code:	**24GE231**	**Course Title:**	**WORKSHOP PRACTICE**
Credits:	**1.5**	**L – T – P**	**0-0-3**
Pre-requisite			**NIL**

Course objectives:

To provide hands on training to the students in:

- Applying basic techniques to measure a field, infer masonry work and install plumbing design.
- Fabricating carpentry, foundry, sheet metal and welding works to practice on workshop trades and making end products.
- Utilizing machining processes like turning, drilling, tapping in parts and 3D printing for performing the jobs.
- Designing electrical wiring layout with MCBs and RCCBs, developing staircase wiring and illumination design circuits for buildings.
- Assembling simple electronic components on PCB by soldering and desoldering and testing with IoT based interfaces.
- Developing blogs and website design for the complete access over the network.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Project based learning
2. Industrial Visit

GROUP – A (Civil and Mechanical)

PART I - CIVIL ENGINEERING PRACTICES	**[5 hours]**
1. FIELD MEASUREMENT, MASONRY WORK AND PLUMBING a. Calculate the area of a built-up space and a small parcel of land-use standard measuring tape and digital distance measuring devices. b. Visit a nearby site where construction is at initial stage and observe for following (if necessary, visit two/three times with a gap of a week). If drawings are available relate/match activities with the drawings. i. Digging and filling.	

ii. Foundation preparations.
iii. Brick/stone masonry.
iv. Concrete laying and curing.
v. Laying of sewerage/sanitary lines.
vi. Bar bending and bar laying for columns, beams and ceiling.
vii. Onsite testing for quality.
viii. Onsite preparation for construction work.
ix. Erection and removal of form work, scaffolding, centering/shuttering.

Prepare a brief report on the construction activities, methods, tools, equipments and materials being used.

c. Installation of water lines for wash basin and showers faucet.

PART II MECHANICAL ENGINEERING PRACTICES	[5 hours]

2. CARPENTRY, FOUNDRY, WELDING AND SHEET METAL
   a. Carpentry: Prepare T/L/Lap Joint from given wooden work piece and make a Box/Tray out of plywood using modern power tools.
   b. Welding: Make a Butt/Lap of MS plate using Arc welding process.
   c. Casting: Demonstration of Pattern making by sand moulding.
   d. Sheet Metal: Fabrication of Sheet Metal Tray and Funnels.
3. LATHE, DRILLING MACHINE AND 3D PRINTER
   a. Designing a driller component using radial machine.
   b. Perform a job using facing and turning in lathe.
   c. Printing simple 3D geometric shapes using SLA printer.

GROUP – B (Electrical, Electronics and IT)

PART III ELECTRICAL ENGINEERING PRACTICES	[3 hours]

4. ELECTRICAL WIRING
   a. Design a wiring circuit integrating energy meter, MCBs and RCCBs.
   b. Develop fluorescent lamp wiring, staircase wiring and electric fan wiring circuits.

PART IV ELECTRONICS ENGINEERING PRACTICES	[4 hours]

5. IOT BASED SOLUTIONS AND PCB
   a. Design a single layer PCB layout structure.
   b. Fabricate single layer PCB printing.
   c. Assembling, soldering and desoldering practice on single layer PCB.
   d. GPIO programming in ESP8266, sensor and actuator interfacing with internet enabled microcontroller device.
   e. Integration of microcontroller-based system with Cloud platform.

PART V COMPUTER SCIENCE AND ENGINEERING PRACTICES	[3 hours]
6. INTERACTIVE DYNAMIC WEBSITE a. Design a website for an application using HTML and CSS. b. Convert the designed website into responsive website using Bootstrap. c. Add dynamism to the website by using JavaScript and embed the social media components to the website. d. Incorporate the database interaction with the website. e. Deploy the developed website in the server.	

Course outcomes:

On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Apply basic techniques for field measurements, masonry work and plumbing.	K3
CO2	Make use of workshop trades like carpentry, foundry, sheet metal and welding for practicing on manufacturing of components.	K3
CO3	Develop simple components using Lathe, Drilling Machine and 3D Printer.	K3
CO4	Construct the electrical wiring circuits for buildings based on their requirement.	K3
CO5	Develop IoT based solutions and PCB for real world use cases.	K3
CO6	Build and host an interactive dynamic website.	K3

COs and POs Mapping:

COs	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	1	2	-	-	-	1	1	-	1	3	2	1
CO2	3	2	1	1	2	-	-	-	1	1	-	1			
CO3	3	2	1	1	2	-	-	-	1	1	-	1			
CO4	3	2	1	1	2	-	-	-	1	1	-	1	1	-	-
CO5	3	2	1	1	2	-	-	-	1	1	-	1			
CO6	3	2	1	1	2	-	-	-	1	1	-	1	-	1	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

The weightage of Continuous Internal Evaluation (CIE) is 60% and for End Semester Examination (ESE) is 40%.

S.No	Component	Type of Assessment	Max Marks	Reduced Marks	Total	Final Marks
4.	Continuous Internal Examination(CIE)-Laboratory	Continuous Assessment	75	75	100	60
5.		Model Lab Exam	25	25		
6.	End Semester Examination (ESE)	Lab Exam	100	40	40	40
					Total	100

Assessment Pattern

Bloom's Category	Terminal Examination
Remember	0
Understand	0
Apply	100
Analyse	0
Evaluate	0
Create	0

Text Books:

1. AICTE's Prescribed Textbook: Workshop / Manufacturing Practices (with Lab Manual) ISBN: 978-93-91505-332
2. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.

Reference Books:

1. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4 th edition, Pearson Education India Edition, 2002.
2. Gowri P. Hariharan and A. Suresh Babu," Manufacturing Technology – I" Pearson Education, 2008.
3. Roy A. Lindberg, "Processes and Materials of Manufacture", 4 th edition, Prentice Hall India, 1998.
4. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House, 2017.

Course Code:	**24EN201**	**Course Title:**	**Presentation and Language Skills Laboratory** (Common to AI&DS,AE,BME,CE,CSE,CSE(AI&ML), EEE, ECE,MECH)
Credits:	**1.5**	**L – T – P**	**0-0-3**
Pre-requisite			**24EN101 English for Engineers**

Course Objectives:

- To apply critical listening skills.
- To make use of critical thinking skills.
- To apply stress as well as tonal variation.
- Make use of language skills to produce error free sentences
- To experiment with presentation skills.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Lab experiment videos
2. Blended Mode of Learning
3. Project based Learning
4. Smart Classroom
5. Flipped Class

	UNIT I	**[12 hours]**
	LIST OF EXERCISES	
	LAB ACTIVITIES	
Sl. No.	**Topics**	**Hours**
1.	Listening to audios (online platforms) and making a critical appreciation of audio content	3
2.	Listening to breaking news	2
3.	Listening to British council / Cambridge English (Selected topics)	2
	CLASSROOM ACTIVITIES	
1	Speaking current issues (selected topics)	2
2	Making conversations at work place, Public Speaking (based on festivals and celebrations)	3

	UNIT II	**[12 hours]**
	LIST OF EXERCISES	
	LAB ACTIVITIES	
Sl. No.	**Topic**	**Hours**

1	English Movie clips and software in the Lab C (Globarena)	3
2	Vocabulary Development through movies/ short films/ Documentaries	3
CLASSROOM ACTIVITIES		
1	Speaking - Just a minute talk and expressions for plans and decisions	3
2	Describing a product	3

UNIT III		**[12 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	**Topic**	**Hours**
1.	Listening to TED talks, scientific lectures.	3
2.	Reading Comprehension strategies	2
3.	Reading- Editorials	2
CLASSROOM ACTIVITIES		
1.	Speaking- Introduction to Phonetics- Speech sounds- Vowels and Consonants- Stress- Rising/ Falling Tone	2
2.	Writing- A day in my life	2
3.	Writing- Situational Dialogues	1

UNIT IV		**[12 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl.No.	**Topic**	**Hours**
1.	Reading Popular Blogs Listening Editorials	3
2.	Creating a Blog	2
CLASSROOM ACTIVITIES		
1.	Errors in Pronunciation. Error detection	3
2.	Writing - Terminology for Engineers. Writing Articles and preparing day to day scripts.	2 2

UNIT V		**[12 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	**Topic**	**Hours**
1.	Prepare PowerPoint presentation (topics selected by	3

	students)	
2.	Reading newspaper articles	2
CLASSROOM ACTIVITIES		
1.	Present the selected topic.	3
2.	Making a short speech / Extempore	2
3.	Writing - Expanding a Proverb Writing Instructions	2

S.No.	Name of the Experiments
1	Making conversation at workplace
2	Writing articles
3	Making expressions for plans and decisions
4	Describing a product
5	Day in my life
6	Writing Terminology for engineers
7	Spotting errors
8	Expansion of proverbs
9	Instructions
10	Reading comprehension

Course Outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Domain
CO1	Build communicative competence through critical listening skills.	K3
CO2	Make use of critical thinking skills to express plans and opinions.	K3
CO3	Apply stress as well as tonal variations for effective communication.	K3
CO4	Make use of language skills to produce error free sentences.	K3
CO5	Experiment with presentation skills to address confidently.	K3

COs and POs Mapping:

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	-	-	-	-	-	-	-	-	-	3	-	3
CO2	-	-	-	-	-	-	-	-	-	3	-	3
CO3	-	-	-	-	-	-	-	-	-	3	-	3
CO4	-	-	-	-	-	-	-	-	-	-	-	3
CO5	-	-	-	-	-	-	-	-	-	3	-	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Assessment Pattern:

Name of the Test	Marks	Total	Reduced to
Continuous Assessment (Experiments 1-10)	50	100	50
Model Examination	50		
End Semester Lab Exam	100	100	50
TOTAL			**100 MARKS**

Textbooks:

1. Raman, Meenakshi and Sangeetha Sharma. Professional Communication. Oxford University Press, Oxford, 2014.
2. Dr. Chellammal. V. Learning to Communicate. Allied Publishers, New Delhi, 2003.
3. Mohan, Krishna. And Meera Bannerjee. Developing Communication Skills. Macmillan India Ltd. 1990.

Reference Books:

Murphy – Raymond. English Grammar in Use BOOK with Answers: A Self-Study. Reference and Practice Book for Intermediate Learners of English. Fourth edition: Cambridge University Press – 2012.

MANUALS/ SOFTWARE: Open Sources / Websites

ROHINI COLLEGE OF ENGINEERING AND TECHNOLOGY

(AUTONOMOUS)

(Anjugramam-Kanyakumari Main Road, Palkulam,Variyoor P.O.-629 401, K.K.Dist.)

Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai

Accredited with A+ Grade by NAAC

B.E. BioMedical Engineering

(B.Tech BME)

Curriculum & Syllabus

(*2024-2025 Admitted Students Onwards*)

Vision Statement of RCET

To be an academic institute of continuous excellence towards education and research in rural regime and provide service to nation in terms of nurturing potentially higher social, ethical and engineering companion graduands.

Mission Statement of RCET

To foster and promote technically competent graduands by imparting the state of art Engineering education in rural regime.

To enunciate research assisted scientific learning by dissemination of knowledge towards science, agriculture, industry and national security.

Vision of the Department

To inculcate competency in the field of Biomedical Engineering to create research oriented technically competent, skilled and socially responsible biomedical professionals.

Mission of the Department

Imparting quality education by providing active interdisciplinary learning environment.

Creating a platform for innovation, research and technology development

Inculcating ethical practices and sense of social responsibilities among students.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1 Graduates will demonstrate ***technical skills*** and leadership qualities to pursue career in broad areas of biomedical Engineering.

PEO2 Graduates will be engaged in ***research and development*** of biomedical engineering and allied fields.

PEO3 Graduate will demonstrate faithfulness to the professional ***codes of***

conduct appropriate to his or her field of study and/or practice with ***social responsibility***.

PROGRAMME OUTCOMES (POs)

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6 Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life- long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OBJECTIVES (PSO'S):

Engineering Graduates will be able

Apply the core concepts of biomedical engineering to design a health care device.

Perform, analyze and interpret the results of various biomedical or health-related tests.

CREDIT INFO		
Sl.No	Category	Credits
1	Humanities and Social Science (HSS)	13
2	Basic Science Courses (BSC)	25
3	Engineering Science Courses (ESC)	25
4	Professional Core Course(PCC)	59
5	Professional Electives Courses (PEC)	18
6	Open Electives Courses (OEC)	12
7	Employability Enhancement Courses (EEC)	17
8	Mandatory Courses (MNC)	-
Total Credits		169

Humanities and Social Science (HSS)							
Sl.no	Course Code	Course Title	Course Type	L	T	P	Credit
1	24GE101	Heritage of Tamils	HSS	1	0	0	1`
2	24EN101	English For Engineers	HSS	2	0	1	2.5
3	24GE201	Tamil And Technology	HSS	1	0	0	1`
4	24EN201	Presentation And Language Skills Laboratory	HSS	0	0	3	1.5
5	24MG601	Product Innovation & Entrepreneurship	HSS	2	0	0	2
6	24GE701	Professional Ethics and Human Values	HSS	2	0	0	2
7	24MG701	Industrial Engineering & Psychology	HSS	3	0	0	3

Basic Science Courses (BSC)

Sl.no	Course Code	Course Title	Course Type	L	T	P	Credit
1	24MA101	Matrix and calculus	BSC	3	1	0	4
2	24PH101	Engineering Physics	BSC	3	0	2	4
3	24CY101	Engineering Chemistry	BSC	3	0	2	4
4	24MA201	Complex Variables and Transforms	BSC	3	1	0	3
5	24PH203	Medical Physics	BSC	2	0	0	2
6	24CY401	Environmental Science and Engineering	BSC	4	0	0	4
7	24MA301	Probability, Random Process and Statistics	BSC	3	1	0	4
Engineering Science Courses (ESC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24ME201	Engineering Graphics & Design	ESC	1	0	4	3
2	24CS201	Programming for Problem Solving In C	ESC	2	0	4	4
3	24EE303	Circuit Analysis	ESC	3	0	2	4
4	24EE202	Fundamentals of Electrical and Electronics Engineering	ESC	3	0	2	4
5	24GE231	Workshop Practices	ESC	3	0	2	4
6	24CS331	Programming for Problem Solving using Python	ESC	0	0	3	1.5
7	24EE301	Electromagnetic Theory	ESC	3	0	2	4
8	24EE304	IoT-Sensors and Devices	ESC	2	0	2	3
Professional Core Courses (PCC)							

S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24BM301	Analog and Digital Electronics	PCC	3	1	0	4
2	24BM302	Bio Science in Medical Engineering	PCC	3	0	0	3
3	24BM303	Human Anatomy and Physiology	PCC	3	0	0	3
4	24BM401	Biomaterials	PCC	3	0	2	4
5	24BM402	Sensors and data acquisition	PCC	3	0	3	4.5
6	24BM403	Biocontrol System	PCC	2	0	2	3
7	24BM404	Biomedical Signal Processing	PCC	3	0	2	4
8	24BM405	Biomechanics	PCC	3	0	2	4
9	24CS402	Data Structures using C++	PCC	3	0	2	4
10	24BM501	Artificial Organs & Implants	PCC	3	0	2	4
11	24EC501	Microprocessors, Microcontrollers and Interfacing Techniques	PCC	3	0	2	4
12	24BM502	Biomedical Instrumentation	PCC	4	0	0	4
13	24BM531	Device Design lab	PCC	3	0	0	3
14	24BM601	Diagnostic and Therapeutic Equipments	PCC	3	0	2	4
15	24BM602	Medical Image Processing	PCC	3	0	2	4
16	24BM701	Biomedical Informatics	PCC	2	0	2	3
17	24BM702	Artificial Intelligence in Health care	PCC	0	0	2	1
Professional Electives Courses I (PEC)							

COMMUNICATION IN HEALTH CARE							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24BM571	Medical Textiles	PEC	3	0	0	3
2	24BM572	Wearable Systems and Body Area Networks	PEC	3	0	0	3
3	24BM573	Biometric Systems	PEC	3	0	0	3
4	24BM574	Medical Imaging Equipment	PEC	3	0	0	3
5	24BM575	Virtual and Augmented Reality in Healthcare	PEC	3	0	0	3
6	24BM576	Medical Optics	PEC	3	0	0	3
Professional Electives Courses II (PEC)							
BIOSYSTEMS AND BIOLOGICAL ENGINEERING							
1	24BM581	Engineering of Nano Materials	PEC	3	0	0	3
2	24BM582	Drug Delivery Systems	PEC	3	0	0	3
3	24BM583	Bioanalytical Techniques And Characterization	PEC	3	0	0	3
4	24BM584	Cellbiology and Tissue Engineering	PEC	3	0	0	3
5	24BM585	Modeling of Physiological Systems	PEC	3	0	0	3
6	24BM586	Computational Biology and Bioinformatics	PEC	3	0	0	3
Professional Electives Courses III (PEC)							
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING							
1	24BM671	Soft Computing	PEC	2	0	2	3
2	24BM672	Machine Learning Techniques	PEC	2	0	2	3

3	24BM673	Deep Learning Techniques	PEC	2	0	2	3
4	24BM674	Python Programming for AI And ML	PEC	2	0	2	3
5	24BM675	Introduction to Data Analytics and Visualization	PEC	2	0	2	3
6	24BM676	Architectures for Management of Large Datasets	PEC	2	0	2	3
Professional Electives Courses IV (PEC)							
IoT							
1	24BM681	IoT Protocols and Industrial Sensors	PEC	2	0	2	3
2	24BM682	IoT Processors	PEC	2	0	2	3
3	24BM683	IoT System Design	PEC	2	0	2	3
4	24BM684	IoT Communication Models	PEC	2	0	2	3
5	24BM685	Industrial IoT and Industry 4.0	PEC	2	0	2	3
6	24BM686	Python for IoT Data Analytics	PEC	2	0	2	3
Professional Electives Courses V (PEC)							
VLSI SYSTEM DESIGN							
1	24BM771	Analog VLSI Circuits	PEC	3	0	0	3
2	24BM772	Low Power VLSI Design	PEC	3	0	0	3
3	24BM773	Nano Electronics	PEC	3	0	0	3
4	24BM774	Device Modeling	PEC	3	0	0	3
5	24BM775	System-On-Chip Design	PEC	3	0	0	3
6	24BM776	FPGA Based System Design	PEC	3	0	0	3
Professional Electives Courses VI (PEC)							

RADIO FREQUENCY AND ANTENNA SYSTEM							
1	24BM781	Microwave Circuits and Systems	PEC	3	0	0	3
2	24BM782	Microwave Integrated Circuits	PEC	3	0	0	3
3	24BM783	RF System Design	PEC	3	0	0	3
4	24BM784	Electromagnetic Interference and Compatibility	PEC	3	0	0	3
5	24BM785	Antenna Technologies for Wireless Applications	PEC	3	0	0	3
6	24BM786	Optical Communication	PEC	3	0	0	3
Open Electives Courses I (OEC)							
ARTIFICIAL INTELLIGENCE AND COMPUTER SCIENCE AND ENGINEERING							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24AI601	Artificial Intelligence and Machine Learning Fundamentals	OEC	3	0	0	3
2	24AI602	Business Intelligence and Its Applications	OEC	3	0	0	3
3	24AI603	Data Science Fundamentals	OEC	3	0	0	3
4	24CS601	Augmented Reality /Virtual Reality	OEC	3	0	0	3
5	24CS602	Full Stack Development	OEC	3	0	0	3
6	24CS603	Software Testing and Quality Assurance	OEC	3	0	0	3
7	24CS604	Cloud Computing	OEC	3	0	0	3
Open Electives Courses II (OEC)							
CIVIL AND AGRICULTURAL ENGINEERING							

1	24AG601	Principles of Crop Production	OEC	3	0	0	3
2	24AG602	Dairy and Food Engineering	OEC	3	0	0	3
3	24AG603	Post-Harvest Technology	OEC	3	0	0	3
4	24AG604	Agricultural Finance, Banking and Co-operation	OEC	3	0	0	3
5	24CI601	Rural Development	OEC	3	0	0	3
6	24CI602	Geographic Information System	OEC	3	0	0	3
7	24CI603	Water Resources management	OEC	3	0	0	3
8	24CI604	Climate Change and its Impact	OEC	3	0	0	3
Open Electives Courses III (OEC)							
BIO MEDICAL AND ELECTRICAL ENGINEERING							
1	24EC501	Nano Electronics	OEC	3	0	0	3
2	24EC503	Digital Signal Processing	OEC	3	0	0	3
3	24EC504	Fuzzy Logic Systems and ANN	OEC	3	0	0	3
4	24EC506	Fiber Optic Sensors	OEC	3	0	0	3
5	24EE701	Robot Process Automation	OEC	3	0	0	3
6	24EE702	Electric vehicle Technology	OEC	3	0	0	3
7	24EE703	Smart Grid	OEC	3	0	0	3
8	24EE704	Energy Conservation and Management	OEC	3	0	0	3
Open Electives Courses IV (OEC)							
MECHANICAL AND MANAGEMENT							
1	24ME701	Additive Manufacturing	OEC	3	0	0	3
2	24ME702	Rocket Propulsion	OEC	3	0	0	3

3	24ME703	Industrial Safety	OEC	3	0	0	3
4	24ME704	Marine Vehicles	OEC	3	0	0	3
5	24MG701	Digital Marketing	OEC	3	0	0	3
6	24MG702	Industrial Psychology	OEC	3	0	0	3
7	24MG703	Logistics and Supply chain Management	OEC	3	0	0	3
8	24MG704	Corporate Social Responsibility	OEC	3	0	0	3

Employability Enhancement Courses (EEC)

S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24EC351	Mini Project – I (Introduction to Innovative Projects)	EEC	0	0	2	1
2	24BM451	Mini Project – II (Design and development of the product)	EEC	0	0	2	1
3	24EN451	Soft Skills Development	EEC	0	0	2	1
4	24BM551	Mini Project – III (Community based Project)	EEC	0	0	2	1
5	24EN651	Business and Managerial Communications	EEC	0	0	2	1
6	24BM651	Mini Project-IV (Micro Project)	EEC	0	0	2	1
7	24GE651	Quantitative and Reasoning Skills-II	EEC	0	0	2	1
8	24BM751	Project Work Phase I (Design and Analysis)	EEC	0	0	2	1
9	24BM752	Industrial Training / Internship	EEC	0	0	4	2

10	24EC851	Project Work Phase II	EEC	0	0	0	2
Mandatory Courses (MNC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24MC101	Induction Programming	MNC	THREE WEEKS			
2	24MC201	Sports and Yoga for Youth Empowerment - I	MNC	0	0	2	0
3	24MC202	NCC Credit Course Level - I	MNC	1	0	2	1#
4	24MC301	Sports and Yoga for Youth Empowerment - II	MNC	0	0	2	0
5	24MC401	NCC Credit Course Level - II	MNC	1	0	0	1#
6	24MC601	Disaster Management	MNC	1	0	0	0
7	24MC701	Constitutions of India	MNC	1	0	0	0

Recommended Courses for Ist SEMESTER

S.no	Course code	Course Title	Category	L	T	P	C
THEORY COURSES							
1	24GE101	Heritage of Tamils	HSS	1	0	0	1`
2	24MA101	Matrices and Calculus	BSC	3	1	0	4
THEORY COURSE WITH LABORATORY COMPONENT							
3	24EN101	English for Engineers	HSS	2	0	1	2.5
4	24PH101	Engineering Physics	BSC	3	0	2	4
5	24CY101	Engineering Chemistry	BSC	3	0	2	4
6	24ME201	Engineering graphics & design	ESC	1	0	4	3
7	24CS201	Programming for problem solving using c	ESC	2	0	4	4
MANDATORY COURSES							
8	24MC101	Induction programming	MNC	THREE WEEKS			
TOTAL				14	1	15	22.5

Recommended Courses for IInd SEMESTER

S.no	Course code	Course Title	Category	L	T	P	C
THEORY COURSES							
1	24 GE202	Tamil And Technology	HSS	1	0	0	1`
2	24 MA202	Complex Variables and Transforms	BSC	3	1	0	4
3	24 PH202	Medical Physics	BSC	3	0	0	3
4	24 CY202	Environmental Science and Engineering	BSC	2	0	0	2
THEORY COURSE WITH LABORATORY COMPONENT							
4	24EE202	Fundamentals of Electrical and Electronics Engineering	ESC	3	0	2	4
5	24BM302	Bio Science in Medical Engineering	PCC	3	0	0	3
LABORATORY COURSES							
7	24CS301	Programming for problem solving using python	ESC	0	0	3	1.5
8	24GE231	Workshop practices	ESC	0	0	3	1.5
9	24EN231	Presentation and language Skills laboratory	HSS	0	0	3	1.5
MANDATORY COURSES							
10	24MC201	Sports and yoga for youth empowerment - I	MNC	0	0	2	0
11	24MC202	NCC Credit Course Level - I	MNC	1	0	2	1#
TOTAL				13	1	15	21.5

பாடநெறி குறியீடு:	24GE101	பாடத்தின் தலைப்பு:	தமிழர்மரபு (Common to AI&DS,AE,BME,CE,CSE,CSE (AI&ML),EEE,ECE,MECH)
கிரெடிட்	1	L – T – P	1-0-0

பாடத்திட்ட நோக்கங்கள்:
தமிழின் மதச்சார்பற்ற தன்மை, இந்திய மொழிக் குடும்பத்தின் திராவிட மொழி, திருக்குறளின் கருத்துக்கள், சமயங்களின் தாக்கம், நவீன இலக்கிய வளர்ச்சி ஆகியவற்றை நினைவு கூர்தல். தமிழர்களின் சமூக மற்றும் பொருளாதார வாழ்வில் நடுகல், சிற்பங்கள், சிலைகள் மற்றும் அழகிய கைவினைப் பொருட்கள், இசைக்கருவிகள் ஆகியவற்றின் தொடர்புடைய அறிவைக் கோடிட்டுக் காட்டுதல். தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகளை மனதில் பதிய வைத்தல். தமிழ்நாட்டின் தாவரங்கள் மற்றும் விலங்கினங்கள், சங்க நகரங்கள் மற்றும் துறைமுகங்கள், சங்க காலத்தின் ஏற்றுமதி மற்றும் இறக்குமதிகளை நினைவுபடுத்துதல், வெளிநாடுகளில் சோழர் படையெடுப்பைக் கண்டறிதல். இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கைக் கண்டறிதல், இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்குக்கு இணையாக இந்தியாவின் பிற பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கத்தை அடையாளம் காணுதல்.

அலகு I மொழி மற்றும் இலக்கியம்:	**[3hours]**
இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம்- பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.	

அலகு II மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக்கலை:	[3hours]
நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.	

அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:	[3hours]
தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.	

அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள்:	[3hours]
தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறைமுகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி.	

அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு:	[3hours]
இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.	

பாடநெறி முடிவுகள் (பாமு):

பாடநெறியின் முடிவில், மாணவர் பின்வரும் திறன்களைப் பெறுவர்:

பாமு	**பாடநெறி முடிவுகள்**	**மிக உயர்ந்த அறிவாற்றல் நிலை**

அலகு I பாமு:	தமிழின் மதச்சார்பற்ற தன்மை, திராவிட மொழியின் பங்கு, திருக்குறளின் கருத்துக்கள், சமயங்களின் தாக்கம், நவீன இலக்கிய வளர்ச்சி ஆகியவற்றையும் தெரிந்துகொள்கிறார்கள்.	கே 1
அலகு II பாமு:	தமிழர்களின் சமூக மற்றும் பொருளாதார வாழ்வில் நடுகல், சிற்பங்கள், சிலைகள் மற்றும் அழகிய கைவினைப் பொருட்கள், இசைக்கருவிகள் ஆகியவற்றை விவரிக்கும் ஆற்றலை பெறுகிறார்கள்.	கே 2
அலகு III பாமு:	தமிழர்களின் பாரம்பரிய விளையாட்டுகளை தெரிந்து கொள்ளுவதால் விளையாட வேண்டும் ஏன்ற ஆர்வத்தை பெறுகிறார்கள்.	கே 1
அலகு IV பாமு:	தமிழ்நாட்டின் தாவரங்கள் மற்றும் விலங்கினங்கள் பற்றிய அறிவையும், சங்க கால கட்டிடக்கலை, ஏற்றுமதி மற்றும் இறக்குமதி தொழில் நுட்ப அறிவை பெறுகிறார்கள்..	கே 1
அலகு V பாமு:	இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கையும், இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு இணையாக இருப்பதையும், தெரிந்து கொள்கிறார்கள்.	கே 1

பாடநெறி முடிவுகள் ***மற்றும் நிரல் முடிவுகள் ஒப்பிடுதல்***

பாமுகள்	மிக உயர்ந்த அறிவாற்றல் நிலை	பாடநெறி முடிவுகள்											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
பாமு**1**	கே 1	**2**	-	-	-	-	-	-	-	-	-	-	-
பாமு**2**	கே 2	**1**	-	-	-	-	-	-	-	-	-	-	-
பாமு**3**	கே 1	**1**	-	-	-	-	-	-	-	-	-	-	-
பாமு**4**	கே 1	**1**	-	-	-	-	-	-	-	-	-	-	-
பாமு**5**	கே 1	**1**	-	-	-	-	-	-	-	-	-	-	-

நிலை 3- அதிக ஒத்துப்போதல், நிலை 2- மிதமாக ஒத்துப்போதல், நிலை 1- குறைவாக ஒத்துப்போதல், நிலை 0- ஒத்துப்போகவில்லை

மதிப்பீட்டுத் திட்டம்:

கூறுகள்	மதிப்பீட்டின் வகை	அதிகபட்ச மதிப்பெண்கள்	குறைக்கப்பட்ட மதிப்பெண்கள்	இறுதி மதிப்பெண்கள்
தொடர்ச்சியான உள் தேர்வு	தொடர்ச்சியான உள் தேர்வு - I	100	40	40
	தொடர்ச்சியான உள் தேர்வு - II	100	40	
இறுதி பருவ தேர்வு	எழுத்து தேர்வு	100	60	60
			மொத்தம்	100

இறுதி பருவ தேர்வு: **(கேள்வி முறை)**

- ஒவ்வொரு யூனிட்டும் இரண்டு 2 மதிப்பெண் வினாக்களையும் ஒரு 16 மதிப்பெண் வினாவையும் (இரண்டில் ஒன்று) கொண்டுள்ளது.
- பதினைந்து கேள்விகளுக்கும் பதிலளிக்க வேண்டும்.

மதிப்பீட்டு முறை

ப்ளூமின் வகை	தொடர்ச்சியான மதிப்பீட்டு சோதனைகள்		இறுதி தேர்வு
	1	2	
நினைவில் கொள்ளுதல்	60	50	60
புரிந்து கொள்ளுதல்	40	50	40
விண்ணப்பித்தல்	0	0	0
பகுப்பாய்வுதல்	0	0	0
மதிப்பிடுதல்	0	0	0
உருவாக்குதல்	0	0	0

TEXT BOOKS:

1. தமிழகவரலாறு - மக்களும்பண்பாடும் - கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்).
2. கணினித்தமிழ் - முனைவர்இல. சுந்தரம். (விகடன்பிரசுரம்).
3. கீழடி - வைகைநதிக்கரையில்சங்ககாலநகரநாகரிகம் (தொல்லியல்துறைவெளியீடு)
4. பொருநை - ஆற்றங்கரைநாகரிகம். (தொல்லியல்துறைவெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International
Institute of Tamil Studies.

REFERENCE BOOKS:

1. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
2. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
3. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department ofArchaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

4. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
5. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
6. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Course Code:	**24MA101**	**Course Title:**	**Matrices and calculus** (Common to AI&DS,AE,BME,CE,CSE,CSE(AI&ML),EEE, ECE,MECH)
Credits:	**4**	**L – T – P**	**3 – 1 – 0**
Pre-requisite			**NIL**

Course objectives:

- To provide the basic tools of calculus mainly for the purpose of modeling the engineering problems mathematically and obtaining solutions.
- To learn the concept of eigenvalues and eigenvectors and to reduce the quadratic form to canonical form.
- To learn the foundation course of Single Variable and multivariable calculus plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

Teaching-Learning Process:

These are sample strategies which teachers can use to accelerate the attainment of the various course outcomes.

Lecture method does not mean only traditional method, but different type of teaching methods may be adopted to develop the outcomes.

Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.

Topics will be introduced in a multiple representation and encourage the students to come up with their own creative ways to solve them.

Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT I – Matrices	[12 hours]
Eigenvalues and Eigenvectors and their properties – Diagonalization of a matrix (Symmetric matrix) – Cayley - Hamilton theorem (without proof) – Inverse and Power of a matrix by Cayley - Hamilton theorem – Quadratic forms and Nature of quadratic forms. Application: Reduction of a quadratic form to canonical form by orthogonal transformation.	

UNIT II – Differential Calculus	[12 hours]
Functions – Limit – Continuity – Derivatives – Differentiation rule – Product and quotient rules – Chain rules – Implicit differentiation – Logarithmic differentiation. Application: Maxima and Minima of functions of one variable	

UNIT III – Functions of Several Variables	[12 hours]
Partial differentiation – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables. Application: Maxima and Minima of functions of two variables using MATLAB - Lagrange's method of undetermined multipliers.	

UNIT IV – Integral Calculus	[12 hours]
Definite and Indefinite integrals - Substitution rule - Techniques of Integration: Bernoulli's theorem (without proof) – Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals. Application: Area between simple closed curves.	

UNIT V – Multiple Integrals	[12 hours]
Double integrals –Double integrals in cartesian and polar coordinates – Change of order of integration– Area enclosed by plane curves – Triple integrals – Change of variables in double and triple integrals. Application: Volume of solids, Mass of Lamina	

Course outcomes:

On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Apply the matrix algebraic techniques for eigen value related applications	K3
CO2	Understand the concepts of limit and continuity of functions	K2
CO3	Compute the derivatives and the extreme points and solve engineering problems	K3
CO4	Use the partial derivatives to find the maxima and minima of multivariable functions	K3
CO5	Use fundamental theorem of calculus to evaluate definite integrals	K3
CO6	Apply the concepts of multiple integrals to find the areas and volumes of geometrical shapes	K3

COs and POs Mapping:

COs	**POs**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	2	1	-	2	-	-	-	-	-	-	2
CO2	2	1	1	-	-	-	-	-	-	-	-	1
CO3	3	2	1	-	2	-	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	-
CO6	3	2	1	-	1	-	-	-	-	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		

	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or choice).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	20	20	20
Understand	40	20	20
Apply	40	60	60
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

TextBooks:

1. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
3. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 2015. [For Units II & IV - Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8]

Reference Books:

1. Muthusubramanian R and Salivahanan S, “Basic Electrical and Electronics Engineering,” McGraw Anton. H, Bivens. I and Davis. S, " Calculus ", Wiley, 10th Edition, 2016
2. Bali. N., Goyal. M. and Watkins. C., “Advanced Engineering Mathematics”, Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
3. Jain. R.K. and Iyengar. S.R.K., “Advanced Engineering Mathematics”, Narosa Publications, New Delhi, 5th Edition, 2016.
4. Narayanan. S. and Manicavachagom Pillai. T. K., “Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.
5. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.Hill, NewDelhi, 2009.

SI.No.	Course Title	Course Instructor	Host Institute
1	Matrix Analysis with Applications	Prof. S. K. Gupta Prof. Sanjeev Kumar	IIT Roorkee
2	Calculus of One Real Variable	Prof. Joydeep Dutta	IIT Kanpur

Equivalent NPTEL/SWAYAM Courses

Web Links and Video Lectures (E-Resources):

1. System of Linear Equations, Eigenvalues and Eigenvectors: https://www.nptelvideos.com/lecture.php?id=13416
2. Concept of Domain, Limit, Continuity and Differentiability: https://www.nptelvideos.com/lecture.php?id=13422
3. Matrix Diagonalization: https://www.nptelvideos.com/lecture.php?id=13481

Course Code:	24EN101	Course Title:	ENGLISH FOR ENGINEERS (Common to AI&DS, AE,BME,CE,CSE,CSE(AI&ML),EEE, ECE,MECH)
Credits:	**2.5**	**L – T – P**	**1-0-3**
Pre-requisite			**NIL**

Course Objectives:

- To develop an understanding of Basic English Grammar.
- To enhance listening skills and select appropriate responses.
- To practise presentation and speaking techniques.
- To develop a quest for reading.
- To practise professional writing.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Language learning softwares / Language Lab
3. Online Resources
4. Smart Class Room
5. Flipped classrooms
6. Project based Collaborative Experiential learning
7. Expert Lecture sessions

UNIT I - BASIC GRAMMAR- VOCABULARY AND EXPRESSIONS	

Grammar: Parts of speech - Types of sentences: Assertive - Imperative - Interrogative & Exclamatory - Affirmative - Negative - Gerunds & Infinitives - Tenses - Voices- Impersonal passives- Prepositions -Articles & Determiners- Cause and effect expressions - Vocabulary: Affixes- Synonyms & Antonyms - Homonyms - Homophones- Compound Nouns.

UNIT II - ACTIVE LISTENING - RESPONDING		**[15 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
SI. No.	**Topic**	**Hours**
1.	Listening to Audio (Podcasts- Audiobooks- Radio Program) and Practice Exercise-Answering Cloze Test Based on Listening	3
2.	Listening to native speaker's Telephone Conversations– Analyzing a Product	3
3.	Listening to Job Interviews - Sports Commentaries / Animated stories / Anecdotes / Event narration	3
4.	Video Comprehension – Brainstorming and Note-Taking	3
CLASSROOM ACTIVITIES		
1.	Listening to Statistical Information and Follow-up Exercises. - Form Filling Exercises	1
2.	Debate and reviewing the performance of each participant - Panel Discussion	2

UNIT III: SPEAKING AND PRESENTATION SKILLS	**[15 hours]**
LIST OF EXERCISES	

LAB ACTIVITIES		
SI. No.	**Topic**	**Hours**
1.	Speaking Development through English software S-net or Globarena and Online Content (Tenses- Voices- SV Agreement- Prepositions- Coherence Markers- Relative Clauses- Modals- Punctuation)	5
CLASSROOM ACTIVITIES		
1.	Self-Introduction - Sharing Childhood Experiences- Talking about Favorite Personalities	1
2.	Describing Recent Innovation in Technology	1
3.	Interviewing Celebrities and Entrepreneurs	1
4.	Situational Conversations (Meeting a friend in a cafe) - Narrating Personal Experience	1
5.	Group Communication- Discussing Social Issues- Current Affairs and Debate	1
6.	Role-Play- Picture/Movie Description	1
7.	Presentation – I (Book /Movie Review- Story Telling- General Presentations)	2
8.	Presentation – II (Technical Presentations)	2

UNIT IV: READING BETWEEN LINES		[12 hours]
LIST OF EXERCISES		
LAB ACTIVITIES		
SI. No.	**Topic**	**Hours**

1.	Reading Comprehension - skimming - scanning (General / Technical passages	2
2.	Reading Longer Texts with Time Frame	2
3.	Reading Data using different types of Texts- Magazines and Internet Materials	2
4.	Reading Research Papers-- Editing/Proofreading	2
	CLASSROOM ACTIVITIES	
1.	Job Advertisements – Manual for Product/Service – Telephone Phrases	1
2.	Reading Cause and Effect Essays-Technical Papers and Case Studies - Sorting out jumbled Sentences in a Paragraph	2
3.	Short Stories - Critical Reading	1

UNIT V- WRITING FOR ENGINEERS	[7+3 hours]
Writing - Application Letters - Resume- Product Description - Essay related to Technical / Social / current topics - Interpretation of Charts - Short Articles on everyday life - letters – Enquiry- Quotation- Order- Claim - Adjustment - Response to complaints - Statement of Purpose (SoP) -Emails - Memos -Notices - Circulars - Minutes of Meetings - Internship - Accident Report - Feasibility Report- Recommendations.	

	LIST OF EXERCISES	
	LAB ACTIVITIES	
SI. No.	**Topic**	**Hours**
1.	Mind Mapping and Brainstorming on any Social Event/Issue	1

2.	Creating a Blog/Vlog/YouTube Channel –Uploading MP3/MP4 – Practice (Movie/Book/ Gadget Review- General/Tech Talks- Interview with Celebrities)	1
3.	Creating a Product Review Blog.	1

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Domain
CO1	Identify various grammatical components- build vocabulary and apply expressions for error-free sentences	K3
CO2	Make use of appropriate words to respond by listening to general and technical online contents	K3
CO3	Experiment with the nuances of presentation and speaking skills	K3
CO4	Apply reading skills in various academic contexts	K3
CO5	Construct legible and flawless sentences proficiently with appropriate choice of words and structures for varied professional contexts	K3

COs and POs Mapping:

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	-	-	-	-	-	-	-	-	-	3	-	3
CO2	-	-	-	-	-	-	-	-	-	3	-	3
CO3	-	-	-	-	-	-	-	-	-	3	-	3

CO4	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**3**
CO5	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**3**

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max. Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - **Theory**	CIE – I	100	60	100	25
	CIE – II	100			
	Skill Assessment I (2 Assignments + 1 seminar)	40	40		
	Skill Assessment II (3 Assignments)	40			
Continuous Internal Examination (CIE) - **Laboratory**	Continuous Assessment (Lab activities & exercises)	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	10	10	10
Understand	30	30	30
Apply	60	60	60
Analyze	0	0	0

Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Gangalakshmi- C- Rathika- B- Saranraj- L. Professional English for Engineers. New Delhi: Cengage- 2022.
2. Murphy- Raymond. English Grammar in Use Book with Answers: A Self-study Reference and Practice Book for Intermediate Learners of English. Fourth Edition: Cambridge University Press- 2012.

Reference Books:

1. Raman- Meenakshi and Sangeetha Sharma. Communication Skills. New Delhi: OUP- 2018
2. R. C. Sharma_ Krishna Mohan - Business Correspondence and Report Writing _ a Practical Approach to Business _ Technical Communication-Mc Graw Hill India (2017)

Web Links and Video Lectures (E-Resources):

MANUALS / SOFTWARE: Open Sources / British Council / Cambridge Websites

Suggested Skill Activities:

1) Listening tests materials [Select podcasts / radio programmes / YouTube videos / audiobooks / materials from British Council] - Cloze tests where students fill in missing words from transcripts – Yes or No Question Answers – one-word answers based on recording – summary of recording
2) Self-introduction / Introduce Colleague
3) Just a Minute talks
4) Extempore

5) Mock GDs

6) Mock Interviews

7) Note Taking of Engineering Lectures

8) Create videos / blogs

9) Present Technical Papers

10) Reading Comprehension Exercises

11) Writing letters – Leave letter – Letter for academic purposes

12) Writing Essays

13) Composing Mails

14) Preparing Statement of Purpose

15) Preparing Covering letter and Resume

Course Code:	24PH101	Course Title:	ENGINEERING PHYSICS
Credits:	4	L – T – P	3-0-2
Pre-requisite			NIL

Course Objectives:
• To make the students effectively to achieve an understanding of Mechanics • To enable the students to gain knowledge of Elasticity. • To enable the students to gain knowledge of Maxwell's Equation and Electromagnetic waves. • To introduce the basics of optics and lasers. • Equipping the students to successfully understand the importance of quantum physics.
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. Lab experiment videos 3. Blended Mode of Learning 4. Project based Learning 5. Experiential Learning 6. NPTEL and Other Videos 7. Smart Class Room 8. Flipped Class

UNIT I -MECHANICS	[9 hours]
Multiparticle dynamics: Center of mass (CM) – Rotation of rigid bodies: Rotational kinematics – Rotational kinetic energy and moment of inertia - Theorems of M. I –M. I of Uniform rod-M. I of a diatomic molecule - Torque– Rotational energy state of a rigid diatomic molecule - Gyroscope – Torsional stress and deformation-Torsional pendulum- Double pendulum.	

Practical Topics: 1. Torsional pendulum – Determination of rigidity modulus of wire and moment of inertia of disc. 2. Compound pendulum – Determination of rigidity modulus

UNIT II - ELASTICITY	**[9 hours]**
Elasticity – Factors affecting Elasticity –Different types of Modulus- Moduli of elasticity and its relation -Stress - strain diagram and its applications - Bending of beams - Bending moment – Cantilever - Young's modulus: Uniform & Non-uniform bending-theory and experiment-I Shaped Girders.	
Practical Topics: 1. Determination of Young's modulus of a given material- Non-uniform bending method 2. Uniform bending – Young's modulus determination.	

UNIT III - MAXWELL'S EQUATIONS AND ELECTROMAGNETIC WAVES	**[9 hours]**
The Maxwell's equations - wave equation- Plane electromagnetic waves in vacuum - properties of electromagnetic waves - Producing electromagnetic waves - Energy and momentum in EM waves - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium vacuum interface for normal incidence.	
Practical Topics: 1. Spectrometer – Determination of wavelength of Hg spectrum using grating. 2. Spectrometer – Angle of the prism 3. Spectrometer – Dispersive power of the prism	

UNIT IV - LASERS &FIBER OPTICS	**[9 hours]**
Lasers: Einstein coefficients and their relations –-characteristics of laser - Types of Laser - Nd-YAG laser -semiconductor laser- Applications -Industrial, Medical, laser based military weapons Fiber optics: principle and classification of optical fibers – propagation of light in optical fiber - Numerical aperture and Acceptance angle– Fiber optic communication system - Applications	

- Displacement and pressure sensors – Endoscopy
Practical Topics: 1. Determination the acceptance angle and numerical aperture of the given optical fiber. 2. Determination of the particle size of the given powder using laser 3. Determination of wavelength of a given laser source - Grating method

NIT V - QUANTUM MECHANICS	[9 hours]
Photons and light waves - Electrons and matter waves- Dual Nature of Light —De Broglie Waves-Compton effect - The Schrodinger equation (Time dependent and time independent forms) - Physical Significance of wave function - Normalization –Free particle - particle in a infinite potential well: 1D,2D and 3D Boxes- Normalization-quantum computation.	
Practical Topics: 1, Young's Double Slit Experiment to demonstrate the wave nature of particles	

Laboratory component: **30 Hours**

Any ten experiments have to be completed from the following list ofExperiments

SI.No	Name of the experiment
1.	Apply parallel axis theorem to find the resultant of system of concurrent coplanar forces.
2.	Torsional pendulum – Determination of rigidity modulus of wire and moment of inertia of disc
3.	Compound pendulum- Determination of moment of inertia of a rigid rod.
4.	Apply the concept of bending of beams to find the Young's modulus of a given material-by Non uniform bending method
5.	Apply the concept of bending of beams to find the Young's modulus of a given material-by Uniform bending method.
6.	Determination of V-I characteristics of a solar cell.
7.	Using Ohm's law verify the laws of resistances .
8.	Using optical fiber find the acceptance angle and numerical aperture.
9.	Make use of the laser source find the particle size of the given powder.

10.	Determination of wavelength of a given laser source - Grating method.
11.	Spectrometer – Determination of wavelength of Hg spectrum using grating.
12.	Spectrometer – Dispersive power of the prism.
13.	Determination of magnetic Induction due to long current carrying conductor.
14.	Make use of the Young's Double Slit Experiment, demonstrate the wave nature of particles.
15.	Spectrometer – Angle of the prism

CO No	Corse Outcomes	Cognitive Domain
CO1	Apply the concepts of Mechanics in materials.	K3
CO2	Apply the concept of elasticity in beams.	K3
CO3	Apply the concept of electromagnetic waves in communication.	K3
CO4	Illustrate the applications of different lasers &Calculate the acceptance angle and numerical aperture of an optical fiber .	K2
CO5	Explain the quantum concepts and quantum computation.	K2

Course outcomes: On completion of the course, the student will have the ability to:

COs and POs Mapping:

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2	2	-	-	-	-	-	-	-	-	1
CO2	3	2	2	-	1	-	-	-	-	-	-	1
CO3	3	2	2	-	1	1	-	-	-	-	-	1
CO 4	3	1	1	-	1	1	-	-	-	-	-	1
CO 5	3	1	1	-	-	-	-	-	-	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	60	100	25
	CIE – II	100			
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			

Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

Assessment Pattern:

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

TEXT BOOKS:

1. D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw Hill Education (Indian Edition), 2017.
2. E.M.Purcell and D.J.Morin, Electricity and Magnetism, Cambridge Univ.Press,
3. 2013.
4. Bhattacharya, D.K. & Poonam, T. "Engineering Physics". Oxford University Press, 2015

REFERENCES:

1. R.Wolfson. Essential University Physics. Volume 1 & 2. Pearson Education (Indian Edition),2009.

2. Paul A. Tipler, Physic – Volume 1 & 2, CBS, (Indian Edition), 2004.

3. K.Thyagarajan and A.Ghatak. Lasers: Fundamentals and Applications, LaxmiPublications,(Indian Edition), 2019.

4. D.Halliday, R.Resnick and J.Walker. Principles of Physics, Wiley (Indian Edition), 2015.

Equivalent NPTEL/SWAYAM Courses:

SI.No	Course Name	Course Instructor	Course Conducting Agency
1	Quantum Mechanics	Prof .P.Ramadevi	IIT -Bombay

Web links and Video Lectures (e-Resources):

1. ELASTICITY

   https://youtu.be/eICv1p8WjgI?si=88hhiQw_fld7ZrBU

2. **MAXWELL'S EQUATIONS AND ELECTROMAGNETIC WAVES**

   https://youtu.be/3IPVZYf7C-U?si=PnP1nupcfGfr1C76

3. **LASERS &FIBER OPTICS**

   https://youtu.be/Ab1nxxkgjH8?si=KR2GS8iBUFayBwdp

4. **QUANTUM MECHANICS**

   https://youtu.be/AEedn_NiWN0?si=Y27pAqawlwKmthNO

Skill Assessment:

1. Explain the concept behind the balance a water bottle on a edge.
2. The leaning Tower of Pisa is able to stand tilted without toppling, what is the reason behind it.
3. Apply the elasticity concept to find the fatigue change in plastic fiber and natural fiber
4. Radio antennas emit visible light, Why
5. What does an opaque substance do when light rays fall on it.
6. Illustrate the things happen when light falls on a piece of black paper.
7. Explain the dual nature of matter.
8. Optical Fiber is used in hard to reach places in mechanical inspection explain it.
9. Is quantum communication faster than the speed of light
10. Compare electron microscope & tunneling microscope.

Course Code:	**24CY101**	**CourseTitle:**	**Engineering Chemistry** (Common to AI&DS,AE,BME,CE,CSE,CSE(AI&ML),EEE, ECE,MECH)
Credits	**4**	**L – T – P**	**3-0-2**
Pre-requisite			**NIL**

Course objectives:

- To provide a comprehensive understanding of water quality parameters, water treatment techniques and wastewater systems.
- To use the fundamental science and engineering principles relevant to materials that includes characterization, properties and processing of engineering materials.
- To familiarize with the principles, working and applications of electrochemistry and storage devices for safe, effective and efficient operations.
- To study, measure, monitor, control and prevent corrosion processes, economically andsafely.
- To classify different types of fuel and fuel analysis techniques that assists to choose mostconvenient fuel for a process involving combustion.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Blended Mode of Learning
3. Experiential Learning
4. NPTEL and Other Videos for theory topics
5. Flipped Class
6. Lab Experiment Videos

UNIT I - WATER TREATMENT	[9 hours]
Water Sources- Water Quality parameters - Hardness of water – types-units and calcium carbonate equivalent. -Determination of hardness of water by EDTA method. Scale and sludge, caustic embrittlement, priming and foaming and boiler corrosion. Water softening methods – internal and external conditioning –zeolite process and ion exchange process. Desalination – reverse osmosis and electro dialysis- Municipal water treatment and waste water treatment process.	
Practical Topics: 1. Determination of total hardness by EDTA method. 2. Estimation of alkalinity by Indicator method. 3. Estimation of chlorine content in water sample by Argentometric method. 4. Determination of BOD in water samples.	

UNIT II - CHEMISTRY OF ENGINEERING MATERIALS	[9 hours]
Adhesives: Introduction- requisites of a good adhesive-adhesive action- industrial applications of adhesives. Insulating Materials: Introduction- requirements- Glass and ceramics - preparation, properties andapplications - fabrication of ceramic ware. Lubricants-Classification of lubricants with examples-characteristics of a good lubricants - mechanism of lubrication (thick film, thin film and extreme pressure) - properties of lubricants: viscosity, cloud point, pour point, flash point and fire point. Electronic materials: Introduction-types, properties and applications of semiconducting materials and transistors, materials used in IC's, fibers and cables- properties and applications, organic solar cells - types and applications.	
Practical Topics: 1. Determination of viscosity of oils using Oswald viscometer. 2. Determination of cloud point and pour point of oils.	

UNIT III -ELECTROCHEMISTRY	[9 hours]

Introduction – Electrode potential – Nernst equation and problems - Electrochemical series - Conductometric titrations (acid - base & precipitation titration) Electrodes: Construction, working and applications of Standard and reference electrode (Hydrogen & Calomel) – Ion selective (glass electrode) – determination of pH using glass electrode. Batteries and Fuel Cells – Types of batteries —dry cell -Lead Storage battery–Nickel- Cadmium Battery – Lithium battery – Battery hazards - Biological Batteries. Fuel Cells – Hydrogen-Oxygen FuelCell.
Practical Topics: 1. Estimation of strength of hydrochloric acid by pHmetry. 2. Determination of strength of acids in a mixture of acids using conductivity meter. 3. Determination of charging and discharging rate of batteries.

UNIT IV -CORROSION AND ITS CONTROL	**[9 hours]**
Corrosion – causes, factors, types, Chemical and Electrochemical Corrosion (Galvanic, Differential aeration) –galvanic series-factors influencing rate of corrosion-measurement of corrosion. Determination of corrosion rate by weight loss method. Control Methods-Electrochemical protection – Sacrificial Anodic method – Impressed Current Cathodic Protection – Corrosion Inhibitors – Bio corrosion Protective Coatings – Paints, Constituents, Functions- Surface coating - Surface preparation for metallic coatings, Electroplating and Electro-lessPlating- ceramic coatings, thermal vaporization coating, HVOF coating	
Practical Topics: 1. Estimation of the Ferrous ions in mild steel by Spectrophotometry. 2. Determination of rate of corrosion of by weight loss method	

UNIT V- FUELS AND COMBUSTION	**[9 hours]**

Fuels: Introduction: Classification of fuels; solid fuel -Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Liquid fuels -Manufacture of synthetic petrol –hydrogenation of coal (Bergius process), Knocking – octane number, diesel oil – cetane number; Power alcohol and biodiesel. Combustion of fuels: Introduction: Calorific value – higher and lower calorific values, Theoretical calculation of calorific value by Dulong's formula - Ignition temperature: spontaneous ignition temperature, Explosive range; Flue gas analysis – ORSAT Method.
Practical Topics: 1. Determination of flash point and fire point of fuels.

Laboratory component: **30 Hours**

Any ten experiments have to be completed from the following list of experiments

SI.No.	Name of the experiment
1	Determine the total hardness of water sample by EDTA method.
2	Analyze the alkalinity of water sample by Indicator method.
3	Analyze the chlorine content in water sample by Argentometric method.
4	Determine the BOD of water samples.
5	Describe the procedure to determine the viscosity of oil using an Oswald viscometer.
6	Identify the cloud point and pour point of oils.
7	Make use of glass electrode to determine the strength of hydrochloric acid.
8	Make use of conductivity meter to determine the strength of acids in a mixture of acids.
9	Determine quantitatively the amount of Ferrous ions in mild steel by Spectrophotometry.
10	Determine the of rate of corrosion of by weight loss method.
11	Describe the procedure to determine the flash point and fire point of fuels.
12	Conduct a study to find out the charging and discharging rate of batteries.

Course outcomes: On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Level
CO1	Analyze the water quality parameters and choose appropriate water treatment methods for use in industries and daily life.	K4
CO2	Make use of the applications of the materials in different engineering disciplines.	K3
CO3	Utilize the principles of electrochemistry and find the materials for energyconversion and storage.	K4
CO4	Determine the corrosion rate to propose suitable protection methods for environmental considerations	K3
CO5	Choose suitable fuels for engineering processes and automobile applications.	K3

COs and POs Mapping

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

COs	POs										
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2	-	-	-	1	-	-	-	-	-	-
CO2	3	2	1	1	-	-	-	-	-	-	-	-
CO3	3	2	1	1	-	-	-	-	-	-	-	-
CO4	2	1	1	-	-	1	2	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduce d Marks	Tota l	Final mark s
Continuous Internal Examination (CIE) - Theory	CIE – I	100	60	10 0	25
	CIE – II	100			
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
	Continuous Assessment	75	75		25

Continuous Internal Examination (CIE) - Laboratory	Model Lab Exam	25	25	100	
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	10	10	10
Understand	30	30	30
Apply	40	40	40
Analyze	20	20	20
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Jain P.C. and Jain M, Engineering Chemistry, Dhanpat Rai Publishing Company, New Delhi, 17th Edition,2021.
2. Dara S S and Umare S.S, A Text Book of Engineering Chemistry, S.Chand & Company Limited, 20thEdition, 2018.

Reference Books:

1. Benjamin M. M, Water Chemistry, Waveland Press, 2nd Edition, 2019.
2. Cicek V, Corrosion Engineering, Springer Publishing, 1st Edition, 2021.
3. Shahinpoor. M, Fundamentals of Smart Materials, Publisher: Royal Society of Chemistry, 1st Edition,2020.

4. Berg H, Bernhardsson S, and Johansson P, Electric Vehicle Batteries: Moving from Research towards Innovation, Publisher: Springer, 1st Edition, 2019.
5. B.K.Sharma "Engineering chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2014).

Web links and Video Lectures (e-Resources):

1. Water and wastewater treatment - https://onlinecourses.nptel.ac.in/noc23_ce12/preview
2. SemiconductorDevices and circuits. - https://nptel.ac.in/courses/108108112
3. Corrosion ProtectionMethods - https://onlinecourses.nptel.ac.in/noc23_mm01/preview
4. Elementary Electrochemistry - https://onlinecourses.nptel.ac.in/noc23_cy19/preview
5. Fuel and combustionTechnology - https://archive.nptel.ac.in/courses/103/105/103105110/

Suggested Skill Activities:

1. Measure the TDS, PH & electrical conductivity of a home water.
2. Removal of temporary hardness of any water sample by suitable method.
3. Find the charging and discharging rate of mobile batteries when it is use or not.
4. The need of engineering material is essential in our day today life. - Justify the answer.
5. Measure the corrosion rate of iron bar when it is exposed in the environment.
6. List out the recent engineering materials used in emerging field.
7. Calculate the higher and lower calorific value of a fuel by using Dulong's formula.
8. List out the type of coatings applied on materials which are used in our daily life.
9. Improper disposal of batteries leads to environmental hazard. Suggest the suitable disposable method.
10. Pure Iron material undergo corrosion more fast than other materials. Give reasons.

Course Code:	**24ME201**	**Course Title:**	**Engineering Graphics and Design**
Credits:	**3**	**L – T – P**	**1-0-4**
Pre-requisite			**NIL**

Course objectives:

To impart knowledge on the

- To enable students to understand the standards and conventions of engineering drawing.
- To enhance the visualization skills to understand objects in the respective positions with respect to principal planes.
- To comprehend general projection theory, with emphasis on orthographic projection to represent three-dimensional objects in two-dimensional views.
- To emphasize freehand sketching and pictorial view to aid in the visualization process and to efficiently communicate ideas graphically.
- To Introduce CAD software for the creation of 3D models and 2D engineering drawings.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. NPTEL and Other Videos
3. Smart Class Room
4. Project based learning

UNIT I - DRAWING FUNDAMENTALS, GEOMETRIC CONSTRUCTION, PROJECTION OF POINTS, STRAIGHT LINES AND PLANES	**[15 hours]**
Drawing BIS standards – Orthographic projections – First angle projection - Drawing instruments – Sheet layout – Conventions – Lines, Lettering, Numbering and Dimensioning Geometric construction – Construction of regular polygons – Conic sections – Ellipse, Parabola and Hyperbola by eccentricity method.Projection of points – Points situated in all four quadrants. Projection of straight lines – Straight lines inclined to both principal planes – Finding true length of the line and true inclinations with respect to principal planes – Rotating line method.	

Projection of planes – Introduction – Polygonal lamina and Circular lamina - Orientation of planes - Plane parallel to both principal planes, Planes perpendicular to both principal planes and Planes inclined to both principal planes – Rotating object method.Orthographic projection of simple engineering components.

UNIT II - PROJECTION OF SOLIDS	[15 hours]
Projection of solids – Introduction – Types of solids – Polyhedra and solids of revolution - Projection with axes inclined to one of the principal planes and parallel to other – Change of Position method. 2D drafting - Basic commands – Coordinate systems, Object section methods. Line, Circle, Polyline, Rectangle, Hatch, Fillet, Chamfer, Trim, Extend, Offset, Dim style – Annotation and Layering – Object snaps - 3D modelling – Basic commands – Extraction of multiple views – Part modelling of simple components - Utensils, Hand tools & Furniture etc. - Drawing views using 3D environment.	

UNIT III - DEVELOPMENT OF SURFACES AND PICTORIAL PROJECTION	[15 hours]
Development of lateral surfaces of truncated Prisms, Pyramids, Cylinders and Cones– Parallel line method and Radial line method. Pictorial Projection – Isometric projection – Introduction – Isometric scale – Isometric view of two right regular composite solids – Isometric projection of truncated frustum of solids – Box method. Problems on applications of Isometric projections of simple objects / engineering components.	

UNIT IV- BASIC COMPUTER AIDED DRAWING APPLICATIONS	[15 hours]
Free hand Sketching - Sketching of geometry - multiple view projection from single pictorial view of objects – Illustrative examples - True free hand, Guided Free hand, Roads, Buildings, Utensils, Hand tools & Furniture's etc.Drawing Simple Mechanisms - Bicycles, Tricycles, Gear trains, Ratchets, two-wheeler cart &Four-wheeler carts to dimensions etc.	

UNIT V- MULTIDISCIPLINARY APPLICATIONS AND PRACTICE	[15 hours]
Electric Wiring and lighting diagrams - Like, Automatic fire alarm, Call bell system, UPS system, Basic power distribution system using suitable software. Basic Building Drawing - Draw various types of lines, graphical symbols for materials, doors and windows, symbols for sanitary, water supply and electrical installations and write abbreviations as per	

IS 962. Like, Architectural floor plan, basic foundation drawing, steel structures- Frames, bridges, trusses using Auto CAD or suitable software, Electronics Engineering Drawings - Like, Simple Electronics Circuit Drawings, practice on layers concept. Graphs & Charts - Like, Column chart, Pie chart, Line charts, Gantt charts, etc. using Microsoft Excel or any suitable software.

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Level
CO1	Apply principles of first angle projection in drafting plan and elevation of points, lines, planes, and solids.	K3
CO2	Apply change of position method in the projection of solids and determine the true shape of the section.	K3
CO3	Apply principles of orthographic projection to extract 2D views from 3D drawing using freehand sketching.	K3
CO4	Apply parallel line and radial line methods to develop lateral surfaces of solids so that students can understand applications in sheet metal design.	K3
CO5	Apply box method to develop the isometric view of simple, truncated, and composite solids.	K3
CO6	Develop simple part model in 3D and plan, elevation, and section of building using a designated CAD software.	K6

COs and POs Mapping:

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	-	-	-	-	-	-	-	2	-	-	1	2	-
CO2	3	1	-	-	-	-	-	-	-	2	-	-	1	2	-
CO3	3	1	-	-	-	-	-	-	-	-	-	-	1	2	-
CO4	3	1	-	-	-	-	-	-	-	2	-	-	1	-	-
CO5	3	1	-	-	-	-	-	-	-	2	-	-	1	2	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	0	0	0
Understand	20	20	20
Apply	40	40	40
Analyze	0	0	0
Evaluate	0	0	0
Create	40	40	40

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. N.D.Bhatt,"Engineering Graphics", Charotor Publishing House, 53RD Edition 2019
2. Natrajan K.V., "A textbook of Engineering Graphics", Dhanalakshmi Publishers, Chennai (2015)

Reference Books:

1. Venugopal K. and Prabhu Raja V., "Engineering drawing + AutoCAD", New Age International (P) Limited (2022)
2. Lakhwinder pal singh, Harwinder Singh, "Engineering Drawing Principles and Applications", Cambridge University Press, 2021.
3. Cecil Johnson, Jay D Helsel and Dennis R Short, "Engineering Drawing and Design", Seventh Edition, McGraw Hill, 2007.
4. Patil, Rajashekar, "Computer Aided Engineering Graphics", New Age International Ltd,2018.
5. Chris Schroder, "Printed Circuit Board Design using AutoCAD", Newnes,1997.
6. K S Sai Ram, "Design of steel structures", Third Edition by Pearson.
7. A S Pabla, "Electrical power distribution", 6th edition, Tata Mcgrawhill.
8. K. R. Gopalakrishna, & Sudhir Gopalakrishna, "Textbook of Computer Aided Engineering Drawing", 39th Edition, Subash Stores, Bangalore, 2017

Web Links and Video Lectures (E-Resources):

1. **http://nptel.ac.in/courses/112103019**
2. https://archive.nptel.ac.in/courses/112/105/112105294/

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 and 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 and SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 and SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

LABORATORY REQUIREMENTS

SYSTEM REQUIREMENTS (For a batch of 30 Students)

Hardware:

1. Intel i3 core due processor with 4GB ram with 500GB hard disk – 30 Nos.
2. Laser Printer – 1 No.

Software:

Drafting package – AutoCAD – Adequate license (Open source)

Suggested Skill Activities:

1. 2D drafting of plan and elevation of computer CPU.
2. 2D drafting of plan and elevation of a thermos flask.
3. 2D drafting of a plan and elevation of piston and cylinder.
4. Sketching the projections of a bicycle in freehand.
5. Sketching the projections of a stapler.
6. Cut and develop the lateral surface of a funnel.
7. Cut one edges vertically and develop the lateral surface of CPU cabin.
8. Cut and develop the lateral surfaces of elbow of a pipe.
9. Draw the isometric view of a simple bread toaster.
10. Draw the isometric view of the computer table.
11. Sketch the assembled view of the screw jack using the orthographic projections of its components.
12. Draft the plan, elevation and section of your home using CAD.
13. Draft the plan, elevation and section of 2 storey office building using CAD.
14. Develop the 3D model of the (a) and (b).

Course Code:	24CS201	Course Title:	PROGRAMMING FOR PROBLEM SOLVING USING C
Credits:	4	L – T – P	2-0-4
Pre-requisite			NIL

Course objectives:

To impart knowledge on the

- To gain knowledge on problem solving techniques
- To learn how to write simple and modular C programs
- To develop C programs using arrays and strings
- To learn the usage of pointers in accessing and manipulating memory
- To develop applications in C using structures & files

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Classroom
8. Flipped Class

UNIT I - BASICS OF C PROGRAMMING	[6 hours]
Problem Solving Techniques: Introduction to Algorithm, Pseudo code, Flow Chart, Structure of ‘C’ program. C Tokens: Keywords, Data Types, Constants, Variables - Declaration - Qualifiers – typedef	

Practical Topics:

1. Steps in Problem Solving Drawing flowchart using yEd tool/Raptor Tool programs using simple statements.
2. Programs to illustrate the use of user-defined data types

UNIT II – BASIC CONSTRUCTS IN C	[6 hours]

Managing simple Input and Output operations - Operators and Expressions - Decision Making: Branching statements, looping statements - Function: Declaration, Definition - Passing arguments by value - Recursion - Storage classes

Practical Topics:

1. Programs using decision making statements
2. Programs using looping statements
3. Programs using user defined functions and recursive functions

UNIT III – ARRAYS AND STRINGS IN C	[6 hours]

Arrays: Initialization - One dimensional, Two dimensional, and Multi-dimensional arrays - String: Basics, declaring and initializing strings, string handling functions: standard and user defined functions

Practical Topics:

1. Build programs using arrays and array-based operations.
2. Programs using one dimensional and two-dimensional arrays.
3. Implementations involving array usage for string operations.

UNIT IV – POINTERS IN C	[6 hours]

Pointers - Passing arguments by address - Dynamic Memory Allocation - Pointer arithmetic - Pointers and one-dimensional array - Pointers and Multi-Dimensional Array: Array of Pointers, Pointer to Pointer, Pointer to an array - void Pointer - Pointer to function

Practical Topics:

1. Implementations involving pointers for dynamic memory allocation
2. Implementations involving pointers for string manipulation.

UNIT V – STRUCTURES, UNIONS AND FILE HANDLING IN C	[6 hours]

Structure: Declaration, Definition-Array of Structures - Pointer to Structure – Nested Structures- Union: Defining union, Accessing union members. Files: File Management

functions, Random access in file- Working with Text Files and Binary Files
Practical Topics: 1. Programs to implement structures 2. Programs to implement union 3. Programs to implement various file operations.

Laboratory Component: **[45 hours]**

Any 12 experiments have to be completed from the following list of experiments.

S.No.	Name of the Experiment
1	Steps in Problem Solving Drawing flowchart using yEd tool/Raptor Tool programs using simple statements
2	Programs to illustrate the use of user-defined data types
3	Programs using decision making statements
4	Programs using looping statements
5	Programs using user defined functions and recursive functions
6	Build programs using arrays and array-based operations.
7	Programs using one dimensional and two dimensional arrays.
8	Implementations involving array usage for string operations.
9	Implementations involving pointers for dynamic memory allocation
10	Implementations involving pointers for string manipulation.
11	Programs to implement structures
12	Programs to implement union
13	Programs to implement various file operations

Course outcomes:

On completion of the course, the student will have the ability to:

CO No	Corse Outcomes	Cognitive Domain
CO1	Make use of problem solving techniques to solve real world problems & outline the structure of C program	K3

CO2	Identify the appropriate looping and control statements in C and develop applications using these statements	K3
CO3	Make use of arrays & strings in development of simple applications	K3
CO4	Apply the concepts of pointers and develop C programs using pointer	K3
CO5	Develop programs for storing, retrieving and processing data using structures and files.	K3

COs and POs Mapping

COs	**POs**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	**3**	**3**	2	-	1	-	-	-		-	-	1
CO2	**3**	**3**	2	-	1	-	-	-		-	-	1
CO3	**3**	**3**	2	1	1	-	-	-		-	-	1
CO4	**3**	**3**	2	1	1	-	-	-		-	-	1
CO5	**3**	**3**	3	1	1	-	-	-		-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		

End Semester Examination (ESE)	Theory Exam	100	15	50	50
	Lab Exam	100	35		
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	20	20	20
Understand	20	20	20
Apply	60	60	60
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2015.
2. Pradip Dey, Manas Ghosh, "Programming in C", AICTE Edition, Oxford University Press, 2018

Reference Books:

1. Yashavant P. Kanetkar, "Let Us C : Authentic guide to C programming language", Eighteenth Edition, BPB Publications, 2021
2. Ashok N Kamthane, Programming in C, Pearson, Third Edition, 2020
3. Reema Thareja, "Programming in C", Oxford University Press, Second Edition, 2016.
4. Paul Deitel and Harvey Deitel, "C How to Program with an Introduction to C++", Eighth edition, Pearson Education, 2018.
5. Anita Goel and Ajay Mittal, "Computer Fundamentals and

Programming in C", 1st Edition, Pearson Education, 2013.
6. E.Balagurusamy, "Programming in ANSI C", seventh edition, Mc Graw Hill Education,2017

Suggested Skill Activities:

1. Steps in Problem Solving Drawing flowchart using yEd tool/Raptor Tool
2. Write a Program to calculate and display the volume of a CUBE having its height (h=10cm), width (w=12cm) and depth (8cm).
3. Ramya has bought 50 kg of onion for Rs 40 per kg and 60 kg of potato for Rs 20 per kg. Then she sold out all the stock with the selling price of Rs 60 per kg and Rs 30 per kg for onion and potato respectively. Write a C program which computes the profit gained by her.
4. A Food delivery boy needs to walk down every street in his area in order to deliver the food. Assume that the distances between the streets along the roads are given. The food delivery boy starts at the hotel and returns back to the hotel after delivering all the foods. Implement an algorithm to help the food delivery boy to walk minimum distance for the purpose.
5. Write a program to input name, marks of 5 subjects of a student and display the name of the student, the total marks scored, percentage scored and the class of result.
6. A location in a map is represented by a pair of points as x co-ordinate and y co-ordinate. Person X wants to move towards person Y which is residing in the location L1 and L2 respectively. Write C Program to find the distance between these two person .
7. If a four-digit number is input through the keyboard, write a program to obtain the sum of the first and last digit of this number.
8. Write a program to find GCD (greatest common divisor or HCF) and LCM (least common multiple) of two numbers
9. Write a Program to multiply two 3 X 3 Matrices.
10. Write a program to create a structure named company which has name, address, phone and no Of Employee as member variables. Read name of company, its address, phone and no Of Employee. Finally

display these members‟ value.

11. Write a program to create array of books. Collect various details of books such as topic, author, department. Collect details for N books and display the details of books based on department name or author
12. A class has strength of N students. The class has two mentors, one person for the odd roll numbers and the other for the rest. Write a C program which reads the roll numbers of all the students and gives two lists of roll numbers corresponding to each advisor
13. Write a C program to maintain the inventory details of items sold in a super market such as item id, name, no of items available, price per item. Perform efficient data storage based on user‟s demand at runtime
14. Write a C program to use binary files for maintaining a telephone directory which includes telephone no, Owner name and address. Here address includes details such as door no, street name, locality, city and pincode. Update the door no of all people belonging to a particular street as follows: Increment the old door no by 10 to get the new door no. (Eg: If the old door no is 13, update it as 23)

பாடநெறி குறியீடு:	24GE201	பாடத்தின் தலைப்பு:	தமிழரும்தொழில்நுட்பமும்
கிரெடிட்	1	L – T – P	1-0-0

பாடத்திட்டநோக்கங்கள்:

1. சங்ககாலத்து நெசவுத்தொழிலை விவரிப்பதற்கும் மட்பாண்டத்தொழில் நுட்பத்தைக் கண்டறிவதற்கும்.
2. சங்ககால கட்டுமானம், மேடை அமைப்பு, சிற்பங்கள், கோவில்கள், அம்மன்கோவில், திருமலைநாயக்கர் மஹால், செட்டிநாட்டு வீடுகள், இந்தோ - சாரோசெனிக் கட்டிடக்கலை ஆகியவற்றைக் கண்டறிந்து மேற்கோள் காட்ட.
3. கப்பல் கட்டுதல் மற்றும் இரும்புத் தொழிலைக் கண்டறிதல், சிலப்பதிகாரத்தில் நாணயங்கள், மணி தயாரிக்கும் தொழிற்சாலைகள், மணிகளின் வகைகள் ஆகியவற்றைப் படிக்க.
4. நீர்நிலைகளின் முக்கியத்துவத்தைகாட்ட, கால்நடை வளர்ப்பு மற்றும் கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகளை கண்காணிக்க, விவசாயம், மீன்பிடி, முத்து மற்றும் முத்துகலாச்சாரம் மற்றும் கடல் பற்றிய பண்டைய அறிவை அங்கீகரிக்க.
5. அறிவியல் தமிழின் வளர்ச்சி மற்றும் தமிழ்க்கணிப்பொறியின் வளர்ச்சியைக் கவனிக்க, இணையத்தில் தமிழ்மென்பொருள் மேம்பாடு, தமிழ் அகராதிகளை மேற்கோள் காட்ட.

அலகு I நெசவு மற்றும் பானைத்தொழில்நுட்பம்:	**[3 hours]**
சங்ககாலத்தில் நெசவுத்தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்புபாண்டங்கள் - பண்டங்களில் கீறல் குறியீடுகள்.	

அலகு II வடிவமைப்பு மற்றும் கட்டிடத்தொழில்நுட்பம்:	[3 hours]
சங்ககாலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்ககாலத்தில் வீட்டுப்பொருட்களில் வடிவமைப்பு - சங்ககாலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடைஅமைப்பு பற்றியவிவரங்கள் - மாமல்லபுரச்சிற்பங்களும், கோவில்களும் - சோழர்காலத்துப் பெருங்கோவில்கள் மற்றும் வழிபாட்டுத்தலங்கள் - நாயக்கர்காலக்கோயில்கள் மாதிரி கட்டமைப்பு பற்றி அறிதல்,மதுரைமீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலைநாயக்கர்மஹால் - செட்டி நாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ - சாரோசெனிக் கட்டிடக்கலை.	

அலகு III உற்பத்தித் தொழில்நுட்பம்	[3 hours]
கப்பல் கட்டும் கலை - உலோகவியல் - இரும்பு தொழிற்சாலை - இரும்பை உருக்குதல், எ்கு வரலாற்றுச்சான்றுகளாக செம்பு மற்றும் தங்கநாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சங்கு மணிகள் - எலும்புத்துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.	

அலகு V அறிவியல் தமிழ் மற்றும் கணிதத்தமிழ்:	[3 hours]
அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி -தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ்மென்பொருள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.	

அலகு IV வேளாண்மை மற்றும் நீர்பாசனத்தொழில்நுட்பம்	[3 hours]
அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக்கு குமுழித்தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மைச்சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன் வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்.	

பாடநெறி முடிவுகள் (பாமு):

பாடநெறியின் முடிவில், மாணவர் பின்வரும் திறன்களைப் பெறுவார்:

பாமு	**பாடநெறி முடிவுகள்**	**மிக உயர்ந்த அறிவாற்றல் நிலை**
அலகு I பாமு:	சங்க கால ஜவுளி தொழில் மற்றும் மட்பாண்ட தொழில்நுட்பம் பற்றி அறிவார்கள்.	கே 1
அலகு II பாமு:	சங்க கால கட்டுமானம், மேடை அமைப்பு, சிற்பங்கள், கோவில்கள், அம்மன் கோவில்,	கே 2

	திருமலை நாயக்கர் மஹால், செட்டிநாட்டு வீடுகள், இந்தோ-சராசனிக் கட்டிடக்கலை ஆகியவற்றை விவரிக்க இயலும்.	
அலகு III பாமு:	கப்பல் கட்டுதல், இரும்புத் தொழில், நாணயம் தயாரித்தல் மற்றும் மணி தயாரிக்கும் தொழில்கள் பற்றி அறிந்து கொள்கிறார்கள்.	கே 1
அலகு IV பாமு:	நீர்நிலைகளின் முக்கியத்துவம், கால்நடை வளர்ப்பு, கிணறு, விவசாயம், மீன்பிடி, முத்து மற்றும் முத்து கலாச்சாரம் மற்றும் கடல் பற்றிய போதுமான அறிவை பெற்றுகொள்கிறார்கள் .	கே 1
அலகு V பாமு:	அறிவியல் தமிழின் வளர்ச்சி, தமிழ்க் கணிப்பொறியின் வளர்ச்சி, இணையத்தில் தமிழ் மென்பொருள் மேம்பாடு, தமிழ் அகராதிகளை சந்தேகம் இன்றி முழுமையாக தெரிந்து கொள்கிறார்கள்.	கே 1

பாடநெறி முடிவுகள் ***மற்றும் நிரல் முடிவுகள் ஒப்பிடுதல்***

நிலை 3- அதிக ஒத்துப்போதல், நிலை 2- மிதமாக ஒத்துப்போதல், நிலை 1- குறைவாக ஒத்துப்போதல், நிலை 0- ஒத்துப்போகவில்லை

பாமுகள்	மிக உயர்ந்த அறிவாற்றல் நிலை	பாடநெறி முடிவுகள்											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
பாமு **1**	கே 1	**2**	-	-	-	-	-	-	-	-	-	-	-
பாமு **2**	கே 2	**1**	-	-	-	-	-	-	-	-	-	-	-
பாமு **3**	கே 1	**1**	-	-	-	-	-	-	-	-	-	-	-
பாமு **4**	கே 1	**1**	-	-	-	-	-	-	-	-	-	-	-
பாமு **5**	கே 1	**1**	-	-	-	-	-	-	-	-	-	-	-

மதிப்பீட்டுத் திட்டம்:கூறுகள்	மதிப்பீட்டின் வகை	அதிகபட்ச	குறைக்கப்பட்ட	இறுதி மதிப்

		மதிப்பெண்கள்	மதிப்பெண்கள்	பெண்கள்
தொடர்ச்சியான உள் தேர்வு	தொடர்ச்சியான உள் தேர்வு - I	100	40	40
	தொடர்ச்சியான உள் தேர்வு - II	100	40	
இறுதி பருவ தேர்வு	எழுத்து தேர்வு	100	60	60
மொத்தம்				100

இறுதி பருவ தேர்வு: (கேள்வி முறை)

- ஒவ்வொரு யூனிட்டும் இரண்டு 2 மதிப்பெண் வினாக்களையும் ஒரு 16 மதிப்பெண் வினாவையும் (இரண்டில் ஒன்று) கொண்டுள்ளது.
- பதினைந்து கேள்விகளுக்கும் பதிலளிக்க வேண்டும்.

மதிப்பீட்டு முறை

ப்ளூமின் வகை	தொடர்ச்சியான மதிப்பீட்டு சோதனைகள்		இறுதி தேர்வு
	1	2	
நினைவில் கொள்ளுதல்	60	50	60
புரிந்து கொள்ளுதல்	40	50	40
விண்ணப்பித்தல்	0	0	0
பகுப்பாய்வுதல்	0	0	0
மதிப்பிடுதல்	0	0	0
உருவாக்குதல்	0	0	0

TEXT BOOKS

1. தமிழகவரலாறு - மக்களும்பண்பாடும் - கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்).
2. கணினித்தமிழ் - முனைவர்இல. சுந்தரம். (விகடன்பிரசுரம்).
3. கீழடி - வைகைநதிக்கரையில்சங்ககாலநகரநாகரிகம் (தொல்லியல்துறைவெளியீடு)
4. பொருநை - ஆற்றங்கரைநாகரிகம். (தொல்லியல்துறைவெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).

REFERENCE BOOKS

1. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
2. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
3. Keeladi - ‘Sangam City C ivilization on the banks of river Vaigai’ (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

4. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
5. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
6. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Course Code:	**24MA201**	**Course Title:**	**Complex Variables and Transforms** (Common to AI&DS,AE,BME,CE,CSE,CSE(AI&ML),EEE, ECE,MECH)
Credits:	**4**	**L – T – P**	**3 – 1 – 0**
Pre-requisite			**24MA101- Matrices and Calculus**

Course objectives:

- To impart analytical ability in solving mathematical problems as applied to the respective branches of Engineering.
- To familiarize the students with complex integration techniques and contour integration techniques which can be used in real integrals.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.

Teaching-Learning Process:

These are sample strategies which teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method does not mean only traditional method, but different type of teaching methods may be adopted to develop the outcomes.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Topics will be introduced in a multiple representation and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT I – Complex Differentiation	**[12 hours]**
Function of a complex variable – Analytic functions – Necessary conditions and sufficient conditions (excluding proof) – Cauchy – Riemann equations –– Properties of analytic function – Harmonic conjugate – Construction of Analytic functions - Conformal mapping: w = z+a, az, 1/z, and bilinear transformation.	

UNIT II – Complex Integration	[12 hours]
Statement and application of Cauchy's integral theorem and integral formula – Taylor and Laurent expansions – Isolated singularities – Residues - Cauchy's residue theorem. Applications: Contour integration over unit circle and semicircular contours (excluding poles on axis).	

UNIT III – Laplace Transforms	[12 hours]
Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems – Transforms of derivatives and integrals – Initial and Final Value Theorem – Inverse Laplace Transform – Convolution Theorem (Statement only) – Solution of linear second order Ordinary differential equations with constant coefficients using Laplace transforms.	

UNIT IV – Fourier Series and Fourier Transforms	[12 hours]
Dirichlet's conditions – General Fourier series – Odd and even functions – Half range series – Harmonic analysis - Statement of Fourier integral theorem – Fourier transform pair – Parseval's identity.	
UNIT V – Partial Differential Equation	**[12 hours]**
Formation of partial differential equations - Classification of partial differential equations - Solutions of one dimensional wave equation, One dimensional heat equation (excluding insulated ends) – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges).	

Course outcomes:

On completion of the course, the student will have the ability to:

CO	Course Outcome	Cognitive domain
CO1	Construct analytic functions and use their conformal mapping property in Engineering problems.	K3
CO2	Solve real and complex integrals using the Cauchy's integral formula and residue theorem.	K3
CO3	Apply Laplace transforms techniques in system modelling, digital signal processing, process control, solving boundary value problems	K3

CO4	Apply Fourier series to solve the steady state two-dimensional heat equation in cartesian coordinates.	K3
CO5	Apply the effective mathematical tools for solutions of partial differential equations that model physical phenomena and engineering problems.	K3

COs and POs Mapping:

COs	**POs**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	1
CO5	3	2	1	-	-	-	-	-	-	-	-	-
CO6	3	2	1	-	-	-	-	-	-	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60

	Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	**2**	
Remember	20	20	20
Understand	20	20	20
Apply	60	60	60
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

4. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
5. Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
6. Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012
7. Kandasamy. P., Thilagavathy. K, and Gunavathy. K, Engineering Mathematics Volume I & II, S. Chand & Co, New Delhi, 2005.Reference Books:

Equivalent NPTEL/SWAYAM Courses

S. No.	Course Title	Course Instructor	Host Institute
1	Partial Differential Equations	Prof. Sivaji Ganesh	IIT Bombay
2	Introduction to Fourier Analysis	Prof. Parasar Mohanty	IIT Kanpur
3	Complex Analysis	Prof. Pranav Haridas	IIT Madras

Web Links and Video Lectures (E-Resources):

4. Analytic Functions, C-R Equations: https://www.nptelvideos.com/lecture.php?id=13416
5. Laplace Transform and its Existence:

   https://www.nptelvideos.com/lecture.php?id=13433
6. Taylor's, Laurent Series of f(z) and Singularities:

   https://www.nptelvideos.com/lecture.php?id=13431
7. Applications of Fourier Transform to PDEs:

   https://www.nptelvideos.com/lecture.php?id=13442

Course Code:	24CY401	Course Title:	Environmental Science and Engineering
Credits:	**2**	**L – T – P**	**2-0-0**

Course objectives:
To impart knowledge on the • To gain in-depth knowledge on natural processes and resources that sustain life and govern economy. • To know the importance of water resources which are important socially, economically viable and environmentally sustainable. • To impart the Knowledge of pollution and its control methods. • To mitigate the environmental and health risks associated with indiscriminate waste andfind the suitable methodologies for waste management. • To balance ecological, economic and social goals, such as reducing carbon emissions, promoting renewable energy and ensuring equitable resource access.
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 8. Chalk and Talk 9. NPTEL and Other Videos 10. Smart Class Room 11. Field visit 12. Project based learning 13. Industrial Visit

UNIT I - Ecology and Biodiversity	**[6 hours]**
Definition, scope and importance of environment – need for public awareness – conceptof an ecosystem - Biodiversity and its values- Biodiversity at global, national and local level- India as a mega-diversity nation – hotspots of biodiversity – threats to biodiversity – endangered and endemic speciesof India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.	
UNIT II - Water resources and Environment microbiology	**[6 hours]**
Water resources: Use and over- utilization of surface and groundwater – dams benefits andproblems, conflicts over water –Water availability at global level, surface level, ground level-Sources-Hydro phonics -Classification of microorganism –Role of microorganism in waste water treatment-Bacterial nutrition and growth.	

UNIT III -Air and Noise pollution	[6 hours]
Sources and classification of air pollutants and their effect on human health-Ambient airquality and emission standards-Air pollutants-Particulate matters-Control equipments- Gravity separator-Centrifugal separator-fabric filter-Electrostatic separator, Catalytic convertors– Noise pollution-causes – Consequences-Control measures- modern tools used in pollution mitigation measures-sustainable activity of pollution control- recent case studies - Environmental Protection Act.	

UNIT IV- Solid waste and Hazardous waste management	[6 hours]
Soil contaminants–sources and management methods of -Solid Waste Hazardous waste – Plastic waste- -Biomedical waste- Hazardous waste& E-waste management -Case studies on Occupational Health and Safety Management system (OHASMS).	

UNIT V-Environmental management and Sustainable development	[6 hours]
Renewable and non-renewable energy Sources- Energy Polices- Development, GDP, Sustainability-concept, needs and challenges-economic, social and aspects of sustainability-Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment-Sustainable goals -Sustainable habitat- Green buildings, Green materials, Energy efficiency, Sustainable transports. Carbon emission-Carbon footprint-Carbon Sequestration.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Illustrate the important features of environment and its conservation.	K2
CO2	Explain the need of water resources and its application to meet the modern requirements and the necessity of its conservation.	K2
CO3	Identify the causes, effects of environmental pollution and explain the control techniques for particulate, gaseous emissions and contribute to the preventive measures in the society.	K3

CO4	Identify the different management methods of solid and hazardous waste.	K3
CO5	Explain the sustainability practices and identify green materials for sustainable development .	K2

Os and POs Mapping:

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

COs	Highest Cognitive Level	**POs**											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	K2	**1**	**-**	**-**	-	-	**1**	**1**	-	-	-	-	-
CO2	K2	**2**	**1**	**-**	**-**	**-**	**1**	**1**	-	**-**	**-**	-	-
CO3	K3	**2**	**-**	**-**	**-**	**-**	**1**	**2**	**1**	-	-	-	-
CO4	K3	**1**	**-**	**-**	**-**	**-**	**2**	**2**	**1**	-	-	-	-
CO5	K2	**1**	**-**	**-**	**-**	**-**	**1**	**2**	**1**	-	-	-	-

Scheme of Evalution:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE)	CIE – I	100	60	100	40
	CIE – II	100			
	Skill Assessment – I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	20	20	20
Understand	60	40	40
Apply	20	40	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Benny Joseph,Environmental Science and Engineering ', Tata McGraw-Hill, NewDelhi, (2014).

2. Miguel Fischer,"Environmental Management: Ecosystems, Competitiveness andWasteManagement" Nova Science Publishers, (2021)

Reference Books:

1. Dharmendra S.Sengar, 'Environmental law ', Prentice hall of India Pvt Ltd, NewDelhi, (2007).

(I) Erach Bharucha, "Textbook of Environmental Studies", Universities Press Pvt, Ltd, Hydrabad, (2015).

2. G.TylerMiller,Scott E.Spoolman,"Environmental Science",Cengag Learning IndiaPvt.Ltd,Delhi, (2014).

3. Mahuabasu, Xavier saverimuthu, "Fundamentals of Environmental Studies",Cambridge university press,(2017)

4. Anubha Kaushik , C.P. Kaushik, "Perspectives in Environmental Studies", New Age International Pvt. Ltd, New Delhi, (2004). 6. Frank R. Spellman, "Handbook of EnvironmentalEngineering", CRC Press, (2015).

Web Links and Video Lectures (E-Resources):

1. Ecology and Society: https://onlinecourses.nptel.ac.in/noc24_hs149/preview
2. Sustainable Power Generation Systems: https://onlinecourses.nptel.ac.in/noc24_ge54/preview
3. Environment and Development: https://onlinecourses.nptel.ac.in/noc24_hs150/preview

Suggested Skill Activities:

1. Why is it beneficial to follow a student centered and participatory process for environmental education?
2. Identify the endemic species of flora and fauna found nearest to your locality.
3. List the major arguments cited against the construction of dams.
4. Discuss how the symbiotic relationship between algae and bacteria is useful in the treatment of sewage in an oxidation pond.
5. List the various ways in which an individual can contribute towards pollution prevention in the society.
6. Mention any four hazardous wastes originating from households and explain theirmanagement strategies.
7. Conduct a survey and find out how chemicals and various material are distributed /cycled in your campus.
8. List the common organic materials that are suitable and unsuitable for composting.
9. List the advantages of recycling of MSW with examples.
10. What are the major obstacles in the implementation of incineration technology in developing countries.

Course Code:	24PH203	Course Title:	MEDICAL PHYSICS
Credits:	3	L – T – P	3-0-0

Course objectives: To impart knowledge * To explore the principle, effects and clinical applications of ionizing radiation. * To study the application of radio isotopes medicine. * To accentuate the effect of sound in human body. * To study the various dosimetry quantities and their effects. * To accentuate the behavior of materials used in medicine.
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 14. Chalk and Talk 15. Lab experiment videos 16. Blended Mode of Learning 17. Project based Learning 18. Experiential Learning 19. NPTEL and Other Videos 20. Smart Class Room 21. Flipped Class

UNIT I EFFECT OF IONIZING RADIATION	**[9 hours]**
Production, properties and classification of electromagnetic radiation- Different sources of radiation - Photoelectric effect- Compton Scattering-Coherent scattering- Infrared radiation and its biological applications-UV radiation and its applications- damaging effects of UV light - Radiometry and photometry- Electrical impedance and Biological Impedance-Artificial Intelligence in Radiotherapy.	

UNIT II NUCLEAR RADIATION AND ITS EFFECTS ON THE BODY	[9 hours]
Radionuclides used in medicine and biology-LD50-Cause of radiation death- Radiation Carcinogenesis-Cataract Genetic Effects-Permissible exposures- Maximum permissible occupational doses- Protective measures- Applications of Artificial intelligence in Nuclear Medicine	

UNIT III ULTRA SOUND IN MEDICINE	[9 hours]
Production-properties and propagation of ultrasonic waves-Bioacoustics-Acoustical characteristics of human body-Ultrasonic Dosimetry-Destructive and non-destructive tests-Cavitation-Piezo electric receivers, thermoelectric probe-Lithotrophy-High power ultrasound in therapy-Artificial intelligence in Medical Ultrasound.	

UNIT IV MICRO DOSIMETRY & NANODOSIMETRY	[9 hours]
Microdosimetry : Microdosimetric quantities- solid state based microdosimetric techniques-gas based microdosimetry- Biological effects of microdosimetry- evaluation of Monte Carlo techniques for microdosimetry, microdosimetry in targeted radionuclide therapy and radiotherapy. **Nanodosimetry and its Applications :**Definition- Nanodosimetric quantities- charge counting Nanodosimetry- electron based nanodosimetry and ion based nanodosimetry-Radiation detector- Radiation protection- Radiation biology- Radiation protection- Gamma spectrometry-Gas sensor Oncology.	

UNIT V MATERIALS USED IN MEDICINE	[9 hours]
Materials for ophthalmology – contact lens and intraocular lens materials – Corneal Implants-	

Implants for Glaucoma-Implants for Retinal Detachment surgery – Bio Materials for bone and joint replacement –dental metals and alloys – ceramic – Bio materials :bioinert – bioactive ceramics – polymers - Artificial organs – cardiovascular materials – cardiac prosthesis - vascular graft materials – cardiac pacemakers – cardiac assist devices – Artificial organs –Dialysis-Heamo filtration

Course outcomes:

On completion of the course, the student will have the ability to:

CO No	Corse Outcomes	Level
CO1	Explain the properties of Electromagnetic Radiation and their effects.	K2
CO2	Understand the use of radionuclides in medicine, cause of radiation, maximum permissible occupational doses protective measures.	K2
CO3	Demonstrate the knowledge on the properties of sound and its application in medicine.	K2
CO4	Explain the biological effects of dosimetry's.	K2
CO5	Understand the use of materials in medicine.	K2

COs and POs Mapping

COs	**POs**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	2	1	1	-	2	2	-	-	-	-	-	2
CO2	2	1	1	-	2	2	-	-	-	-	-	2
CO3	2	1	1	-	-	-	-	-	-	-	-	2
CO4	2	1	1	-	-	-	-	-	-	-	-	2
CO5	2	1	1	-	-	-	2	-	-	-	-	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level - NotMapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	20	20	20
Understand	80	80	80
Apply	0	0	0
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

TEXT BOOKS:

1. B.H. Brown, R.H. Smallwood, D.C. Barber, P.V. Lawford, D.R. Hose, ―Medical Physics and

Biomedical Engineering, Institute of physics publishing, Bristol and Philadelphia, 1999.

2. Abu-Faraj, Ziad O., Handbook of Research on Biomedical Engineering Education and Advance Bioengineering Learning, 2012,Volume 1, IGI Global, Hershey, USA.

REFERENCES:

1. W.J. Meredith and J.B. Massey "Fundamental Physics of Radiology" Varghese Publishing house, Third Edition, 2013.
2. Steve Webb, The Physics of Medical Imaging, Taylor & Francis, Newyork, Second Edition, 2012.

NPTEL COURSE

Sl.No	Course Name	Course Instructor	Course Conducting Agency
1	Introduction to Biomedical Imaging systems.	Dr.Arun k. Thittai	IIT Chennai

WEB LINKS AND VIDEO LECTURES (E-RESOURCES):

Ionizing Radiation Dose https://youtu.be/f08efmygAlM?si=hYBPhKFM7whXQrbw

Ultrasonic waves https://youtu.be/josqjch79pe

Micro dosimetry & Nano dosimetry
https://youtu.be/7OjgGFsxmKA?si=BBPVuBO8QSgvP1

SKILL ASSESSMENT

1.How do you feel the effects of electromagnetic radiation in the earth.

2.List the applications of UV rays beyond medical field.

3.Explain the advantages of the cobalt 60 radio isotope in medicine.

4.Give the protective measures of nuclear radiation leakage.

5.Explain how ultrasonic waves used for scanning the materials in industry.

6.List the different types of radiation measurements.

7.Explain the various applications of nano materials in modern technology.

8.Explain the role of nanomaterials in medicine.

9.What are the various applications of light waves in optical industry.

10.Give the detailed report on bio-composite materials in medical field.

Course Code:		Course Title:	Biosciences in Medical Engineering
Credits:	4	L – T – P	3-0-2

Course objectives:

To impart knowledge on the

- Biochemical reactions and their functions.
- Function of carbohydrates, lipids, proteins and amino acids.
- Role of biomolecules in metabolic diseases and disorders.
- Structure and functions of Kidney and Liver.
- Different applications of biochemistry.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Flipped Class

UNIT I – Introduction to Biochemistry	[9 hours]
Introduction to biochemistry – Biomolecules, structure of water & its importance – Important noncovalent forces – Hydrogen bonds, electrostatic, hydrophobic & vanderwaals forces – Acid, base & buffers – pH, Henderson Hasselbalch equation. Biological buffers and their significance – Principle of viscosity – surface tension, adsorption, diffusion, osmosis & their applications in biological systems.	
Practical Topics: 1. Preparation of solutions: 1) Percentage solutions, 2) Molar solutions, 3) Normal solutions. 2. Standardization of pH meter, preparation of buffers, emulsions. 3. Spectroscopy: Determination of absorption maxima (λ max) of a given solution.	

UNIT II – Complex Organic Compounds	[9 hours]
Carbohydrates – General classification - Structure and functions - Lipids structure and function - Structure of proteins and amino acids –. Carbohydrate - Blood glucose regulation - Diabetus mellitus-types – GTT – Aminoacids – Phenylketonuria - Lipids and Lipoproteins Cholesterol- Factors affecting the level - Plasma lipoprotein – Types - Hyper and hypo- lipo proteinemias.	
Practical Topics: 1. Qualitative analysis of carbohydrates. 2. Estimation of protein by Biuret Method. 3. Estimation of Glucose by DNS Method.	

UNIT III – Cell Degeneration, Repair and Neoplasia	[9 hours]
Cell Injury- Reversible cell injury and Irreversible cell injury and Necrosis, Apoptosis, Intracellular accumulations, Pathological calcification- Dystrophic and Metastatic. Cellular adaptations of growth and differentiation, Inflammation and Repair including fracture healing, Neoplasia, Classification of Tumours, Carcinogenesis, spread of tumours Autopsy and Biopsy.	
Practical Topics: 1. Identification of types of tumours in slides. 2. Identification of the cell whether it is necrosis or Apoptosis. 3. Identification of pathological calcification in slides.	

UNIT IV – Microbiology and Immunopathology	[9 hours]
Microscopy: types– Staining Techniques- Principle and applications of Chromatography – Electrophoresis – spectrophotometry- Natural and artificial immunity, hypersensitivity, Antibody and cell mediated tissue injury, Immunological techniques. Nucleic acid, Double helical structure of DNA, various forms of DNA.	
Practical Topics: 1. Types of Staining: Simple stain, Gram stain. 2. Basic staining- Haematoxylin and Eosin staining	

3. Special staining- cresyl fast Blue(CFV)-Trichrome-oil red O-PAS

UNIT V – Clinical Analysis	[9 hours]
Blood and urine - Composition and functions - Types and functions of RBC - WBC and platelet - Urine profile (creatinine – urea – albumin - sugar) - Color of urine - Specific gravity. Urine analysis - Organ function tests - Liver function tests - Kidney function tests - Thyroid function tests - Adrenal function tests - Pancreatic function tests - Gastric function tests.	
Practical Topics: 1. Qualitative examination for normal organic constituents in urine. 2. Estimation of Creatinine, Urea and Uric acid. 3. Urine physical and chemical examination (protein, reducing substances, ketones, bilirubin).	

Laboratory Component: **[30 hours]**

Any 12 experiments have to be completed from the following list of experiments.

S.No.	Name of the Experiment
1	Preparation of solutions: 1) Percentage solutions, 2) Molar solutions, 3) Normal solutions.
2	Standardization of pH meter, preparation of buffers, emulsions.
3	Spectroscopy: Determination of absorption maxima (λ max) of a given solution.
4	Qualitative analysis of carbohydrates.
5	Estimation of protein by Biuret Method.
6	Estimation of Glucose by DNS Method.
7	Identification of types of tumours in slides.
8	Identification of the cell whether it is necrosis or Apoptosis.
9	Identification of pathological calcification in slides.
10	Types of Staining: Simple stain, Gram stain.
11	Basic staining- Haematoxylin and Eosin staining
12	Special staining- cresyl fast Blue(CFV)-Trichrome-oil red O-PAS
13	Qualitative examination for normal organic constituents in urine.

14	Estimation of Creatinine, Urea and Uric acid.
15	Urine physical and chemical examination (protein, reducing substances, ketones, bilirubin).

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Explain the fundamental concepts of biochemistry
CO2	Apply complex organic compounds to determine the abnormalities in human body.
CO3	Explain the functioning of enzymes and metabolism.
CO4	Apply the clinical analysis to determine the functioning of internal organs.
CO5	Apply the analytical techniques to determine the different clinical parameters.

COs and POs Mapping:

COs	**POs**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**1**
CO2	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**1**
CO3	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**1**
CO4	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**1**
CO5	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**1**

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final marks</th></tr>
<tr><td rowspan="5">Continuous Internal Examination (CIE) - Theory</td><td>CIE – I</td><td>100</td><td rowspan="2">50</td><td rowspan="5">100</td><td rowspan="5">25</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>MCQ</td><td>20</td><td>10</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td rowspan="2">Continuous Internal Examination (CIE) - Laboratory</td><td>Continuous Assessment</td><td>75</td><td>75</td><td rowspan="2">100</td><td rowspan="2">25</td></tr>
<tr><td>Model Lab Exam</td><td>25</td><td>25</td></tr>
<tr><td rowspan="2">End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>35</td><td rowspan="2">50</td><td rowspan="2">50</td></tr>
<tr><td>Lab Exam</td><td>100</td><td>15</td></tr>
<tr><td colspan="5" align="right">Total</td><td>100</td></tr>
</table>

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

<table>
<tr><th rowspan="2">Bloom's Category</th><th colspan="2">Continuous Assessment Tests</th><th rowspan="2">Terminal Examination</th></tr>
<tr><th>1</th><th>2</th></tr>
<tr><td>Remember</td><td>20</td><td>20</td><td>20</td></tr>
<tr><td>Understand</td><td>20</td><td>60</td><td>40</td></tr>
</table>

Apply	60	20	40
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. RAFI MD "Text book of biochemistry for Medical Student" Fourth Edition, Universities Press, Orient Blackswan Private Limited - New Delhi 2021.
2. Practical Biochemistry – Principles & Techniques, Keith Wilson & John Walker. Oxford university press.

Reference Books:

1. Keith Wilson & John Walker, "Practical Biochemistry - Principles & Techniques", Oxford University Press, 2019.
2. Underwood JCE: General and Systematic Pathology Churchill Livingstone, 3rd edition, 2018.
3. Dubey RC and Maheswari DK. "A Text Book of Microbiology" Chand & Company Ltd, 2020.
4. Prescott, Harley and Klein, "Microbiology", 10th edition, McGraw Hill, 2017.
5. Ananthanarayanan & Panicker, "Microbiology" Orientblackswan, 2017 10th edition.
6. Harper's review of biochemistry By David. W. Martin, Peter. A. Mayes, Victor. W. Rodwell. LANGE medical publications, 2021.

Web Links and Video Lectures (E-Resources):

1. Introduction to Biochemistry:

https://onlinecourses.nptel.ac.in/noc24_ee125/preview

2. Complex Organic Compounds:

https://onlinecourses.nptel.ac.in/noc24_ee112/preview

3. Introduction to Enzymes and Hormones:

https://onlinecourses.nptel.ac.in/noc24_ee147/preview

4. Clinical Analysis:

https://onlinecourses.nptel.ac.in/noc24_ee103/preview

5. Analytical Techniques:

https://onlinecourses.nptel.ac.in/noc24_ee83/preview

Suggested Skill Activities:

1. Manipulate the chemical composition of buffer solution to evaluate the chemical process involved in extraction of oxygen from water.
2. A patient with low level albumin was recommended for clinical test. Use BCG Method to determine the level of albumin in the provided sample.
3. In a number of circumstances, bile salt depletion has been demonstrated to cause diarrhea. It's unclear exactly how bile salts cause diarrhea, but one possibility is that they cause the intestines to secrete more Cl- and absorb less NaCl. Describe the techniques used to detect bile salts in bile juice.
4. Determination of total protein in serum by using Biuret method under such circumstances? Include the normal range of serum protein as well.
5. Describe how the recently created staining techniques—the Helicobacter pylori silver stain HpSS methods and the modified McMullen's methods—were used to identify the H pylori organism in gastric sample Demonstrate the purpose of biochemistry in application level to find the Molar, normal and Percentage of a solution.
6. Demonstrate the purpose of biochemistry in application level to find the Molar, normal and Percentage of a solution.
7. Demonstrate the methods used to find the level of carbohydrates, Lipids and proteins in living organism.
8. Demonstrate the cycles used in living organisms.
9. Demonstrate the clinical test for Liver and Kidney Failures.
10. Demonstrate the Analytic technique used for Clinical Purpose.

Course Code:	**24EE202**	**Course Title:**	**Fundamentals of Electrical and Electronics Engineering**
Credits:	**4**	**L – T – P**	**3-0-2**
Pre-requisite			**NIL**

Course objectives:

To impart knowledge on the

- Basics of DC electric circuits and its analysis
- Analysis of AC circuits and magnetic circuits
- Working principles and application of DC machines and transformers
- Digital devices and their characteristics
- Functional elements and working of sensors and actuators used for smart systems.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I –DC Circuits	**[9 hours]**
Introduction to DC Circuits – Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws –Nodal Analysis, Mesh analysis with independent sources only – Appliances.	
Practical Topics: 4. Model an electrical circuit and simulate it to verify Ohms Law. 5. Model an electrical circuit and simulate it to verify Kirchhoff's Voltage Law. 6. Model an electrical circuit and simulate it to verify Kirchhoff's Current Law.	

UNIT II – AC Circuits and Magnetic Circuits	[9 hours]
Introduction to poly-phase circuits - Representation of sinusoidal waveform – peak and rms values, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations – Converters: rectifiers and inverters; Basics of magnetic circuits – Flux – Flux density – Magnetic resonance – Self-inductance – mutual-inductance – Coupling.	
Practical Topics: 4. Demonstrate the measurement of power in an RLC circuit using wattmeter method. 5. Interpret the DC output of an RLC circuit using half wave rectifier. 6. Interpret the DC output of an RLC circuit using full wave rectifier.	

UNIT III – DC Machines and Transformers	[9 hours]
Construction, principle of operation, characteristic and application – DC Motor and DC Generator, Types of DC motors and generators – Application: Electric Vehicle – Structure of electric power system – Introduction to single phase transformers –Construction, principle of operation, characteristics and application.	
Practical Topics: 4. Conduct the load test on DC shunt motor to outline its characteristics. 5. Outline the study on the starting methods of DC series motor. 6. Conduct a study on transformer construction for real-time applications.	

UNIT IV – Digital Electronics	[9 hours]
Introduction to digital systems – Number system – Boolean Algebra – POS and SOP – Logic gates – K-map simplification – Flip Flops – Combinational logic circuits: adders – subtractors.	
Practical Topics: 4. Experiment with the logic gates to verify its truth table. 5. Make use of the logic gates to verify the functioning of half and full adders. 6. Make use of the logic gates to verify the functioning of half and full subtractors.	

UNIT V – Sensors and its Applications	[9 hours]
Sensors in IoT – Mobile based sensors, Resistance Temperature sensor, Humidity sensor –Medical sensor – Neural sensor – Motion sensor – PIR sensor, Piezoelectric sensor, Air quality sensor – CO_2 Sensor, RFID sensor, Water leakage detection sensor, Light sensors - Introduction to actuators in automation – Applications: smart homes – smart cities – smart parking system.	
Practical Topics: 4. Utilize Arduino and Bluetooth module for automating home appliances. 5. UtilizeESP8266 processorfor automating home appliances. 6. Construct an Arduino based solar tracker for solar irradiation measurement.	

Laboratory Component: **[30 hours]**

Any 12experiments have to be completed from the following list of experiments.

S.No	Name of the Experiment
1	Model an electrical circuit and simulate it to verify Ohms Law.
2	Model an electrical circuit and simulate it to verify Kirchhoff's Voltage Law.
3	Model an electrical circuit and simulate it to verify Kirchhoff's Current Law.
4	Demonstrate the measurement of power in an RLC circuit using wattmeter method.
5	Interpret the DC output of an RLC circuit using half wave rectifier.
6	Interpret the DC output of an RLC circuit using full wave rectifier.
7	Conduct the load test on DC shunt motor to outline its characteristics.
8	Outline the study on the starting methods of DC series motor.
9	Conduct a study on transformer construction for real-time applications.
10	Experiment with the logic gates to verify its truth table.
11	Make use of the logic gates to verify the functioning of half and full adders.
12	Make use of the logic gates to verify the functioning of half and full subtractors.
13	Utilize Arduino and Bluetooth module for automating home appliances.
14	UtilizeESP8266 processorfor automating home appliances.
15	Construct an Arduino based solar tracker for solar irradiation measurement.

Course outcomes:

On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Apply the circuit laws and theorems to compute the electrical parameters of domestic and industrial appliances.	K3
CO2	Compare the behavior of AC circuits & magnetic circuits for a given input.	K2
CO3	Explain the construction, working, and application of electrical machine and transformer to infer its characteristics.	K2
CO4	Apply the semiconductor principles using diodes, transistors, thyristors and displays for developing electronic switches and displays.	K3
CO5	Identify the sensors for applications in Engineering.	K3

COs and POs Mapping:

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2	1	1	2	-	-	-	2	-	-	1
CO2	2	1	1	-	2	-	-	-	2	-	-	1
CO3	2	1	1	-	2	-	-	-	2	-	-	1
CO4	3	2	1	1	2	-	-	-	2	-	-	1
CO5	3	2	1	1	2	-	-	-	2	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

Assessment Pattern

Bloom's Category	Internal Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	60	40	40
Apply	20	40	40
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).

- All the fifteen questions have to be answered.

Text Books:

1. D P Kothari and I.J Nagarath, "Basic Electrical and Electronics Engineering," McGraw Hill Education (India)Private Limited, Second Edition, 2020
2. A.K.Sawhney and PuneetSawhney,"A Course in Electrical & Electronic Measurements & Instrumentation,"DhanpatRai and Co, 2015.

Reference Books:

6. John Bird, "Electrical Circuit theory and technology", Routledge; 2017.
7. Muthusubramanian R and Salivahanan S, "Basic Electrical and Electronics Engineering,"McGraw Hill, NewDelhi,2009.
8. Nagsarkar T K and Sukhija M S, "Basics of Electrical Engineering," Oxford University press, 2012.
9. V K Mehta, Rohitmehta "Principles of Electronics," S.Chand& Company Ltd, 2015.
10. Mahmood Nahvi and Joseph A.Edminister, "Electric Circuits," Schaum' Outline Series, McGraw Hill, 2009.
11. H.S. Kalsi, "Electronic Instrumentation," Tata McGraw-Hill, New Delhi, 2010.
12. Ian Sinclair, "Sensors and Transducers," Elsevier Science, 3rd Edition, 2000.
13. Perry Lea, "Internet of things for architects," Packt, 2018.
14. V N Mittle and Arvind Mittle "Basic Electrical Engineering," McGraw Hill, New Delhi, 2005.
15. R.S. Sedha, "A Textbook of Applied Electronics," S. Chand & Co., 2008.
16. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry and Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017.

Web Links and Video Lectures (E-Resources):

1. A Basic Course on Electric and Magnetic Circuits :
   https://onlinecourses.nptel.ac.in/noc24_ee125/preview

2. Basic Electrical Circuits:
   https://onlinecourses.nptel.ac.in/noc24_ee112/preview
3. Digital Circuits:
   https://onlinecourses.nptel.ac.in/noc24_ee147/preview
4. Electrical Machines – I:
   https://onlinecourses.nptel.ac.in/noc24_ee103/preview
5. Sensor Technologies: Physics, Fabrication and Circuits:
   https://onlinecourses.nptel.ac.in/noc24_ee83/preview
6. Semiconductor Devices and Circuits:
   https://onlinecourses.nptel.ac.in/noc24_ee143/preview

Suggested Skill Activities:

11. List the different electrical loads available in home, college and prepare their rating chart.
12. Design the residential house wiring using fuse, switch, indicator, lamp, circuit breaker, energy meter and apply Thevenin's theorem to find the current in particular branch.
13. Take a room in your home and replace the fluorescent lamp to LED lamp to calculate the monthly electrical charge and compare with the previous month.
14. Write the parts of the fan and electric mixer in home and draw the wiring diagram for fan and electric mixer.
15. Visit the nearby substation and list out the details of safety measures followed by electrical engineers.
16. List out the rating of electrical machines used in home appliances.
17. Identify the semiconductor devices in electronic appliances.
18. Develop IOT based solutions for engineering applications.
19. Draw the wiring diagram of EV and mentions its parts.
20. Visit nearby power plant and demonstrate the various components, working, power generation and distribution in power plant as a report.

Course Code:	**24GE231**	**Course Title:**	**WORKSHOP PRACTICE**
Credits:	**1.5**	**L – T – P**	**0-0-3**
Pre-requisite			**NIL**

Course objectives:

To provide hands on training to the students in:

- Applying basic techniques to measure a field, infer masonry work and install plumbing design.
- Fabricating carpentry, foundry, sheet metal and welding works to practice on workshop trades and making end products.
- Utilizing machining processes like turning, drilling, tapping in parts and 3D printing for performing the jobs.
- Designing electrical wiring layout with MCBs and RCCBs, developing staircase wiring and illumination design circuits for buildings.
- Assembling simple electronic components on PCB by soldering and desoldering and testing with IoT based interfaces.
- Developing blogs and website design for the complete access over the network.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

5. Project based learning
6. Industrial Visit

GROUP – A (Civil and Mechanical)

PART I - CIVIL ENGINEERING PRACTICES	[5 hours]
1. FIELD MEASUREMENT, MASONRY WORK AND PLUMBING a. Calculate the area of a built-up space and a small parcel of land-use standard measuring tape and digital distance measuring devices. b. Visit a nearby site where construction is at initial stage and observe for following (if necessary, visit two/three times with a gap of a week). If drawings are available relate/match activities with the drawings. i. Digging and filling. ii. Foundation preparations. iii. Brick/stone masonry. iv. Concrete laying and curing. v. Laying of sewerage/sanitary lines. vi. Bar bending and bar laying for columns, beams and ceiling. vii. Onsite testing for quality. viii. Onsite preparation for construction work. ix. Erection and removal of form work, scaffolding, centering/shuttering. Prepare a brief report on the construction activities, methods, tools, equipments and materials being used. c. Installation of water lines for wash basin and showers faucet.	

PART II MECHANICAL ENGINEERING PRACTICES	[5 hours]
2. CARPENTRY, FOUNDRY, WELDING AND SHEET METAL a. Carpentry: Prepare T/L/Lap Joint from given wooden work piece and make a Box/Tray out of plywood using modern power tools. b. Welding: Make a Butt/Lap of MS plate using Arc welding process. c. Casting: Demonstration of Pattern making by sand moulding. d. Sheet Metal: Fabrication of Sheet Metal Tray and Funnels. 3. LATHE, DRILLING MACHINE AND 3D PRINTER a. Designing a driller component using radial machine. b. Perform a job using facing and turning in lathe. c. Printing simple 3D geometric shapes using SLA printer.	

GROUP – B (Electrical, Electronics and IT)

PART III ELECTRICAL ENGINEERING PRACTICES	[3 hours]
4. ELECTRICAL WIRING	

a. Design a wiring circuit integrating energy meter, MCBs and RCCBs. b. Develop fluorescent lamp wiring, staircase wiring and electric fan wiring circuits.

PART IV ELECTRONICS ENGINEERING PRACTICES	[4 hours]
5. IOT BASED SOLUTIONS AND PCB a. Design a single layer PCB layout structure. b. Fabricate single layer PCB printing. c. Assembling, soldering and desoldering practice on single layer PCB. d. GPIO programming in ESP8266, sensor and actuator interfacing with internet enabled microcontroller device. e. Integration of microcontroller-based system with Cloud platform.	

PART V COMPUTER SCIENCE AND ENGINEERING PRACTICES	[3 hours]
6. INTERACTIVE DYNAMIC WEBSITE a. Design a website for an application using HTML and CSS. b. Convert the designed website into responsive website using Bootstrap. c. Add dynamism to the website by using JavaScript and embed the social media components to the website. d. Incorporate the database interaction with the website. e. Deploy the developed website in the server.	

Course outcomes:

On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Apply basic techniques for field measurements, masonry work and plumbing.	K3
CO2	Make use of workshop trades like carpentry, foundry, sheet metal and welding for practicing on manufacturing of components.	K3
CO3	Develop simple components using Lathe, Drilling Machine and 3D Printer.	K3
CO4	Construct the electrical wiring circuits for buildings based on their requirement.	K3
CO5	Develop IoT based solutions and PCB for real world use cases.	K3
CO6	Build and host an interactive dynamic website.	K3

COs and POs Mapping:

COs	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	1	2	-	-	-	1	1	-	1	3	2	1
CO2	3	2	1	1	2	-	-	-	1	1	-	1			
CO3	3	2	1	1	2	-	-	-	1	1	-	1			
CO4	3	2	1	1	2	-	-	-	1	1	-	1	1	-	-
CO5	3	2	1	1	2	-	-	-	1	1	-	1			
CO6	3	2	1	1	2	-	-	-	1	1	-	1	-	1	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

The weightage of Continuous Internal Evaluation (CIE) is 60% and for End Semester Examination (ESE) is 40%.

S.No	Component	Type of Assessment	Max Marks	Reduced Marks	Total	Final Marks
1.	**Continuous Internal Examination(CIE)-Laboratory**	Continuous Assessment	75	75	100	60
2.		Model Lab Exam	25	25		
3.	**End Semester Examination (ESE)**	Lab Exam	100	40	40	40
					Total	100

Assessment Pattern

Bloom's Category	**Terminal Examination**
Remember	0
Understand	0
Apply	100
Analyse	0
Evaluate	0
Create	0

Text Books:

1. AICTE's Prescribed Textbook: Workshop / Manufacturing Practices (with Lab Manual) ISBN: 978-93-91505-332
2. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.

Reference Books:

1. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4 th edition, Pearson Education India Edition, 2002.
2. Gowri P. Hariharan and A. Suresh Babu," Manufacturing Technology – I" Pearson Education, 2008.
3. Roy A. Lindberg, "Processes and Materials of Manufacture", 4 th edition, Prentice Hall India, 1998.
4. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House, 2017.

Course Code:	**24EN201**	**Course Title:**	**Presentation and Language Skills Laboratory** (Common to AI&DS,AE,BME,CE,CSE,CSE(AI&ML), EEE, ECE,MECH)
Credits:	**1.5**	**L – T – P**	**0-0-3**
Pre-requisite			**24EN101 English for Engineers**

Course Objectives:

- To apply critical listening skills.
- To make use of critical thinking skills.
- To apply stress as well as tonal variation.
- Make use of language skills to produce error free sentences
- To experiment with presentation skills.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Lab experiment videos
2. Blended Mode of Learning
3. Project based Learning
4. Smart Classroom
5. Flipped Class

UNIT I		**[12 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	**Topics**	**Hours**
5.	Listening to audios (online platforms) and making a critical appreciation of audio content	3

6.	Listening to breaking news	2
7.	Listening to British council / Cambridge English (Selected topics)	2
CLASSROOM ACTIVITIES		
1	Speaking current issues (selected topics)	2
2	Making conversations at work place, Public Speaking (based on festivals and celebrations)	3

UNIT II		[12 hours]
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	**Topic**	**Hours**
1	English Movie clips and software in the Lab C (Globarena)	3
2	Vocabulary Development through movies/ short films/ Documentaries	3
CLASSROOM ACTIVITIES		
1	Speaking - Just a minute talk and expressions for plans and decisions	3
2	Describing a product	3

UNIT III		[12 hours]
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	**Topic**	**Hours**
2.	Listening to TED talks, scientific lectures.	3
2.	Reading Comprehension strategies	2
3.	Reading- Editorials	2
CLASSROOM ACTIVITIES		
9.	Speaking- Introduction to Phonetics- Speech sounds- Vowels and Consonants- Stress- Rising/ Falling Tone	2
10.	Writing- A day in my life	2
11.	Writing- Situational Dialogues	1

UNIT IV		[12 hours]
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl.No.	**Topic**	**Hours**
5.	Reading Popular Blogs Listening Editorials	3
6.	Creating a Blog	2
CLASSROOM ACTIVITIES		
4.	Errors in Pronunciation. Error detection	3
5.	Writing - Terminology for Engineers. Writing Articles and preparing day to day scripts.	2 2

UNIT V		[12 hours]
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	**Topic**	**Hours**
1	Prepare PowerPoint presentation (topics selected by students)	3
2	Reading newspaper articles	2
CLASSROOM ACTIVITIES		
1.	Present the selected topic.	3
2.	Making a short speech / Extempore	2
3.	Writing - Expanding a Proverb Writing Instructions	2

S.No.	Name of the Experiments
1	Making conversation at workplace
2	Writing articles
3	Making expressions for plans and decisions
4	Describing a product
5	Day in my life
6	Writing Terminology for engineers
7	Spotting errors
8	Expansion of proverbs
9	Instructions
10	Reading comprehension

Course Outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Domain
CO1	Build communicative competence through critical listening skills.	K3
CO2	Make use of critical thinking skills to express plans and opinions.	K3
CO3	Apply stress as well as tonal variations for effective communication.	K3
CO4	Make use of language skills to produce error free sentences.	K3
CO5	Experiment with presentation skills to address confidently.	K3

COs and POs Mapping:

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	-	-	-	-	-	-	-	-	-	3	-	3
CO2	-	-	-	-	-	-	-	-	-	3	-	3
CO3	-	-	-	-	-	-	-	-	-	3	-	3
CO4	-	-	-	-	-	-	-	-	-	-	-	3
CO5	-	-	-	-	-	-	-	-	-	3	-	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Assessment Pattern:

Name of the Test	**Marks**	**Total**	**Reduced to**
Continuous Assessment (Experiments 1-10)	50	100	50
Model Examination	50		
End Semester Lab Exam	100	100	50
TOTAL			**100 MARKS**

Textbooks:

1. Raman, Meenakshi and Sangeetha Sharma. Professional Communication. Oxford University
   Press, Oxford, 2014.
2. Dr. Chellammal. V. Learning to Communicate. Allied Publishers, New Delhi, 2003.
3. Mohan, Krishna. And Meera Bannerjee. Developing Communication Skills. Macmillan India
   Ltd. 1990.

Reference Books:

Murphy – Raymond. English Grammar in Use BOOK with Answers: A Self-Study, Reference and Practice Book for Intermediate Learners of English. Fourth edition: Cambridge University Press – 2012.

MANUALS/ SOFTWARE: Open Sources / Websites

Course Code:	**24CS301**	**Course Title:**	**PROGRAMMING FOR PROBLEM SOLVING USING PYTHON**
Credits:	**1.5**	**L – T – P**	**0-0-3**

Course objectives:

To impart knowledge on the

- To explain basic concepts in Python
- To implement programs using functions, loops, and conditional statements.
- To demonstrate the concepts of data structures
- To make use of strings and exception handling in Python
- To demonstrate file handling and python modules

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

8. Lab experiment videos
9. Project based Learning

Laboratory Component: **[20 hours]**

S.No	**Name of the Experiment**
1	Develop simple python programs using basic data types
2	Develop simple python programs using operators and expressions
3	Develop Python programs using conditional statements
4	Develop Python programs using various Loops
5	Develop python programs using Functions.
6	Develop programs to demonstrate the use of List, and Tuples
7	Develop programs to demonstrate the use of Dictionaries
8	Demonstrate the various string manipulation functions
9	Develop programs to show Exception Handling in tasks
10	Execute programs using Numpy in Jupiter notebook
11	Python program using File I/O, random access file handling methods and Zipping and Unzipping of files
12	Develop Python programs using packages

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Develop basic programs using fundamental data types	K3
CO2	Solve the given problem statement using programming concepts such as operators, conditional and looping statements and functions.	K3
CO3	Make use of data structures such as lists, tuples, and dictionaries to manage and manipulate data in development of simple applications	K3
CO4	Create programs using string handling functions and apply exception handling, and make use of NumPy to solve problems	K3
CO5	Make use of file operations and packages in development of simple applications	K3

COs and POs Mapping

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	**3**	**3**	3	-	1	-	-	-		-	-	1
CO2	**3**	**3**	3	-	1	-	-	-		-	-	1
CO3	**3**	**2**	2	1	1	-	-	-		-	-	1
CO4	**3**	**2**	2	1	1	-	-	-		-	-	1
CO5	**3**	**3**	3	1	1	-	-	-		-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

The weightage of Continuous Internal Evaluation (CIE) is 60% and for End Semester Examination (ESE) is 40%.

S.No	Component	Type of Assessment	Max Marks	Reduced Marks	Total	Final Marks
1	**Continuous Internal Examination(CIE)-Laboratory**	Continuous Assessment	75	75	100	60
2		Model Lab Exam	25	25		
3	**End Semester Examination (ESE)**	Lab Exam	100	40	40	40
					Total	100

Assessment Pattern

Bloom's Category	Terminal Examination
Remember	0
Understand	0
Apply	100
Analyze	0
Evaluate	0
Create	0

Text Books:

1. Reema Thareja, "Python Programming: Using Problem Solving Approach", Oxford University Press, 2017.
2. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.

Reference Books:

1. Guido van Rossum, Fred L. Drake Jr., "An Introduction to Python – Revised and Updated for Python 3.2", Network Theory Ltd., 2011.
2. John V Guttag, "Introduction to Computation and Programming Using Python", Revised and Expanded Edition, MIT Press , 2013
3. Charles Dierbach, "Introduction to Computer Science using Python", Wiley India Edition, 2016.
4. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd., 2015.
5. Kenneth A. Lambert, "Fundamentals of Python: First Programs", Cengage Learning, 2012.
6. Vijay Kumar Sharma, Vimal Kumar, Swati Sharma, Shashwat Pathak, "Python Programming – A Practical Approach", CRC Press, First Edition, 2022

ROHINI COLLEGE OF ENGINEERING AND TECHNOLOGY

(AUTONOMOUS)

(Anjugramam-Kanyakumari Main Road, Palkulam,Variyoor P.O.-629 401, K.K.Dist.)

Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai

Accredited with A+ Grade by NAAC

BE. Civil Engineering

Curriculum & Syllabus

(*2024-2025 Admitted Students Onwards*)

Vision Statement of RCET

To be an academic institute of continuous excellence towards education and research in rural regime and provide service to nation in terms of nurturing potentially higher social, ethical and engineering companion graduands.

Mission Statement of RCET

To foster and promote technically competent graduands by imparting the state of art Engineering education in rural regime.To enunciate research assisted scientific learning by dissemination of knowledge towards science, agriculture, industry and national security.

Vision of the Department

To develop professional knowledge and competent Civil Engineers to create ethically skilled students for better contribution to the society.

Mission of the Department

M1: To provide technically valuable education for the development of Civil Professionals

M2: To make a platform for the students to explore their potential and critical thinking in research field.

M3: To create awareness and spirit of ethical thoughts in societal concerns for professional development.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Graduates will apply the knowledge of Civil Engineering concepts to solve real world Engineering problems.

PEO2: Graduates will have required qualities for a successful career in Civil Engineering and good interaction skills.

PEO3: Graduates will exhibit the professional skills with ethical values through societal concerns.

PROGRAMME OUTCOMES (PO)

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 Conduct investigations of complex problems: Draw well-founded conclusions applying the knowledge acquired from research and research methods including design of experiments, analysis and interpretation of data and synthesis of information and to arrive at significant conclusion.

PO5 Modern tool usage: Form, select and apply relevant techniques, resources and Engineering and IT tools for Engineering activities like electronic prototyping, modeling and control of systems and also being conscious of the limitations.

PO6 The engineer and society: Understand the role and responsibility of the Professional Civil Engineer and to assess societal, health, safety issues based on the reasoning received from the contextual knowledge.

PO7 Environment and sustainability: Be aware of the impact of professional Engineering solutions in societal and environmental contexts and exhibit the knowledge and the need for Sustainable Development.

PO8 Ethics: Apply the principles of Professional Ethics to adhere to the norms of the engineering practice and to discharge ethical responsibilities

PO9 Individual and team work: Function actively and efficiently as an individual or a member/leader of different teams and multidisciplinary projects.

PO10 Communication: Communicate efficiently the engineering facts with a wide range of engineering community and others, to understand and prepare reports and design documents; to make effective presentations and to frame and follow instructions.

PO11 Project management and finance: Demonstrate the acquisition of the body of engineering knowledge and insight and Management Principles and to apply them as member / leader in teams and multidisciplinary environments.

PO12 Life-long learning: Recognize the need for self and life-long learning, keeping pace with technological challenges in the broadest sense.

PROGRAMME SPECIFIC OUTCOMES (PSOS)

PSO1: Apply and develop basic concepts of civil engineering by inculcating the best practices for solving real time problem through feasible solution and to specialize in various academics

PSO2: Ability to provide interdisciplinary skill to meet the social needs through civil engineering and to develop successful professional career along with strong technical, communication and presentation skill.

PSO3: To apply experimental knowledge, analysis, interpretation of data and information to Civil Engineering problems.

CREDIT INFO		
Sl.No	**Category**	**Credits**
1	Humanities and Social Science (HSS)	13
2	Basic Science Courses (BSC)	25
3	Engineering Science Courses (ESC)	24
4	Professional Core Courses (PCC)	60.5
5	Professional Electives Courses (PEC)	18
6	Open Electives Courses (OEC)	12
7	Employability Enhancement Courses (EEC)	17
9	Mandatory Courses (MNC)	-
Total Credits		**169.5**

Humanities and Social Science (HSS)							
Sl.No	**Course Code**	**Course Title**	**Course Type**	**L**	**T**	**P**	**Credit**
1	24GE101	Heritage of Tamils	HSS	1	0	0	1
2	24EN101	English for Engineers	HSS	2	0	1	2.5
3	24GE201	Tamils and Technology	HSS	1	0	0	1
4	24EN231	Presentation and Communication Skills Laboratory	HSS	0	0	3	1.5
5	24MG602	Essentials of Entrepreneurship	HSS	2	0	0	2
6	24MG701	Economics for Engineers	HSS	3	0	0	3
7	24GE701	Professional Ethics And Human Values	HSS	2	0	0	2
Basic Science Courses (BSC)							
Sl.No	**Course Code**	**Course Title**	**Course Type**	**L**	**T**	**P**	**Credit**
1	24MA101	Matrices And Calculus	BSC	3	1	0	4
2	24PH101	Engineering Physics	BSC	3	0	2	4
3	24CY101	Engineering Chemistry	BSC	3	0	2	4
4	24MA201	Complex Variables And Transforms	BSC	3	1	0	4
5	24PH202	Applied Material Science	BSC	3	0	0	3

6	24CY401	Environment Science And Engineering	BSC	2	0	0	2
7	24MA302	Probability, Statistics And Numerical Methods	BSC	4	0	0	4
Engineering Science Courses (ESC)							
Sl.No	**Course Code**	**Course Title**	**Course Type**	**L**	**T**	**P**	**Credit**
1	24ME301	Engineering Mechanics	ESC	3	1	0	4
2	24EE202	Fundamentals Of Electrical And Electronics Engineering	ESC	3	0	2	4
3	24ME201	Engineering Graphics And Design	ESC	1	0	4	3
4	24CS201	Programming For Problem Solving Using C	ESC	2	0	4	4
5	24GE231	Workshop Practices	ESC	0	0	3	1.5
6	24CE301	Engineering Geology	ESC	3	0	0	3
7	24CE331	Building Planning and Computer Aided Civil Engineering Drawing	ESC	0	0	4	2
8	24CS331	Programming For Problem Solving in Python	ESC	0	0	3	1.5
9	24CE632	Computer Aided Analysis and Design Laboratory	ESC	0	0	4	2
Professional Core Courses (PCC)							
Sl.No	**Course Code**	**Course Title**	**Course Type**	**L**	**T**	**P**	**Credit**
1	24CE201	Strength of Materials -I	PCC	3	0	0	3
2	24CE302	Building Materials and Technology	PCC	2	0	2	3
3	24CE303	Fluid Mechanics	PCC	3	0	2	4
4	24CE304	Engineering Surveying	PCC	3	0	2	4
5	24CE401	Strength of Materials-II	PCC	3	1	0	3
6	24CE402	Construction Techniques And Management	PCC	3	0	0	3
7	24CE403	Geotechnical Engineering – I	PCC	3	0	2	4
8	24CE404	Transportation Engineering	PCC	3	0	2	4
9	24CE405	Hydraulics and Hydraulic Machinery	PCC	3	0	2	4
10	24CE406	Environmental Engineering	PCC	3	0	2	4
11	24CE501	Structural Analysis	PCC	3	0	0	3
12	24CE502	Design of Reinforced Concrete Elements	PCC	3	0	0	3

13	24CE503	Geotechnical Engineering - II	PCC	3	0	2	4
14	24CE504	Concrete Technology	PCC	2	0	2	3
15	24CE601	Design of Steel Structures	PCC	3	1	0	4
16	24CE631	Environmental and Irrigation Engineering Drawing	PCC	0	0	4	2
17	24CE701	Estimation, Costing and Valuation	PCC	3	1	0	4
Professional Electives Courses (PEC)							
Sl.No	**Course Code**	**Course Title**	**Course Type**	**L**	**T**	**P**	**Credit**
Professional Elective-I- Structural Engineering							
1	24CE571	Fundamentals of Prestressed Concrete Design	PEC	3	0	0	3
2	24CE572	Prefabricated Structures	PEC	3	0	0	3
3	24CE573	Corrosion of RC Structures	PEC	3	0	0	3
4	24CE574	Advanced Design of RC Structures	PEC	3	0	0	3
5	24CE575	Repair and Rehabilitation of Structures	PEC	3	0	0	3
6	24CE576	Pre Engineered Buildings	PEC	3	0	0	3
Professional Elective-II- Environmental Engineering							
1	24CE581	Municipal Solid waste Management	PEC	3	0	0	3
2	24CE582	Industrial Waste Water Management	PEC	3	0	0	3
3	24CE583	Air And Noise Pollution Control	PEC	3	0	0	3
4	24CE584	Climate Change And Sustainable Management	PEC	3	0	0	3
5	24CE585	Solid And Hazardous Waste Management	PEC	3	0	0	3
6	24CE586	Environmental Impact Assessment	PEC	3	0	0	3
Professional Elective-III- Hydrology and Water Resources Engineering							
1	24CE671	Irrigation Engineering	PEC	3	0	0	3
2	24CE672	Ground Water Engineering	PEC	3	0	0	3
3	24CE673	Water Resources Systems Engineering	PEC	3	0	0	3
4	24CE674	Urban Water Infrastructure	PEC	3	0	0	3

5	24CE675	Hydrology And Water Resources Engineering	PEC	3	0	0	3
6	24CE676	Remote Sensing And GIS	PEC	3	0	0	3
Professional Elective-IV- Transportation Engineering and Management							
1	24CE681	Railways Airport Dock And Harbour Engineering	PEC	3	0	0	3
2	24CE682	Intelligent Transportation Systems	PEC	3	0	0	3
3	24CE683	Housing Planning And Management	PEC	3	0	0	3
4	24CE684	Bridge Engineering	PEC	3	0	0	3
5	24CE685	Traffic Engineering and Management	PEC	3	0	0	3
6	24CE686	Pavement Engineering	PEC	3	0	0	3
Professional Elective-V- Construction Techniques and Practices							
1	24CE771	Energy Efficient Buildings	PEC	3	0	0	3
2	24CE772	Building Services For Civil Engineers	PEC	3	0	0	3
3	24CE773	Smart Materials And Measuring Techniques	PEC	3	0	0	3
4	24CE774	Construction Equipment And Practices	PEC	3	0	0	3
5	24CE775	Advanced Construction Techniques	PEC	3	0	0	3
6	24CE776	Construction Safety Practices	PEC	3	0	0	3
Professional Elective-VI- Ocean Engineering							
1	24CE781	Port Harbor Engineering	PEC	3	0	0	3
2	24CE782	Off Shore Structures	PEC	3	0	0	3
3	24CE783	Coastal Engineering	PEC	3	0	0	3
4	24CE784	Coastal Zone Management And Remote Sensing	PEC	3	0	0	3
5	24CE785	Marine Geotechnical Engineering	PEC	3	0	0	3
6	24CE786	Ocean Wave Dynamics	PEC	3	0	0	3

Open Electives Courses (OEC)

Sl.No	Course Code	Course Title	Course Type	L	T	P	Credit
Open Elective-I (Artificial Intelligence and Computer science and Engineering)							
1	24AI601	Artificial Intelligence and Machine Learning Fundamentals	OEC	3	0	0	3

2	24AI602	Business Intelligence and Its Applications	OEC	3	0	0	3
3	24AI603	Data Science Fundamentals	OEC	3	0	0	3
4	24CS601	Augmented Reality /Virtual Reality	OEC	3	0	0	3
5	24CS602	Full Stack Development	OEC	3	0	0	3
6	24CS603	Software Testing and Quality Assurance	OEC	3	0	0	3
7	24CS604	Cloud Computing	OEC	3	0	0	3
Open Elective-II (Electronics and Communication and Agricultural Engineering)							
1	24AG601	Principles of Crop Production	OEC	3	0	0	3
2	24AG602	Dairy and Food Engineering	OEC	3	0	0	3
3	24AG603	Post-Harvest Technology	OEC	3	0	0	3
4	24AG604	Agricultural Finance, Banking and Co-operation	OEC	3	0	0	3
5	24EC501	Nano Electronics	OEC	3	0	0	3
6	24EC502	Digital Signal Processing	OEC	3	0	0	3
7	24EC503	Fuzzy Logic Systems and ANN	OEC	3	0	0	3
8	24EC504	Fiber Optic Sensors	OEC	3	0	0	3
Open Elective-III (Bio Medical and Electrical Engineering)							
1	24BM701	Wearable Devices	OEC	3	0	0	3
2	24BM702	Telemedicine and Healthcare Delivery	OEC	3	0	0	3
3	24BM703	Medical Informatics	OEC	3	0	0	3
4	24BM704	Basics of Human Anatomy and Physiology	OEC	3	0	0	3
5	24EE701	Robot Process Automation	OEC	3	0	0	3
6	24EE702	Electric vehicle Technology	OEC	3	0	0	3
7	24EE703	Smart Grid	OEC	3	0	0	3
8	24EE704	Energy Conservation and Management	OEC	3	0	0	3
Open Elective-IV (Mechanical and Management)							
1	24ME701	Additive Manufacturing	OEC	3	0	0	3
2	24ME702	Rocket Propulsion	OEC	3	0	0	3
3	24ME703	Industrial Safety	OEC	3	0	0	3
4	24ME704	Marine Vehicles	OEC	3	0	0	3
5	24MG701	Digital Marketing	OEC	3	0	0	3

6	24MG702	Industrial Psychology	OEC	3	0	0	3
7	24MG703	Logistics and Supply chain Management	OEC	3	0	0	3
8	24MG704	Corporate Social Responsibility	OEC	3	0	0	3
Employability Enhancement Courses (EEC)							
Sl.No	**Course Code**	**Course Title**	**Course Type**	**L**	**T**	**P**	**Credit**
1	24CE351	Mini Project – I (Introduction to Innovative Projects)	EEC	0	0	2	1
2	24CE451	Mini Project – II (Design and development of the product)	EEC	0	0	2	1
3	24EN451	Soft Skills Development	EEC	0	0	2	1
4	24CE551	Mini Project – III (Community based Project)	EEC	0	0	2	1
5	24EN631	Business and Managerial Communications	EEC	0	0	2	1
6	24GE531	Quantitative and Reasoning Skills-I	EEC	0	0	2	1
7	24CE651	Mini Project-IV (Micro Project)	EEC	0	0	2	1
8	24GE631	Quantitative And Reasoning Skills-II	EEC	0	0	2	1
9	24CE751	Project Work Phase I (Design and Analysis)	EEC	0	0	4	2
10	24CE752	Industrial Training / Internship	EEC	0	0	0	2
11	24CE851	Project Work Phase II	EEC	0	0	10	5
Mandatory Courses (MNC)							
Sl.NO	**Course Code**	**Course Title**	**Course Type**	**L**	**T**	**P**	**Credit**
1	24MC101	Induction Programming	MNC				
2	24MC201	Sports And Yoga For Youth Empowerment - I	MNC	0	0	2	0
3	24MC202	NCC Credit Course Level - I	MNC	1	0	2	1#
4	24MC301	Sports and Yoga for Youth Empowerment - II	MNC	0	0	2	0
5	24MC401	NCC Credit Course Level – II	MNC	1	0	2	1#
6	24MC601	Disaster Management	MNC	1	0	0	1#
7	24MC701	Constitutions of India	MNC	1	0	0	1#

SEMESTER - I

S. No	Course Code	Course Title	Course Category	L	T	P	C
THEORY COURSES							
1	24GE101	*தமிழர் மரபு*/Heritage of Tamils	HSS	1	0	0	1
2	24MA101	Matrix and calculus	BSC	3	1	0	4
3	24ME301	Engineering Mechanics	ESC	3	1	0	4
INTEGRATED COURSES							
4	24EN101	English For Engineers	HSS	1	0	3	2.5
5	24PH101	Engineering Physics	BSC	3	0	2	4
6	24CY101	Engineering Chemistry	BSC	3	0	2	4
7	24EE202	Fundamentals of Electrical and Electronics Engineering	ESC	3	0	2	4
MANDATORY COURSES							
8	24MC101	Induction Programming	MNC	Three Weeks			
Total				**17**	**2**	**9**	**23.5**

SEMESTER - II

S. No	Course Code	Course Title	Course Category	L	T	P	C
THEORY COURSES							
1	24GE201	*தமிழரும் தொழில்நுட்பமும்*/ Tamil and Technology	HSS	1	0	0	1
2	24MA201	Complex Variables and Transforms	BSC	4	0	0	4
3	24PH202	Applied Material Science	BSC	3	0	0	3
4	24CY401	Environmental Science and Engineering	BSC	2	0	0	2
6	24CE201	Strength of Materials- I	PCC	3	0	0	3
INTEGRATED COURSES							
6	24ME201	Engineering Graphics and Design	ESC	1	0	4	3
7	24CS201	Programming for Problem Solving in C	ESC	2	0	4	4
LABORATORY COURSES							
8	24GE231	Workshop Practices	ESC	0	0	3	1.5
9	24EN231	Presentation and Language Skills Laboratory	HSS	0	0	3	1.5
MANDATORY COURSES							
10	24MC201	Sports And Yoga For Youth Empowerment - I	MNC	0	0	2	0
11	24MC202	NCC Credit Course Level - I	MNC	1	0	2	1#
Total				**16**	**0**	**14**	**23**

பாடநெறி குறியீடு	24GE101	பாடத்தின் தலைப்பு:	தமிழர் மரபு (Common to AI& DS, AE, BME, CE, CSE, CSE (AI& ML), EEE, ECE, MECH)
கிரெடிட்	1	L – T – P	1-0-1

பாடத்திட்ட நோக்கங்கள்:

1. தமிழின் மதச்சார்பற்ற தன்மை, இந்திய மொழிக் குடும்பத்தின் திராவிட மொழி, திருக்குறளின் கருத்துக்கள், சமயங்களின் தாக்கம், நவீன இலக்கிய வளர்ச்சி ஆகியவற்றை நினைவு கூர்தல்.
2. தமிழர்களின் சமூக மற்றும் பொருளாதார வாழ்வில் நடுகல், சிற்பங்கள், சிலைகள் மற்றும் அழகிய கைவினைப் பொருட்கள், இசைக்கருவிகள் ஆகியவற்றின் தொடர்புடைய அறிவைக் கோடிட்டுக் காட்டுதல்.
3. தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகளை மனதில் பதிய வைத்தல்.
4. தமிழ்நாட்டின் தாவரங்கள் மற்றும் விலங்கினங்கள், சங்க நகரங்கள் மற்றும் துறைமுகங்கள், சங்க காலத்தின் ஏற்றுமதி மற்றும் இறக்குமதிகளை நினைவுபடுத்துதல், வெளிநாடுகளில் சோழர் படையெடுப்பைக் கண்டறிதல்.

இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கைக் கண்டறிதல், இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்குக்கு இணையாக இந்தியாவின் பிற பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கத்தை அடையாளம் காணுதல்.

அலகு I மொழி மற்றும் இலக்கியம்:	[3 hours]
இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம்- பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.	

அலகு II மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக்கலை:	[3 hours]
நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.	

அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:	[3 hours]
தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.	

அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள்:	[3 hours]
தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறைமுகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி.	

அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு:	[3 hours]
இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தங்கங்களின் அச்சு வரலாறு.	

Total : 15 Periods

பாடநெறி முடிவுகள் (பாமு):

பாடநெறியின் முடிவில், மாணவர் பின்வரும் திறன்களைப் பெறுவர்:

பாமு	**பாடநெறி முடிவுகள்**	**மிக உயர்ந்த அறிவாற்றல் நிலை**
அலகு I பாமு:	தமிழின் மதச்சார்பற்ற தன்மை, திராவிட மொழியின் பங்கு, திருக்குறளின் கருத்துக்கள், சமயங்களின் தாக்கம், நவீன இலக்கிய வளர்ச்சி ஆகியவற்றையும் தெரிந்துகொள்கிறார்கள்.	கே 1
அலகு II பாமு:	தமிழர்களின் சமூக மற்றும் பொருளாதார வாழ்வில் நடுகல், சிற்பங்கள், சிலைகள் மற்றும் அழகிய கைவினைப் பொருட்கள், இசைக்கருவிகள் ஆகியவற்றை விவரிக்கும் ஆற்றலை பெறுகிறார்கள்.	கே 2
அலகு III பாமு:	தமிழர்களின் பாரம்பரிய விளையாட்டுகளை தெரிந்து கொள்ளுவதால் விளையாட வேண்டும் ஏன்ற ஆர்வத்தை பெறுகிறார்கள்.	கே 1
அலகு IV பாமு:	தமிழ்நாட்டின் தாவரங்கள் மற்றும் விலங்கினங்கள் பற்றிய அறிவையும், சங்க கால கட்டிடக்கலை, ஏற்றுமதி மற்றும் இறக்குமதி தொழில் நுட்ப அறிவை பெறுகிறார்கள்..	கே 1
அலகு V பாமு:	இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கையும், இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு இணையாக இருப்பதையும், தெரிந்து கொள்கிறார்கள்.	கே 1

பாடநெறி முடிவுகள் மற்றும் நிரல் முடிவுகள் ஒப்பிடுதல்

பாமுகள்	மிக உயர்ந்த அறிவாற்றல் நிலை	பாடநெறி முடிவுகள்											
		1	2	3	4	5	6	7	8	9	10	11	12
பாமு1	கே 1	2	-	-	-	-	-	-	-	-	-	-	-
பாமு2	கே 2	1	-	-	-	-	-	-	-	-	-	-	-
பாமு3	கே 1	1	-	-	-	-	-	-	-	-	-	-	-
பாமு4	கே 1	1	-	-	-	-	--	-	-	-	-	-	-
பாமு5	கே 1	1	-	-	-	-	-	-	-	-	-	-	-

நிலை 3- அதிக ஒத்துப்போதல், நிலை 2- மிதமாக ஒத்துப்போதல், நிலை 1- குறைவாக ஒத்துப்போதல், நிலை 0- ஒத்துப்போகவில்லை

மதிப்பீட்டுத் திட்டம்:

கூறுகள்	மதிப்பீட்டின் வகை	அதிகபட்ச மதிப்பெண்கள்	குறைக்கப்பட்ட மதிப்பெண்கள்	இறுதி மதிப்பெண்கள்
தொடர்ச்சியான உள் தேர்வு	தொடர்ச்சியான உள் தேர்வு - I	100	40	40
	தொடர்ச்சியான உள் தேர்வு - II	100	40	
இறுதி பருவ தேர்வு	எழுத்து தேர்வு	100	60	60
மொத்தம்				100

மதிப்பீட்டு முறை

ப்ளூமின் வகை	தொடர்ச்சியான மதிப்பீட்டு சோதனைகள்		இறுதி தேர்வு
	1	**2**	
நினைவில் கொள்ளுதல்	60	50	60
புரிந்து கொள்ளுதல்	40	50	40
விண்ணப்பித்தல்	0	0	0
பகுப்பாய்வுதல்	0	0	0
மதிப்பிடுதல்	0	0	0
உருவாக்குதல்	0	0	0

இறுதி பருவ தேர்வு: (கேள்வி முறை)

- ஒவ்வொரு யூனிட்டும் இரண்டு 2 மதிப்பெண் வினாக்களையும் ஒரு 16 மதிப்பெண் வினாவையும் (இரண்டில் ஒன்று) கொண்டுள்ளது.
- பதினைந்து கேள்விகளுக்கும் பதிலளிக்க வேண்டும்

Course Code:	**24GE101**	**Course Title:**	**HERITAGE OF TAMILS (Common to AI& DS, AE, BME, CE, CSE, CSE (AI& ML), EEE, ECE, MECH)**
Credits:	**1**	**L – T – P**	**1-0-0**
Pre -requisite			**Nil**

COURSEOBJECTIVES:

- Recalling the secular nature of Tamil, the Dravidian language of the Indian language family, the ideas of Thirukkural, the influence of religions and the development of modern literature.
- To outline the relevant knowledge of Nadukal, sculptures, statues and beautiful handicrafts, musical instruments in the social and economic life of Tamils.
- Terukhoothu, Karakatam, Villuppattu, KanyanKoothu, Wailatam, DholpaVaikhuthoo, Silampattam,Valali,Puliyattam, Memorizing the games of Tamils
- Flora and fauna of TamilNadu, Sangam cities and ports, reminiscence of exports and imports of Sangam period, tracing Chola invasion abroad.
- Identify the role of Tamils in the Indian Liberation War and identify the influence of Tamil culture in other parts of India along with the role of Siddha medicine in Indian medicine.

UNIT I LANGUAGE AND LITERATURE	**[3hours]**
Language Families in India - Dravidian Languages – Tamil as a Classical Language Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land -Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry-Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.	

UNIT II HERITAGE-ROCK ART PAINTINGS TO MODERN ART SCULPTURE	**[3hours]**
Hero stone to modern sculpture-Bronze icons-Tribes and their handicrafts-Art of temple car making Massive Terracott as cultptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram-Role of Temples in Social and Economic Life of Tamils.	

UNIT III FOLK AND MARTIAL ARTS	**[3hours]**
Therukoothu, Karagattam, VilluPattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tigerdance - Sports and Games of Tamils.	

UNIT IV THINAI CONCEPT OF TAMILS	**[3hours]**
Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature –Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age- Overseas Conquest of Cholas.	

UNIT V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE	[3hours]
Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other partsof India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine –Inscriptions & Manuscripts – Print History of Tamil Books.	

Course outcomes:

On completion of the course, the student will have the ability to:

COs	Course Outcomes	Highest cognitive level
CO1	Know the secular nature of Tamil, the role of Dravidian language, the ideas of Thirukkural, the influence of religions and the development of modern literature.	K1
CO2	Understand the social and economic life of the Tamils and to describe sculptures, statues and beautiful handicrafts, musical instruments.	K2
CO3	Get the interest in playing Terukoothu, Karakatam, Villuppattu, Kanyan Koothu, Wailatam, Dholbaik Koothu, Silampattam, Valali, Tiger Actam, and splashing	K1
CO4	Acquire knowledge of TamilNadu's flora and fauna, Sangam architecture, export and import techniques.	K1
CO5	Know the role of Tamils in the Indian Liberation War and the role of Siddha medicine in Indian medicine.	K1

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	60	50	60
Understand	40	50	40
Apply	0	0	0
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

COsand POs Mapping

COs	Highest Cognitive Level	POs											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	K1	**2**	-	-	-	-	-	-	-	-	-	-	-
CO2	K2	**1**	-	-	-	-	-	-	-	-	-	-	-
CO3	K1	**1**	-	-	-	-	-	-	-	-	-	-	-
CO4	K1	**1**	-	-	-	-	--	-	-	-	-	-	-
CO5	K1	**1**	-	-	-	-	-	-	-	-	-	-	-

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Final marks
Continuous Internal Examination (CIE)	CIE– I	100	40	40
	CIE–II	100	40	
End Semester Examination (ESE)	Theory Exam	100	60	60
Total				100

End semester Examination:(QP PATTERN)

- Each unit consists of two 2 marks questions and one16marks question(either or).
- All the fifteen questions have to be answered.

TEXT BOOKS

1. .தமிழகவரலாறு - மக்களும்பண்பாடும் - கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்).
2. கணினித்தமிழ் - முனைவர்இல. சுந்தரம். (விகடன்பிரசுரம்).
3. கீழடி - வைகைநதிக்கரையில்சங்ககாலநகரநாகரிகம் (தொல்லியல்துறைவெளியீடு)
4. பொருநை - ஆற்றங்கரைநாகரிகம். (தொல்லியல்துறைவெளியீடு)
5. SocialLifeofTamils(Dr.K.K.Pillay)AjointpublicationofTNTB&ESCandRMRL–(inprint)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.

REFERENCEBOOKS

1.Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by:International Institute of Tamil Studies).

2.The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)

3.Keeladi-‘SangamCityCivilizationonthebanksofriverVaigai’(JointlyPublishedby:Department Of Archaeology &Tamil Nadu Text Book and Educational Services Corporation, TamilNadu)

4.Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)

5.Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, TamilNadu)

6.JourneyofCivilizationIndustoVaigai(R.Balakrishnan)(Publishedby:RMRL)–ReferenceBook

Course Code:	**24MA101**	**Course Title:**	**MATRICES AND CALCULUS (Common to AI& DS, AE, BME, CE, CSE, CSE (AI& ML), EEE, ECE, MECH)**
Credits:	**4**	**L – T – P**	**3 – 1 – 0**
Pre -requisite			**Nil**

Course objectives:

- To provide the basic tools of calculus mainly for the purpose of modeling the engineering problems mathematically and obtaining solutions.
- To learn the concept of eigenvalues and eigenvectors and to reduce the quadratic form to canonical form.
- To learn the foundation course of Single Variable and multivariable calculus plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

Teaching-Learning Process:

These are sample strategies which teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method does not mean only traditional method, but different type of teaching methods may be adopted to develop the outcomes.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Topics will be introduced in a multiple representation and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT I – MATRICES	**[12 hours]**
Eigenvalues and Eigenvectors and their properties – Diagonalization of a matrix (Symmetric matrix) – Cayley - Hamilton theorem (without proof) – Inverse and Power of a matrix by Cayley - Hamilton theorem – Quadratic forms and Nature of quadratic forms. Application: Reduction of a quadratic form to canonical form by orthogonal transformation.	

UNIT II – Differential Calculus	**[12 hours]**
Functions – Limit – Continuity – Derivatives – Differentiation rule – Product and quotient rules – Chain rules – Implicit differentiation – Logarithmic differentiation. Application: Maxima and Minima of functions of one variable	

UNIT III – FUNCTIONS OF SEVERAL VARIABLES	[12 hours]
Partial differentiation – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables. Application: Maxima and Minima of functions of two variables using MATLAB - Lagrange's method of undetermined multipliers.	

UNIT IV – Integral Calculus	[12 hours]
Definite and Indefinite integrals - Substitution rule - Techniques of Integration: Bernoulli's theorem (without proof) – Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals. Application: Area between simple closed curves.	

UNIT V – Multiple Integrals	[12 hours]
Double integrals –Double integrals in cartesian and polar coordinates – Change of order of integration– Area enclosed by plane curves – Triple integrals – Change of variables in double and triple integrals.	
Application: Volume of solids, Mass of Lamina	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Apply the matrix algebraic techniques for eigen value related applications
CO2	Understand the concepts of limit and continuity of functions
CO3	Compute the derivatives and the extreme points and solve engineering problems
CO4	Use the partial derivatives and the maxima and minima of multivariable functions
CO5	Use fundamental theorem of calculus to evaluate definite integrals
CO6	Apply the concepts of multiple integrals to find the areas and volumes of geometrical shapes

COs and POs Mapping:

COs	**POs**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	2	1		2							2
CO2	2	1	1									1
CO3	3	2	1		2							
CO4	3	2	1									
CO5	3	2	1									
CO6	3	2	1		1							1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	20	20	20
Understand	40	40	20
Apply	40	60	60
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
3. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 8th

Edition, New Delhi, 2015. [For Units II & IV - Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8]

Reference Books:

1. Muthusubramanian R and Salivahanan S, “Basic Electrical and Electronics Engineering,” McGraw Anton. H, Bivens. I and Davis. S, " Calculus ", Wiley, 10th Edition, 2016
2. Bali. N., Goyal. M. and Watkins. C., “Advanced Engineering Mathematics”, Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
3. Jain. R.K. and Iyengar. S.R.K., “Advanced Engineering Mathematics”, Narosa Publications, New Delhi, 5th Edition, 2016.
4. Narayanan. S. and Manicavachagom Pillai. T. K., “Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.
5. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.Hill, NewDelhi, 2009.

Equivalent NPTEL/SWAYAM Courses

S. No.	Course Title	Course Instructor	Host Institute
1	Matrix Analysis with Applications	Prof. S. K. Gupta Prof. Sanjeev Kumar	IIT Roorkee
2	Calculus of One Real Variable	Prof. Joydeep Dutta	IIT Kanpur

Web Links and Video Lectures (E-Resources):

1. System of Linear Equations, Eigenvalues and Eigenvectors: https://www.nptelvideos.com/lecture.php?id=13416
2. Concept of Domain, Limit, Continuity and Differentiability: https://www.nptelvideos.com/lecture.php?id=13422
3. Matrix Diagonalization: https://www.nptelvideos.com/lecture.php?id=13481

Course Code:	24ME301	Course Title:	ENGINEERING MECHANICS (Common for Agri ,Civil and Mechanical)
Credits:	4	L – T – P	3-1-0
Pre -requisite			Nil

Course objectives: To impart knowledge on the • To Learn the use scalar and vector analytical techniques for analysing forces in statically determinate structures • To introduce the equilibrium of rigid bodies, vector methods and free body diagram • To study and understand the properties of surfaces and solids. • To learn the principles of friction, forces and apply the concepts of frictional forces at the contact surfaces of various engineering systems. • To develop basic dynamics concepts – force, momentum, work and energy
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. Lab experiment videos 3. Blended Mode of Learning 4. Project based Learning 5. Experiential Learning 6. NPTEL and Other Videos 7. Smart Class Room 8. Flipped Class

UNIT I – STATICS OF PARTICLES	[9+3 hours]
Fundamental Concepts and Principles, Systems of Units, Method of Problem Solutions, Statics of Particles - Forces in a Plane, Resultant of Forces, Resolution of a Force into Components, Rectangular Components of a Force, Unit Vectors. Equilibrium of a Particle- Newton’s First Law of Motion, Space and Free-Body Diagrams.	

UNIT II – EQUILIBRIUM OF RIGID BODIES	[9+3 hours]
Principle of Transmissibility, Equivalent Forces, Vector Product of Two Vectors, Moment of a Force about a Point, Varignon’s Theorem, Rectangular Components of the Moment of a Force, Distributed Loads on Beams, Moment of a Force about an Axis, Couple - Moment of a Couple, Equivalent Couples, Addition of Couples, Resolution of a Given Force into a Force -Couple system, Further Reduction of a System of Forces, Equilibrium in Two Dimensions - Reactions at Supports.	

UNIT III – PROPERTIES OF SURFACES AND SOLIDS	[9+3 hours]
Centroids of lines and areas – symmetrical and unsymmetrical shapes, Determination of Centroids by Integration, Theorems of Pappus- Guldinus, Centre of Gravity of a Three-Dimensional Body, Moments of Inertia of Areas and Mass - Determination of the Moment of Inertia of an Area by Integration, Polar Moment of Inertia, Radius of Gyration of an Area, Parallel-Axis Theorem, Moments of Inertia of Composite Areas, Moments of Inertia of a Mass - Moments of Inertia of Thin Plates.	

UNIT IV – FRICTION	[9+3 hours]
The Laws of Dry Friction, Coefficients of Friction, Angles of Friction, Wedge friction, Wheel Friction, Rolling Resistance, Ladder friction, Belt friction.	

UNIT V – DYNAMICS OF PARTICLES	[9+3 hours]
Kinematics - Rectilinear Motion and Curvilinear Motion of Particles. Kinetics- Newton's Second Law of Motion-Equations of Motions, Dynamic Equilibrium, Energy and Momentum Methods - Work of a Force, Kinetic Energy of a Particle, Principle of Work and Energy, Principle of Impulse and Momentum, Impact of bodies.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Illustrate the vector and scalar representation of forces and moments.
CO2	Analyse the rigid body in equilibrium.
CO3	Understand the properties of surfaces and solids.
CO4	Apply the friction and its effects by the laws of friction
CO5	Calculate dynamic forces exerted in rigid body.

COs and POs Mapping:

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	3	2	1	1	-	-	-	-	-	-	3
CO2	3	3	2	1	1	-	-	-	-	-	-	3
CO3	3	3	3	1	1	-	-	-	-	-	-	3
CO4	3	3	3	1	1	-	-	-	-	-	-	3
CO5	3	3	3	1	1	-	-	-	-	-	-	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final marks</th></tr>
<tr><td rowspan="5">Continuous Internal Examination (CIE) - Theory</td><td>CIE – I</td><td>100</td><td rowspan="2">50</td><td rowspan="5">100</td><td rowspan="5">40</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>MCQ</td><td>20</td><td>10</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td>End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>60</td><td>60</td><td>60</td></tr>
<tr><td colspan="5" align="right">Total</td><td>100</td></tr>
</table>

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	40	40	40
Apply	40	40	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Beer Ferdinand P, Russel Johnston Jr., David F Mazurek, Philip J Cornwell, Sanjeev Sanghi, Vector Mechanics for Engineers: Statics and Dynamics, McGraw Higher Education., 12thEdition, 2019.
2. Vela Murali, "Engineering Mechanics-Statics and Dynamics", Oxford University Press, 2018.
3. Kottiswaran N "Engineering Mechanics-Statics and Dynamics", Pearson Education, 2018.

Reference Books:

1. Boresi P and Schmidt J, Engineering Mechanics: Statics and Dynamics, 1/e, Cengage learning, 2008.

2. Hibbeller, R.C., Engineering Mechanics: Statics, and Engineering Mechanics: Dynamics, 13th edition, Prentice Hall, 2013.
3. Irving H. Shames, Krishna Mohana Rao G, Engineering Mechanics – Statics and Dynamics, 4thEdition, Pearson Education Asia Pvt. Ltd., 2005.
4. Meriam J L and Kraige L G, Engineering Mechanics: Statics and Engineering Mechanics: Dynamics, 7th edition, Wiley student edition, 2013.
5. Timoshenko S, Young D H, Rao J V and SukumarPati, Engineering Mechanics, 5thEdition, McGraw Hill Higher Education, 2013.
6. Bansal R K., Engineering Mechanics-Statics and Dynamics, Revised 7th Edition, Laxmi Publications.

Web Links and Video Lectures (E-Resources):

1. NPTEL: Engineering Mechanics https://archive.nptel.ac.in/courses/112/106/112106286/
2. https://www.iitg.ac.in/rkbc/me101/Presentation/L16-18.pdf

Suggested Skill Activities:

1. Force analysis on any stationary object
2. Force analysis of structures and structural components
3. Determination of centre of gravity of composite surfaces
4. Building different types of slopes for frictional applications
5. Force analysis on any moving object

Course Code:	**24EN101**	**Course Title:**	**ENGLISH FOR ENGINEERS [Common to AI&DS, AE,BME,CE,CSE,CSE(AI& ML),EEE, ECE,MECH]**
Credits:	**2.5**	**L – T – P**	**2-0-1**
Pre -requisite			**Nil**

Course Objectives:

1. To develop an understanding of Basic English Grammar.
2. To enhance listening skills and select appropriate responses.
3. To practise presentation and speaking techniques.
4. To develop a quest for reading.
5. To practise professional writing.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Language learning softwares / Language Lab
3. Online Resources
4. Smart Class Room
5. Flipped classrooms
6. Project based Collaborative Experiential learning
7. Expert Lecture sessions

UNIT I - BASIC GRAMMAR- VOCABULARY AND EXPRESSIONS	**[8 hours]**
Grammar: Parts of speech - Types of sentences: Assertive - Imperative - Interrogative & Exclamatory - Affirmative - Negative - Gerunds & Infinitives - Tenses - Voices- Impersonal passives- Prepositions- Articles & Determiners- Cause and effect expressions - Vocabulary: Affixes- Synonyms & Antonyms - Homonyms - Homophones- Compound Nouns.	

UNIT II - ACTIVE LISTENING - RESPONDING		**[15 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	**Topic**	**Hours**
1.	Listening to Audio (Podcasts- Audiobooks- Radio Program) and Practice Exercise-Answering Cloze Test Based on Listening	3
2.	Listening to native speaker’s Telephone Conversations– Analyzing a Product	3
3.	Listening to Job Interviews - Sports Commentaries / Animated stories / Anecdotes / Event narration	3

4.	Video Comprehension – Brainstorming and Note-Taking	3
CLASSROOM ACTIVITIES		
1.	Listening to Statistical Information and Follow-up Exercises. - Form Filling Exercises	1
2.	Debate and reviewing the performance of each participant - Panel Discussion	2

UNIT III: SPEAKING AND PRESENTATION SKILLS		**[15 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	**Topic**	**Hours**
1.	Speaking Development through English software S-net or Globarena and Online Content (Tenses- Voices- SV Agreement- Prepositions- Coherence Markers- Relative Clauses- Modals- Punctuation)	5
CLASSROOM ACTIVITIES		
1.	Self-Introduction - Sharing Childhood Experiences- Talking about Favorite Personalities	1
2.	Describing Recent Innovation in Technology	1
3.	Interviewing Celebrities and Entrepreneurs	1
4.	Situational Conversations (Meeting a friend in a cafe) - Narrating Personal Experience	1
5.	Group Communication- Discussing Social Issues- Current Affairs and Debate	1
6.	Role-Play- Picture/Movie Description	1
7.	Presentation – I (Book /Movie Review- Story Telling- General Presentations)	2
8.	Presentation – II (Technical Presentations)	2

UNIT IV: READING BETWEEN LINES		**[12 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	**Topic**	**Hours**
1.	Reading Comprehension - skimming - scanning (General / Technical passages	2
2.	Reading Longer Texts with Time Frame	2
3.	Reading Data using different types of Texts- Magazines and Internet Materials	2
4.	Reading Research Papers-- Editing/Proofreading	2
CLASSROOM ACTIVITIES		
1.	Job Advertisements – Manual for Product/Service – Telephone Phrases	1

2.	Reading Cause and Effect Essays-Technical Papers and Case Studies - Sorting out jumbled Sentences in a Paragraph	2
3.	Short Stories - Critical Reading	1

LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	**Topic**	**Hours**
1.	Mind Mapping and Brainstorming on any Social Event/Issue	1
2.	Creating a Blog/Vlog/YouTube Channel –Uploading MP3/MP4 – Practice (Movie/Book/ Gadget Review- General/Tech Talks- Interview with Celebrities)	1
3.	Creating a Product Review Blog.	1

UNIT V- WRITING FOR ENGINEERS	**[7+3 hours]**
Writing - Application Letters - Resume- Product Description - Essay related to Technical / Social / current topics - Interpretation of Charts - Short Articles on everyday life - letters – Enquiry- Quotation- Order- Claim - Adjustment - Response to complaints - Statement of Purpose (SoP) -Emails - Memos -Notices - Circulars - Minutes of Meetings - Internship - Accident Report - Feasibility Report-Recommendations.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Identify various grammatical components- build vocabulary and apply expressions for error-free sentences	K3
CO2	Make use of appropriate words to respond by listening to general and technical online contents	K3
CO3	Experiment with the nuances of presentation and speaking skills	K3
CO4	Apply reading skills in various academic contexts	K3
CO5	Construct legible and flawless sentences proficiently with appropriate choice of words and structures for varied professional contexts	K3

COs and POs Mapping:

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1										3		3
CO2										3		3
CO3										3		3
CO4										3		3
CO5										3		3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max. Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE) - **Theory**	CIE – I	100	60	100	25
	CIE – II	100			
	Skill Assessment – I (2 Assignments + 1 seminar)	40	40		
	Skill Assessment – II (3Assignments)	40			
Continuous Internal Examination (CIE) - **Laboratory**	Continuous Assessment (Lab activities & exercises)	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**Terminal Examination**
	1	**2**	
Remember	10	10	10
Understand	30	30	30
Apply	60	60	60
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Gangalakshmi- C- Rathika- B- Saranraj- L. Professional English for Engineers. New Delhi: Cengage- 2022.
2. Murphy- Raymond. English Grammar in Use Book with Answers: A Self-study Reference and Practice Book for Intermediate Learners of English. Fourth Edition: Cambridge University Press- 2012.

Reference Books:

1. Raman- Meenakshi and Sangeetha Sharma. Communication Skills. New Delhi: OUP- 2018
2. R. C. Sharma_Krishna Mohan - Business Correspondence and Report Writing _ a Practical Approach to Business _ Technical Communication-Mc Graw Hill India (2017)

Web Links and Video Lectures (E-Resources):

MANUALS / SOFTWARE: Open Sources / British Council / Cambridge Websites

Suggested Skill Activities:

1) Listening tests materials [Select podcasts / radio programmes / YouTube videos / audiobooks / materials from British Council] - Cloze tests where students fill in missing words from transcripts – Yes or No Question Answers – one-word answers based on recording – summary of recording
2) Self-introduction / Introduce Colleague
3) Just a Minute talks
4) Extempore
5) Mock GDs
6) Mock Interviews
7) Note Taking of Engineering Lectures
8) Create videos / blogs
9) Present Technical Papers
10) Reading Comprehension Exercises
11) Writing letters – Leave letter – Letter for academic purposes
12) Writing Essays
13) Composing Mails
14) Preparing Statement of Purpose
15) Preparing Covering letter and Resume

Course Code:	**24PH101**	**Course Title:**	**ENGINEERING PHYSICS (Common to ALL Branches)**
Credits:	**4**	**L – T – P**	**3-0-2**
Pre -requisite			**Nil**

COURSE OBJECTIVES

- To make the students effectively to achieve an understanding of Mechanics
- To enable the students to gain knowledge of Elasticity.
- To enable the students to gain knowledge of Maxwell's Equation and Electromagnetic waves.
- To introduce the basics of optics and lasers.
- Equipping the students to be successfully understand the importance of quantum physics.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT- I MECHANICS	**[9 hours]**
Multiparticle dynamics: Center of mass (CM) – Rotation of rigid bodies: Rotational kinematics – Rotational kinetic energy and moment of inertia - Theorems of M .I –M.I of Uniform rod-M.I of a diatomic molecule - Torque– Rotational energy state of a rigid diatomic molecule - Gyroscope – Torsional stress and deformation-Torsional pendulum-Double pendulum.	

Practical Topics: 1. Torsional pendulum – Determination of rigidity modulus of wire and moment ofinertia of disc. 2. Compound pendulum – Determination of rigidity modulus

UNIT- II ELASTICITY	[9 hours]
Elasticity – Factors affecting Elasticity –Different types of Modulus- Moduli of elasticity and its relation -Stress - strain diagram and its applications - Bending of beams - Bending moment – Cantilever - Young's modulus : Uniform & Non-uniform bending-theory and experiment-I Shaped Girders.	
Practical Topics: 1. Determination of Young's modulus of a given material- Non uniform bending method 2. Uniform bending – Young's modulus determination.	

UNIT- III MAXWELL'S EQUATIONS AND ELECTROMAGNETIC WAVES	[9 hours]
The Maxwell's equations - wave equation- Plane electromagnetic waves in vacuum - properties of electromagnetic waves - Producing electromagnetic waves - Energy and momentum in EM waves - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium vacuum interface for normal incidence..	
Practical Topics: 1. Spectrometer – Determination of wavelength of Hg spectrum using grating. 2. Spectrometer – Angle of the prism 3. Spectrometer – Dispersive power of the prism	

UNIT- IV LASERS &FIBER OPTICS	[9 hours]
Lasers:-Einstein coefficients and their relations –-characteristics of laser - Types of Laser - Nd-YAG laser -semiconductor laser- Applications -Industrial, Medical, laser based military weapons Fiber optics: principle and classification of optical fibers – propagation of light in optical fiber - Numerical aperture and Acceptance angle– Fiber optic communication system - Applications - Displacement and pressure sensors – Endoscopy	
Practical Topics: 1. Determination the acceptance angle and numerical aperture of the given optical fiber. 2. Determination of the particle size of the given powder using laser 3. Determination of wavelength of a given laser source - Grating method	

UNIT-V QUANTUM MECHANICS	**[9 hours]**
Photons and light waves - Electrons and matter waves- Dual Nature of Light –-De Broglie Waves-Compton effect - The Schrodinger equation (Time dependent and time independent forms) - Physical Significance of wave function - Normalization –Free particle - particle in a infinite potential well: 1D,2D and 3D Boxes- Normalization-quantum computation.	
Practical Topics: 1, Young's Double Slit Experiment to demonstrate the wave nature of particles	

Laboratory component: **(30 Hours)**

Any ten experiments have to be completed from the following list ofExperiments

Sl. No	Name of the experiment
1.	Apply parallel axis theorem to find the resultant of system of concurrent coplanar forces.
2.	Torsional pendulum – Determination of rigidity modulus of wire and moment of inertia of disc
3.	Compound pendulum- Determination of moment of inertia of a rigid rod.
4.	Apply the concept of bending of beams to find the Young's modulus of a given material- by Non uniform bending method
5.	Apply the concept of bending of beams to find the Young's modulus of a given material- by Uniform bending method.
6.	Determination of V-I characteristics of a solar cell.
7.	Using Ohm's law verify the laws of resistances .
8.	Using optical fiber find the acceptance angle and numerical aperture.
9.	Make use of the laser source find the particle size of the given powder.
10.	Determination of wavelength of a given laser source - Grating method
11.	Spectrometer – Determination of wavelength of Hg spectrum using grating
12.	Spectrometer – Dispersive power of the prism
13.	Determination of magnetic Induction due to long current carrying conductor.
14.	Make use of the Young's Double Slit Experiment, demonstrate the wave nature of particles.
15.	Spectrometer – Angle of the prism

Course outcomes: On completion of the course, the student will have the ability to:

CO No	Corse Outcomes	Level
CO1	Apply the concepts of Mechanics in materials.	K3
CO2	Apply the concept of elasticity in beams.	K3
CO3	Apply the concept of electromagnetic waves in communication.	K3
CO4	Illustrate the applications of different lasers &Calculate the acceptance angle and numerical aperture of an optical fiber .	K2
CO5	Explain the quantum concepts and quantum computation.	K2

COs and POs Mapping

COs	POs										
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2	2	-			-	-	-	-	-	1
CO2	3	2	2	-	1		-	-	-	-	-	1
CO3	3	2	2	-	1	1	-	-	-	-	-	1
CO 4	3	1	1	-	1	1	-	-	-	-	-	1
CO 5	3	1	1	-			-	-	-	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped

Scheme of Evaluation

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	60	100	25
	CIE – II	100			
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

TEXT BOOKS:

1. D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw Hill Education (Indian Edition), 2017.
2. E.M.Purcell and D.J.Morin, Electricity and Magnetism, Cambridge Univ.Press, 2013.
3. Bhattacharya, D.K. & Poonam, T. "Engineering Physics". Oxford University Press, 2015

REFERENCES:

1. R.Wolfson. Essential University Physics. Volume 1 & 2. Pearson Education (Indian Edition),2009.
2. Paul A. Tipler, Physic – Volume 1 & 2, CBS, (Indian Edition), 2004.
3. K.Thyagarajan and A.Ghatak. Lasers: Fundamentals and Applications, LaxmiPublications,(Indian Edition), 2019.
4. D.Halliday, R.Resnick and J.Walker. Principles of Physics, Wiley (Indian Edition), 2015.

NPTEL COURSE:

Sl.No	Course Name	Course Instructor	Course Conducting Agency
1	Quantum Mechanics	Prof .P.Ramadevi	IIT -Bombay

Web links and Video Lectures (e-Resources):

ELASTICITY

https://youtu.be/eICv1p8WjgI?si=88hhiQw_fld7ZrBU

MAXWELL'S EQUATIONS AND ELECTROMAGNETIC WAVES

https://youtu.be/3IPVZYf7C-U?si=PnP1nupcfGfr1C76

LASERS &FIBER OPTICS

https://youtu.be/Ab1nxxkgjH8?si=KR2GS8iBUFayBwd

pQUANTUM MECHANICS

https://youtu.be/AEedn_NiWN0?si=Y27pAqawlwKmthNO

Skill Assessment:

1. Explain the concept behind the balance a water bottle on a edge.
2. The leaning Tower of Pisa is able to stand tilted without toppling, what is the reason behind it.
3. Apply the elasticity concept to find the fatigue change in plastic fiber and natural fiber
4. Radio antennas emit visible light, Why?
5. What does an opaque substance do when light rays fall on it.
6. Illustrate the things happen when light falls on a piece of black paper.
7. Explain the dual nature of matter.
8. Optical Fiber is used in hard to reach places in mechanical inspection explain it.
9. Is quantum communication faster than the speed of light?
10. Compare electron microscope & tunneling microscope.

Course Code	**24CY101**	**Cours eTitle:**	**ENGINEERING CHEMISTRY (Common to ALL Branches)**
Credits:	**4**	**L – T – P**	**3-0-2**
Pre -requisite			**Nil**

Course objectives:

- To provide a comprehensive understanding of water quality parameters, water treatmenttechniques and wastewater systems.
- To use the fundamental science and engineering principles relevant to materials that includescharacterization, properties and processing of engineering materials.
- To familiarize with the principles, working and applications of electrochemistry and storagedevices for safe, effective and efficient operations.
- To study, measure, monitor, control and prevent corrosion processes, economically andsafely.
- To classify different types of fuel and fuel analysis techniques that assists to choose mostconvenient fuel for a process involving combustion.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Blended Mode of Learning
3. Experiential Learning
4. NPTEL and Other Videos for theory topics
5. Flipped Class
6. Lab Experiment Videos

UNIT-1 WATER TREATMENT	**[9 hours]**
Water Sources- Water Quality parameters - Hardness of water – types-units and calcium carbonate equivalent. -Determination of hardness of water by EDTA method. Scale and sludge, caustic embrittlement, priming and foaming and boiler corrosion. Water softening methods – internal and external conditioning –zeolite process and ion exchange process. Desalination – reverse osmosis andelectro dialysis- Municipal water treatment and waste water treatment process.	

Practical Topics:

1. Determination of total hardness by EDTA method.
2. Estimation of alkalinity by Indicator method.
3. Estimation of chlorine content in water sample by Argentometric method.
4. Determination of BOD in water samples.

UNIT-2 CHEMISTRY OF ENGINEERING MATERIALS	[9 hours]
Adhesives: Introduction- requisites of a good adhesive-adhesive action-industrial applications of adhesives. **Insulating Materials**: Introduction- requirements- Glass and ceramics - preparation, properties andapplications - fabrication of ceramic ware. **Lubricants-**Classification of lubricants with examples-characteristics of a good lubricants - mechanism of lubrication (thick film, thin film and extreme pressure) - properties of lubricants: viscosity, cloud point, pour point, flash point and fire point**.** **Electronic materials:** Introduction-types, properties and applications of semiconducting materials and transistors, materials used in IC's, fibers and cables- properties and applications, organic solar cells - types and applications.	
Practical Topics: 1. Determination of viscosity of oils using Oswald viscometer. 2. Determination of cloud point and pour point of oils.	

UNIT-3 ELECTROCHEMISTRY	[9 hours]
Introduction – Electrode potential – Nernst equation and problems - Electrochemical series - Conductometric titrations (acid - base & precipitation titration) **Electrodes:** Construction, working and applications of Standard and reference electrode (Hydrogen & Calomel) – Ion selective (glass electrode) – determination of pH using glass electrode. Batteries and Fuel Cells – Types of batteries —dry cell -Lead Storage battery–Nickel-Cadmium Battery – Lithium battery – Battery hazards - Biological Batteries. Fuel Cells – Hydrogen-Oxygen FuelCell.	
Practical Topics: 1. Estimation of strength of hydrochloric acid by pHmetry. 2. Determination of strength of acids in a mixture of acids using conductivity meter. 3. Determination of charging and discharging rate of batteries.	

UNIT-4 CORROSION AND ITS CONTROL	[9 hours]
Corrosion – causes, factors, types, Chemical and Electrochemical Corrosion (Galvanic, Differential aeration) –galvanic series-factors influencing rate of corrosion-measurement of corrosion. Determination of corrosion rate by weight loss method. Control Methods-Electrochemical protection – Sacrificial Anodic method – Impressed Current Cathodic Protection – Corrosion Inhibitors – Bio corrosion Protective Coatings – Paints, Constituents, Functions- Surface coating - Surface preparation for metallic coatings, Electroplating and Electro-lessPlating- ceramic coatings, thermal vaporization coating, HVOF coating	
Practical Topics: 1. Estimation of the Ferrous ions in mild steel by Spectrophotometry. 2. Determination of rate of corrosion of by weight loss method	

UNIT-5 FUELS AND COMBUSTION	[9 hours]
Fuels: Introduction: Classification of fuels; solid fuel -Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Liquid fuels -Manufacture of synthetic petrol –hydrogenation of coal (Bergius process), Knocking – octane number, diesel oil – cetane number; Power alcohol and biodiesel. Combustion of fuels: Introduction: Calorific value – higher and lower calorific values, Theoretical calculation of calorific value by Dulong's formula - Ignition temperature: spontaneous ignition temperature, Explosive range; Flue gas analysis – ORSAT Method.	
Practical Topics: 1. Determination of flash point and fire point of fuels. 2. Determination of charging and discharging rate of batteries.	

Laboratory component: **[30 hours]**

Any ten experiments have to be completed from the following list of experiments

Sl.No.	Name of the experiment
1	Determine the total hardness of water sample by EDTA method.
2	Analyze the alkalinity of water sample by Indicator method.
3	Analyze the chlorine content in water sample by Argentometric method.
4	Determine the BOD of water samples.
5	Describe the procedure to determine the viscosity of oil using an Oswald viscometer.
6	Identify the cloud point and pour point of oils.
7	Make use of glass electrode to determine the strength of hydrochloric acid.
8	Make use of conductivity meter to determine the strength of acids in a mixture of acids.
9	Determine quantitatively the amount of Ferrous ions in mild steel by Spectrophotometry.
10	Determine the of rate of corrosion of by weight loss method.
11	Describe the procedure to determine the flash point and fire point of fuels.
12	Conduct a study to find out the charging and discharging rate of batteries.

Course outcomes: On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest cognitive level
CO1	Analyze the water quality parameters and choose appropriate water treatment methods for use in industries and daily life.	K4
CO2	Make use of the applications of the materials in different engineering disciplines.	K3
CO3	Utilize the principles of electrochemistry and find the materials for energyconversion and storage.	K4
CO4	Determine the corrosion rate to propose suitable protection methods for environmental considerations	K3
CO5	Choose suitable fuels for engineering processes and automobile applications.	K3

COs and POs Mapping

COs	Highest Cognitive Level	POs											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	K4	2	2				1						
CO2	K3	2	1										
CO3	K4	2	1										
CO4	K3	2	2	1			2	2					
CO5	K3	2	1										

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	10	10	10
Understand	30	30	30
Apply	40	40	40
Analyze	20	20	20
Evaluate	0	0	0
Create	0	0	0

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	60	100	25
	CIE – II	100			
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	**100**

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Jain P.C. and Jain M, Engineering Chemistry, Dhanpat Rai Publishing Company, New Delhi, 17th Edition,2021.
2. Dara S S and Umare S.S, A Text Book of Engineering Chemistry, S.Chand & Company Limited, 20thEdition, 2018.

Reference Books:

1. Benjamin M. M, Water Chemistry, Waveland Press, 2nd Edition, 2019.
2. Cicek V, Corrosion Engineering, Springer Publishing, 1st Edition, 2021.
3. Shahinpoor. M, Fundamentals of Smart Materials, Publisher: Royal Society of Chemistry, 1st Edition,2020.
4. Berg H, Bernhardsson S, and Johansson P, Electric Vehicle Batteries: Moving from Research towardsInnovation, Publisher: Springer, 1st Edition, 2019.
5. B.K.Sharma "Engineering chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2014).

Web links and Video Lectures (e-Resources):

1. Water and wastewater treatment - https://onlinecourses.nptel.ac.in/noc23_ce12/preview
2. SemiconductorDevices and circuits. - https://nptel.ac.in/courses/108108112
3. Corrosion ProtectionMethods - https://onlinecourses.nptel.ac.in/noc23_mm01/preview
4. Elementary Electrochemistry - https://onlinecourses.nptel.ac.in/noc23_cy19/preview
5. Fuel and combustionTechnology - https://archive.nptel.ac.in/courses/103/105/103105110/

Suggested Skill Activities:

1. Measure the TDS, PH & electrical conductivity of a home water.
2. Removal of temporary hardness of any water sample by suitable method.

3. Find the charging and discharging rate of mobile batteries when it is use or not.
4. The need of engineering material is essential in our day today life. - Justify the answer.
5. Measure the corrosion rate of iron bar when it is exposed in the environment.
6. List out the recent engineering materials used in emerging field.
7. Calculate the higher and lower calorific value of a fuel by using Dulong's formula.
8. List out the type of coatings applied on materials which are used in our daily life.
9. Improper disposal of batteries leads to environmental hazard. Suggest the suitable disposable method.
10. Pure Iron material undergo corrosion more fast than other materials. Give reasons.

Course Code:	**24EE202**	**Course Title:**	**FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING**
Credits:	**4**	**L – T – P**	**3-0-2**
Pre -requisite			**Nil**

Course objectives:

To impart knowledge on the

- Basics of DC electric circuits and its analysis
- Analysis of AC circuits and magnetic circuits
- Working principles and application of DC machines and transformers
- Digital devices and their characteristics
- Functional elements and working of sensors and actuators used for smart systems.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I –DC CIRCUITS	[9 hours]
Introduction to DC Circuits – Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws –Nodal Analysis, Mesh analysis with independent sources only – Appliances.	
Practical Topics: 1. Model an electrical circuit and simulate it to verify Ohms Law. 2. Model an electrical circuit and simulate it to verify Kirchhoff's Voltage Law. 3. Model an electrical circuit and simulate it to verify Kirchhoff's Current Law.	

UNIT II – AC CIRCUITS AND MAGNETIC CIRCUITS	[9 hours]
Introduction to poly-phase circuits - Representation of sinusoidal waveform – peak and rms values, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations – Converters: rectifiers and inverters; Basics of magnetic circuits – Flux – Flux density – Magnetic resonance – Self-inductance – mutual-inductance – Coupling.	
Practical Topics: 1. Demonstrate the measurement of power in an RLC circuit using wattmeter method. 2. Interpret the DC output of an RLC circuit using half wave rectifier. 3. Interpret the DC output of an RLC circuit using full wave rectifier.	

UNIT III – DC MACHINES AND TRANSFORMERS	[9 hours]
Construction, principle of operation, characteristic and application – DC Motor and DC Generator, Types of DC motors and generators – Application: Electric Vehicle – Structure of electric power system – Introduction to single phase transformers – Construction, principle of operation, characteristics and application.	
Practical Topics: 1. Conduct the load test on DC shunt motor to outline its characteristics. 2. Outline the study on the starting methods of DC series motor. 3. Conduct a study on transformer construction for real-time applications.	

UNIT IV – DIGITAL ELECTRONICS	[9 hours]
Introduction to digital systems – Number system – Boolean Algebra – POS and SOP – Logic gates – K-map simplification – Flip Flops – Combinational logic circuits: adders – subtractors.	
Practical Topics: 1. Experiment with the logic gates to verify its truth table. 2. Make use of the logic gates to verify the functioning of half and full adders. 3. Make use of the logic gates to verify the functioning of half and full subtractors.	

UNIT V – SENSORS AND ITS APPLICATIONS	[9 hours]
Sensors in IoT – Mobile based sensors, Resistance Temperature sensor, Humidity sensor –Medical sensor – Neural sensor – Motion sensor – PIR sensor, Piezoelectric sensor, Air quality sensor – CO_2 Sensor, RFID sensor, Water leakage detection	

sensor, Light sensors - Introduction to actuators in automation – Applications: smart homes – smart cities – smart parking system.
Practical Topics: 1. Utilize Arduino and Bluetooth module for automating home appliances. 2. UtilizeESP8266 processorfor automating home appliances. 3. Construct an Arduino based solar tracker for solar irradiation measurement.

Laboratory Component: **[30 hours]**

Any 12experiments have to be completed from the following list of experiments.

S.No.	**Name of the Experiment**
1	Model an electrical circuit and simulate it to verify Ohms Law.
2	Model an electrical circuit and simulate it to verify Kirchhoff's Voltage Law.
3	Model an electrical circuit and simulate it to verify Kirchhoff's Current Law.
4	Demonstrate the measurement of power in an RLC circuit using wattmeter method.
5	Interpret the DC output of an RLC circuit using half wave rectifier.
6	Interpret the DC output of an RLC circuit using full wave rectifier.
7	Conduct the load test on DC shunt motor to outline its characteristics.
8	Outline the study on the starting methods of DC series motor.
9	Conduct a study on transformer construction for real-time applications.
10	Experiment with the logic gates to verify its truth table.
11	Make use of the logic gates to verify the functioning of half and full adders.
12	Make use of the logic gates to verify the functioning of half and full subtractors.
13	Utilize Arduino and Bluetooth module for automating home appliances.
14	UtilizeESP8266 processorfor automating home appliances.
15	Construct an Arduino based solar tracker for solar irradiation measurement.

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Apply the circuit laws and theorems to compute the electrical parameters of domestic and industrial appliances.
CO2	Compare the behavior of AC circuits & magnetic circuits for a given input.
CO3	Explain the construction, working, and application of electrical machine and transformer to infer its characteristics.
CO4	Apply the semiconductor principles using diodes, transistors, thyristors and displays for developing electronic switches and displays.
CO5	Identify the sensors for applications in Engineering.

COs and POs Mapping:

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2	1	1	2	-	-	-	2	-	-	1
CO2	2	1	1	-	2	-	-	-	2	-	-	1
CO3	2	1	1	-	2	-	-	-	2	-	-	1
CO4	3	2	1	1	2	-	-	-	2	-	-	1
CO5	3	2	1	1	2	-	-	-	2	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max. Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - **Theory**	CIE – I	100	60	100	25
	CIE – II	100			
	Skill Assessment – I (2 Assignments + 1 seminar)	40	40		
	Skill Assessment – II (3Assignments)	40			
Continuous Internal Examination (CIE) - **Laboratory**	Continuous Assessment (Lab activities & exercises)	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	60	40	40
Apply	20	40	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or)
- All the fifteen questions have to be answered.

Text Books:

1. D P Kothari and I.J Nagarath, “Basic Electrical and Electronics Engineering,” McGraw Hill Education (India)Private Limited, Second Edition, 2020
2. A.K.Sawhney and PuneetSawhney,“A Course in Electrical & Electronic Measurements & Instrumentation,”DhanpatRai and Co, 2015.

Reference Books:

1. John Bird, “Electrical Circuit theory and technology”, Routledge; 2017.
2. Muthusubramanian R and Salivahanan S, “Basic Electrical and Electronics Engineering,”McGraw Hill, NewDelhi,2009.
3. Nagsarkar T K and Sukhija M S, “Basics of Electrical Engineering,” Oxford University press, 2012.
4. V K Mehta, Rohitmehta “Principles of Electronics,” S.Chand& Company Ltd, 2015.
5. Mahmood Nahvi and Joseph A.Edminister, “Electric Circuits,” Schaum’ Outline Series, McGraw Hill, 2009.
6. H.S. Kalsi, “Electronic Instrumentation,” Tata McGraw-Hill, New Delhi, 2010.
7. Ian Sinclair, “Sensors and Transducers,” Elsevier Science, 3rd Edition, 2000.
8. Perry Lea, “Internet of things for architects,” Packt, 2018.
9. V N Mittle and Arvind Mittle “Basic Electrical Engineering,” McGraw Hill, New Delhi, 2005.
10. R.S. Sedha, “A Textbook of Applied Electronics,” S. Chand & Co., 2008.
11. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry and Gonzalo Salgueiro, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, CISCO Press, 2017.

Web Links and Video Lectures (E-Resources):

1. A Basic Course on Electric and Magnetic Circuits
   https://onlinecourses.nptel.ac.in/noc24_ee125/preview

2. Basic Electrical Circuits: https://onlinecourses.nptel.ac.in/noc24_ee112/preview
3. Digital Circuits: https://onlinecourses.nptel.ac.in/noc24_ee147/preview
4. Electrical Machines – I: https://onlinecourses.nptel.ac.in/noc24_ee103/preview
5. Sensor Technologies: Physics, Fabrication and Circuits: https://onlinecourses.nptel.ac.in/noc24_ee83/preview
6. Semiconductor Devices and Circuits: https://onlinecourses.nptel.ac.in/noc24_ee143/preview

Suggested Skill Activities:

1. List the different electrical loads available in home, college and prepare their rating chart.
2. Design the residential house wiring using fuse, switch, indicator, lamp, circuit breaker, energy meter and apply Thevenin’s theorem to find the current in particular branch.
3. Take a room in your home and replace the fluorescent lamp to LED lamp to calculate the monthly electrical charge and compare with the previous month.
4. Write the parts of the fan and electric mixer in home and draw the wiring diagram for fan and electric mixer.
5. Visit the nearby substation and list out the details of safety measures followed by electrical engineers.
6. List out the rating of electrical machines used in home appliances.
7. Identify the semiconductor devices in electronic appliances.
8. Develop IOT based solutions for engineering applications.
9. Draw the wiring diagram of EV and mentions its parts.
10. Visit nearby power plant and demonstrate the various components, working, power generation and distribution in power plant as a report.

பாடநெறி குறியீடு:	**24GE201**	**பாடத்தின் தலைப்பு:**	தமிழரும் தொழில்நுட்பமும்
கிரெடிட்	**1**	**L – T – P**	**1-0-1**
Pre -requisite		**Nil**	

பாடத்திட்டநோக்கங்கள்:

1. சங்ககாலத்து நெசவுத்தொழிலை விவரிப்பதற்கும் மட்பாண்டத்தொழில் நுட்பத்தைக் கண்டறிவதற்கும்.
2. சங்ககால கட்டுமானம், மேடை அமைப்பு, சிற்பங்கள், கோவில்கள், அம்மன்கோவில், திருமலைநாயக்கர் மஹால், செட்டிநாட்டு வீடுகள், இந்தோ - சாரோசெனிக் கட்டிடக்கலை ஆகியவற்றைக் கண்டறிந்து மேற்கோள் காட்ட.
3. கப்பல் கட்டுதல் மற்றும் இரும்புத் தொழிலைக் கண்டறிதல், சிலப்பதிகாரத்தில் நாணயங்கள், மணி தயாரிக்கும் தொழிற்சாலைகள், மணிகளின் வகைகள் ஆகியவற்றைப் படிக்க.
4. நீர்நிலைகளின் முக்கியத்துவத்தைகாட்ட, கால்நடை வளர்ப்பு மற்றும் கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகளை கண்காணிக்க, விவசாயம், மீன்பிடி, முத்து மற்றும் முத்துகலாச்சாரம் மற்றும் கடல் பற்றிய பண்டைய அறிவை அங்கீகரிக்க.

அறிவியல் தமிழின் வளர்ச்சி மற்றும் தமிழ்க்கணிப்பொறியின் வளர்ச்சியைக் கவனிக்க, இணையத்தில் தமிழ்மென்பொருள் மேம்பாடு, தமிழ் அகராதிகளை மேற்கோள் காட்ட.

அலகு I நெசவு மற்றும் பானைத்தொழில்நுட்பம்	**[3 hours]**
சங்ககாலத்தில் நெசவுத்தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்புபாண்டங்கள் - பண்டங்களில் கீறல் குறியீடுகள்	

அலகு II வடிவமைப்பு மற்றும் கட்டிடத்தொழில்நுட்பம்:	**[3 hours]**
சங்ககாலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்ககாலத்தில் வீட்டுப்பொருட்களில் வடிவமைப்பு - சங்ககாலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடைஅமைப்பு பற்றியவிவரங்கள் - மாமல்லபுரச்சிற்பங்களும், கோவில்களும் - சோழர்காலத்துப் பெருங்கோவில்கள் மற்றும் வழிபாட்டுத்தலங்கள் - நாயக்கர்காலக்கோயில்கள் மாதிரி கட்டமைப்பு பற்றி அறிதல்,மதுரைமீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலைநாயக்கர்மஹால் - செட்டி நாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ - சாரோசெனிக் கட்டிடக்கலை	

அலகு III உற்பத்தித் தொழில்நுட்பம்	[3 hours]
கப்பல் கட்டும் கலை - உலோகவியல் - இரும்பு தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு வரலாற்றுச்சான்றுகளாக செம்பு மற்றும் தங்கநாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சங்கு மணிகள் - எலும்புத்துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.	

அலகு IV வேளாண்மை மற்றும் நீர்பாசனத்தொழில்நுட்பம்	[3 hours]
அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக்கு குமுழித்தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மைச்சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன் வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்	

அலகு V அறிவியல் தமிழ் மற்றும் கணிதத்தமிழ்	[3 hours]
அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி -தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ்மென்பொருள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.	

பாடநெறி முடிவுகள் (பாமு):

பாடநெறியின் முடிவில், மாணவர் பின்வரும் திறன்களைப் பெறுவர்:

பாமு	**பாடநெறி முடிவுகள்**	**மிக உயர்ந்த அறிவாற்றல் நிலை**
அலகு I பாமு:	சங்க கால ஜவுளி தொழில் மற்றும் மட்பாண்ட தொழில்நுட்பம் பற்றி அறிவார்கள்.	கே 1
அலகு II பாமு:	சங்க கால கட்டுமானம், மேடை அமைப்பு, சிற்பங்கள், கோவில்கள், அம்மன் கோவில், திருமலை நாயக்கர் மஹால், செட்டிநாட்டு வீடுகள், இந்தோ-சராசனிக் கட்டிடக்கலை ஆகியவற்றை விவரிக்க இயலும்.	கே 2
அலகு III பாமு:	கப்பல் கட்டுதல், இரும்புத் தொழில், நாணயம் தயாரித்தல் மற்றும் மணி தயாரிக்கும் தொழில்கள் பற்றி அறிந்து கொள்கிறார்கள்.	கே 1
அலகு IV பாமு:	நீர்நிலைகளின் முக்கியத்துவம், கால்நடை வளர்ப்பு, கிணறு, விவசாயம், மீன்பிடி, முத்து மற்றும் முத்து கலாச்சாரம் மற்றும் கடல் பற்றிய போதுமான அறிவை பெற்றுகொள்கிறார்கள் .	கே 1
அலகு V பாமு:	அறிவியல் தமிழின் வளர்ச்சி, தமிழ்க் கணிப்பொறியின் வளர்ச்சி, இணையத்தில் தமிழ் மென்பொருள் மேம்பாடு, தமிழ் அகராதிகளை சந்தேகம் இன்றி முழுமையாக தெரிந்து கொள்கிறார்கள்.	கே 1

பாடநெறி முடிவுகள் மற்றும் நிரல் முடிவுகள் ஒப்பிடுதல்

பாமுகள்	மிக உயர்ந்த அறிவாற்றல் நிலை	பாடநெறி முடிவுகள்											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
பாமு**1**	கே 1	**2**	-	-	-	-	-	-	-	-	-	-	-
பாமு**2**	கே 2	**1**	-	-	-	-	-	-	-	-	-	-	-
பாமு**3**	கே 1	**1**	-	-	-	-	-	-	-	-	-	-	-
பாமு**4**	கே 1	**1**	-	-	-	-	--	-	-	-	-	-	-
பாமு**5**	கே 1	**1**	-	-	-	-	-	-	-	-	-	-	-

நிலை 3- அதிக ஒத்துப்போதல், நிலை 2- மிதமாக ஒத்துப்போதல், நிலை 1- குறைவாக ஒத்துப்போதல், நிலை 0- ஒத்துப்போகவில்லை

மதிப்பீட்டுத் திட்டம்:

கூறுகள்	மதிப்பீட்டின் வகை	அதிகபட்ச மதிப்பெண்கள்	குறைக்கப்பட்ட மதிப்பெண்கள்	இறுதி மதிப்பெண்கள்
தொடர்ச்சியான உள் தேர்வு	தொடர்ச்சியான உள் தேர்வு - I	100	40	40
	தொடர்ச்சியான உள் தேர்வு - II	100	40	
இறுதி பருவ தேர்வு	எழுத்து தேர்வு	100	60	60
மொத்தம்				100

மதிப்பீட்டு முறை

ப்ளூமின் வகை	***தொடர்ச்சியான மதிப்பீட்டு சோதனைகள்***		***இறுதி தேர்வு***
	1	**2**	
நினைவில் கொள்ளுதல்	60	50	60
புரிந்து கொள்ளுதல்	40	50	40
விண்ணப்பித்தல்	0	0	0
பகுப்பாய்வுதல்	0	0	0
மதிப்பிடுதல்	0	0	0
உருவாக்குதல்	0	0	0

இறுதி பருவ தேர்வு: (கேள்வி முறை)

- ஒவ்வொரு யூனிட்டும் இரண்டு 2 மதிப்பெண் வினாக்களையும் ஒரு 16 மதிப்பெண் வினாவையும் (இரண்டில் ஒன்று) கொண்டுள்ளது.
- பதினைந்து கேள்விகளுக்கும் பதிலளிக்க வேண்டும்

CourseCode:	24GE101	Course Title:	Heritage of Tamils
Credits:	**1**	**L – T – P**	**1-0-0**
Pre -requisite		**Nil**	

COURSE OBJECTIVES:

1. To describe the textile industry of the Sangam period and trace the pottery technique.
2. To identify and quote Construction in the Sangam period, platform structure, sculptures, temples, Amman temple, ThirumalaiNayakar Mahal, Chettinad houses, Indo-Saracenic architecture.
3. Finding Shipbuilding and iron industry, to read minting of coins, bell making factories, types of bells in Silapathikaram.
4. To show the Importance of water bodies, to observe Cattle rearing and Wells designed for cattle, to recognize Agriculture, Fisheries, Pearl and pearl culture and Ancient knowledge of the sea.

- To observe Development of Scientific Tamil and Development of Tamil computing, to quote Tamil Software Development, Tamil Dictionaries on the Internet.

UNIT I WEAVING AND CERAMIC TECHNOLOGY	[3hours]
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.	

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY	[3hours]
Designing and Structural construction House & Designs in household materials during Sangam Age – Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram – Sculptures and Temples of Mamallapuram – Great Temples of Cholas and other worship places – Temples of Nayaka Period – Type study (Madurai Meenakshi Temple)- ThirumalaiNayakar Mahal – Chetti Nadu Houses, Indo – Saracenic architecture at Madras during British Period.	

UNIT III MANUFACTURING TECHNOLOGY	[3hours]
Art of Ship Building – Metallurgical studies – Iron industry – Iron smelting, steel -Copper and gold - Coins as source of history – Minting of Coins – Beads making-industries Stone beads - Glass beads – Terracotta beads -Shell beads/ bone beats – Archeological evidences – Gem stone types described in Silappathikaram	

UNIT IV THINAI CONCEPT OF TAMILS	[3hours]
FloraandFaunaofTamils&AhamandPuramConceptfromTholkappiyamandSangamLiterature – Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports ofSangam Age -ExportandImportduringSangam Age- Overseas Conquestof Cholas.	

UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING	[3hours]
Development of Scientific Tamil – Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.	

Course outcomes:

On completion of the course, the student will have the ability to:

COs	Course Outcomes	Highest cognitive level
CO1	Know about Sangam period textile industry and pottery technology.	K1
CO2	Able to describe Sangam period construction, platform structure, sculptures, temples, Amman temple, Tirumala Nayakkar Mahal, Chettinad houses, Indo-Saracenic architecture.	K2
CO3	Learn about the shipbuilding, iron industry, coinage and bell making industries	K1
CO4	Acquire adequate knowledge about the importance of water bodies, animal husbandry, wells, agriculture, fishing, pearl and pearl culture and the sea	K1
CO5	Learn Scientific Tamil Development, Tamil Computer Development, Tamil Software Development on the Internet, Tamil Dictionaries without a doubt.	K1

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	60	50	60
Understand	40	50	40
Apply	0	0	0
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

Cos and POs Mapping

COs	Highest Cognitive Level	POs											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	K1	**2**	-	-	-	-	-	-	-	-	-	-	-
CO2	K2	**1**	-	-	-	-	-	-	-	-	-	-	-
CO3	K1	**1**	-	-	-	-	-	-	-	-	-	-	-
CO4	K1	**1**	-	-	-	-	--	-	-	-	-	-	-
CO5	K1	**1**	-	-	-	-	-	-	-	-	-	-	-

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Final marks**
Continuous Internal Examination (CIE)	CIE– I	100	40	40
	CIE–II	100	40	
End Semester Examination (ESE)	Theory Exam	100	60	60
Total				100

End semester Examination:(QPPATTERN)

- Each unit consists of two2 marks questions and one16marks question (either or).
- All the fifteen questions have to be answered.

TEXT BOOKS

1. .தமிழகவரலாறு - மக்களும்பண்பாடும் - கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்).
2. கணினித்தமிழ் - முனைவர்இல. சுந்தரம். (விகடன்பிரசுரம்).
3. கீழடி - வைகைநதிக்கரையில்சங்ககாலநகரநாகரிகம் (தொல்லியல்துறைவெளியீடு)
4. பொருநை - ஆற்றங்கரைநாகரிகம். (தொல்லியல்துறைவெளியீடு)
7. SocialLifeofTamils(Dr.K.K.Pillay)AjointpublicationofTNTB&ESCandRMRL–(inprint)
8. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute ofTamil Studies.

REFERENCEBOOKS

1.Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by:International Institute of Tamil Studies).

2.The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute ofTamil Studies.)

3.Keeladi-‘SangamCityCivilizationonthebanksofriverVaigai’(JointlyPublishedby:Department ofArchaeology&TamilNadu Text Bookand Educational Services Corporation,TamilNadu)

4.Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: TheAuthor)

5.Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, TamilNadu)

6.Journey of Civilization IndustoVaigai(R.Balakrishnan) (Publishedby:RMRL)–Reference Book

Course Code:	**24MA201**	**Course Title:**	**COMPLEX VARIABLES AND TRANSFORMS (COMMON TO ALL BRANCHES)**
Credits:	**4**	**L – T – P**	**3 – 1 – 0**
Pre -requisite			**Nil**

Course objectives:

- To impart analytical ability in solving mathematical problems as applied to the respective branches of Engineering.
- To familiarize the students with complex integration techniques and contour integration techniques which can be used in real integrals.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.

Teaching-Learning Process:

These are sample strategies which teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method does not mean only traditional method, but different type of teaching methods may be adopted to develop the outcomes.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Topics will be introduced in a multiple representation and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT I – COMPLEX DIFFERENTIATION	**[12 hours]**
Function of a complex variable – Analytic functions – Necessary conditions and sufficient conditions (excluding proof) – Cauchy – Riemann equations — Properties of analytic function – Harmonic conjugate – Construction of Analytic functions - Conformal mapping: w = z+a, az, 1/z, and bilinear transformation.	
UNIT II – COMPLEX INTEGRATION	**[12 hours]**
Statement and application of Cauchy's integral theorem and integral formula – Taylor and Laurent expansions – Isolated singularities – Residues - Cauchy's residue theorem. Applications: Contour integration over unit circle and semicircular contours (excluding poles on axis).	

UNIT III – LAPLACE TRANSFORMS	**[12 hours]**
Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems – Transforms of derivatives and integrals – Initial and Final Value Theorem – Inverse Laplace Transform – Convolution Theorem (Statement only) – Solution of linear second order Ordinary differential equations with constant coefficients using Laplace transforms.	

UNIT IV – FOURIER SERIES AND FOURIER TRANSFORMS	[12 hours]
Dirichlet's conditions – General Fourier series – Odd and even functions – Half range series – Harmonic analysis - Statement of Fourier integral theorem – Fourier transform pair – Parseval's identity.	

UNIT V – PARTIAL DIFFERENTIAL EQUATION	[12 hours]
Formation of partial differential equations - Classification of partial differential equations - Solutions of one dimensional wave equation, One dimensional heat equation (excluding insulated ends) – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges).	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Construct analytic functions and use their conformal mapping property in Engineering problems.
CO2	Solve real and complex integrals using the Cauchy's integral formula and residue theorem.
CO3	Apply Laplace transforms techniques in system modelling, digital signal processing, process control, solving boundary value problems
CO4	Apply Fourier series to solve the steady state two-dimensional heat equation in cartesian coordinates.
CO5	Apply the effective mathematical tools for solutions of partial differential equations that model physical phenomena and engineering problems.

COs and POs Mapping:

COs	**POs**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	2										
CO2	3	2										
CO3	3	2										
CO4	3	2	1									1
CO5	3	2	1									
CO6	3	2	1									1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	20	20	20
Understand	20	20	20
Apply	60	60	60
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
3. Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012
4. Kandasamy. P., Thilagavathy. K, and Gunavathy. K, Engineering Mathematics Volume I & II, S. Chand & Co, New Delhi, 2005.Reference Books:

Equivalent NPTEL/SWAYAM Courses

S. No.	Course Title	Course Instructor	Host Institute
1	Partial Differential Equations	Prof. Sivaji Ganesh	IIT Bombay
2	Introduction to Fourier Analysis	Prof. Parasar Mohanty	IIT Kanpur
3	Complex Analysis	Prof. Pranav Haridas	IIT Madras

Web Links and Video Lectures (E-Resources):

1. Analytic Functions, C-R Equations:
   https://www.nptelvideos.com/lecture.php?id=13416
2. Laplace Transform and its Existence:
   https://www.nptelvideos.com/lecture.php?id=13433
3. Taylor's, Laurent Series of f(z) and Singularities:
   https://www.nptelvideos.com/lecture.php?id=13431
4. Applications of Fourier Transform to PDEs:
   https://www.nptelvideos.com/lecture.php?id=13442

Course Code	**24PH202**	**Course Title:**	**APPLIED MATERIAL SCIENCE (Common to Mech, Civil & Agri)**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

- To study the electrical properties of materials including electron theory of metals.
- To familiarize with the properties of semiconductors, determination of charge carriers and device applications.
- Equipping the students to understand the applications of magnetic materials and dielectric materials.
- To impart knowledge on the processing and applications of new engineering materials
- To motivate the students towards the different material testing methods

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I CONDUCTING MATERIALS	[9 hours]
Classical free electron theory - Expression for electrical conductivity - Thermal conductivity, Wiede- Mann Franz law, Merits & Demerits of classical free Electron Theory - Quantum free electron theory - Electron in a metal – degenerate and non-degenerate states – Fermi-Dirac statistics– Density of energy states – Energy bands in solids – Electron effective mass.	

UNIT II SEMICONDUCTING MATERIALS	[9 hours]
Direct and indirect band gap semiconductors – Intrinsic Semiconductors - Carrier concentration in intrinsic semiconductors - Variation of Fermi level with temperature – extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors – Variation of Fermi level with temperature – Hall effect and devices- Ohmic contacts– Schottky diode.	

UNIT III MAGNETIC AND DIELECTRIC MATERIALS	[9 hours]
Magnetic materials – Classification (Dia , Para & Ferro) – Hysteresis – Ferrites - $BaTiO_3$ – Application of Nd-FeB magnets. Electric polarization – Different types of polarization – Temperature and frequency dependence –Dielectric loss and dielectric breakdown – dielectric materials applications - capacitors and transformers	

UNIT IV SMART MATERIALS	[9 hours]
Metallic glasses - Shape memory alloys - Composites - Definition and Classification - Fiber reinforced plastics (FRP) and fiber reinforced metals (FRM) - Ceramics - Classification - Crystalline - Non Crystalline - Bonded - ceramics, Manufacturing methods - Slip casting - Isostatic pressing - Gas pressure bonding - Properties - thermal, mechanical, electrical and chemical ceramic fiber- Applications of ceramics in electronics.	

UNIT V MATERIALS TESTING	[9 hours]
Microscope-Magnification Power-Resolving Power-Optical & Electron Microscope-Difference between optical & Electron Microscope-Tunneling - Scanning Electron Microscope-Transmission Electron Microscope- Scanning Tunneling Microscope-hardness - Rockwell and Brinell hardness - Knoop and Vickers Micro hardness- spot test techniques	

Course outcomes: On completion of the course, the student will have the ability to:

CO No	Corse Outcomes	Blooms Level
CO1	Explain the electrical properties of materials.	K2
CO2	Apply the properties of semiconducting materials in electronics.	K3
CO3	Infer the properties of magnetic and dielectric materials for relevant electrical and electronics engineering applications.	K2
CO4	Utilize the smart materials in the field of Engineering..	K3
CO5	Make use of different testing methods for analyzing the properties of materials.	K3

COs and POs Mapping

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	2	1	1	-	-	-	-	-	-	-	-	1
CO2	3	2	1	-	-	-	-	-	-	-	-	1
CO3	2	1	1	-	-	-	-	-	-	-	-	1
CO4	3	2	1	-	-	-	-	-	-	-	-	1
CO5	3	2	1	-	-	-	-	-	-	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End semester Examination
	1	2	
Remember	20	20	20
Understand	60	40	40
Apply	20	40	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered

TEXT BOOKS:

1. S.O. Kasap. Principles of Electronic Materials and Devices, McGraw Hill Education(Indian Edition), 2020.
2. R.F.Pierret. Semiconductor Device Fundamentals. Pearson (Indian Edition), 2006.
3. O.P.Khanna. "Materials Science and metallurgy: Dhanpat Rai Publications,2011

REFERENCE BOOKS:

1. Jasprit Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw- HillEducation (Indian Edition), 2019.
2. Charles Kittel, Introduction to Solid State Physics, Wiley India Edition, 2019.
3. Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, Concepts of Modern Physics, McGrawHill (Indian Edition), 2017.

NPTEL COURSE:

Sl.No	Course Name	Course Instructor	Course Conducting Agency
1	Solid state Physics	Prof. Amal Kumar Das	IIT Kharagpur

WEB LINKS AND VIDEO LECTURES (E-RESOURCES):

1. Electrical Conductivity: https://www.youtube.com/watch?v=QvPSVwzU-8A
2. Band Theory of solids:
   https://www.youtube.com/watch?v=qcE2Wcpm05k&ab_channel=nptelhrd
3. Intrinsic semiconductor: https://www.youtube.com/watch?v=JZN3DAaeOB8
4. Brinell Hardness Test: https://www.youtube.com/watch?v=TM487F4p-YM
5. FRP:
   https://www.youtube.com/watch?v=tyKtUoQo9VM&list=PLbMVogVj5nJTnVBY4n3KHSPJsPDy38QS

Suggested Skill Activities:

1. As you look at materials and objects around your house Which do you think are conductors and insulators?
2. Identify the change when you connect a light bulb to battery using conductive materials?
3. What will happen if you connect a light bulb to battery using insulating materials?
4. List the usage of alphanumerical displays in day to life.
5. Compute the size variation and efficiency of the nano materials.
6. Illustrate the role of semiconductors in renewable energy technologies.
7. Explain the reason for using smart materials like SMA in retractable roofs.
8. List out 10 uses of magnetic materials in house.
9. Explain the testing methodology used in aerospace technology.
10. Discuss about the role of semiconductor in temperature sensors which is air conditioner.

Course Code:	**24CY401**	**Course Title:**	**ENVIRONMENTAL SCIENCE AND ENGINEERING**
Credits:	**2**	**L – T – P**	**2-0-0**
Pre -requisite			**Nil**

Course objectives:

To impart knowledge on the

- To gain in-depth knowledge on natural processes and resources that sustain life and govern economy.
- To know the importance of water resources which are important socially, economicallyviable and environmentally sustainable.
- To impart the Knowledge of pollution and its control methods.
- To mitigate the environmental and health risks associated with indiscriminate waste and find the suitable methodologies for waste management.
- To balance ecological, economic and social goals, such as reducing carbon emissions,promoting renewable energy and ensuring equitable resource access.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. NPTEL and Other Videos
3. Smart Class Room
4. Field visit
5. Project based learning
6. Industrial Visit

UNIT I - ECOLOGY AND BIODIVERSITY	**[6 hours]**
Definition, scope and importance of environment – need for public awareness – conceptof an ecosystem - Biodiversity and its values- Biodiversity at global, national and local level- India as a mega-diversity nation – hotspots of biodiversity – threats to biodiversity – endangered and endemic speciesof India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.	
UNIT II - WATER RESOURCES AND ENVIRONMENT MICROBIOLOGY	**[6 hours]**
Water resources: Use and over- utilization of surface and groundwater – dams benefits and problems, conflicts over water –Water availability at global level, surface level, ground level-Sources-Hydro phonics -Classification of microorganism –Role of microorganism in waste water treatment-Bacterial nutrition and growth.	

UNIT III -AIR AND NOISE POLLUTION	**[6 hours]**
Sources and classification of air pollutants and their effect on human health-Ambient air quality and emission standards-Air pollutants-Particulate matters-Control equipments- Gravity separator-Centrifugal separator-fabric filter-Electrostatic separator, Catalytic convertors– Noise pollution-causes – Consequences-Control measures- modern tools used in pollution mitigation measures-sustainable activity of pollution control- recent case studies - Environmental Protection Act.	

UNIT IV- SOLID WASTE AND HAZARDOUS WASTE MANAGEMENT	**[6 hours]**
Soil contaminants–sources and management methods of -Solid Waste Hazardous waste – Plastic waste- -Biomedical waste- Hazardous waste& E-waste management -Case studies on Occupational Health and Safety Management system (OHASMS).	

UNIT V-ENVIRONMENTAL MANAGEMENT AND SUSTAINABLE DEVELOPMENT	**[6 hours]**
Renewable and non-renewable energy Sources- Energy Polices- Development, GDP, Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment-Sustainable goals -Sustainable habitat- Green buildings, Green materials, Energy efficiency, Sustainable transports. Carbon emission-Carbon footprint-Carbon Sequestration.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Illustrate the important features of environment and its conservation.	K2
CO2	Explain the need of water resources and its application to meet the modern requirements and the necessity of its conservation.	K2
CO3	Identify the causes, effects of environmental pollution and explain the control techniques for particulate, gaseous emissions and contribute to the preventive measures in the society.	K3
CO4	Identify the different management methods of solid and hazardous waste.	K3
CO5	Explain the sustainability practices and identify green materials for sustainable development.	K2

COs and POs Mapping:

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	2					1	1					
CO2	1	1				1	1					
CO3	2					1	2	1				
CO4	1					2	2	1				
CO5	1					1	2	1				

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	60	100	40
	CIE – II	100			
	Skill Assessment – I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	20	20	30
Understand	60	40	30
Apply	20	40	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or)
- All the fifteen questions have to be answered.

Text Books:

1. Benny Joseph,Environmental Science and Engineering ‘, Tata McGraw-Hill, New Delhi, (2014).
2. Miguel Fischer,“Environmental Management: Ecosystems, Competitiveness and Waste Management” Nova Science Publishers, (2021)

Reference Books:

1. Dharmendra S.Sengar, ‘Environmental law ‘, Prentice hall of India Pvt Ltd, New Delhi, (2007).
2.Erach Bharucha, “Textbook of Environmental Studies”, Universities Press Pvt, Ltd, Hydrabad, (2015).
3. G.TylerMiller,Scott E.Spoolman,“Environmental Science”,Cengag Learning India Pvt.Ltd,Delhi, (2014).
4. Mahuabasu, Xavier saverimuthu, “Fundamentals of Environmental Studies”, Cambridge university press,(2017)
5. Anubha Kaushik , C.P. Kaushik, “Perspectives in Environmental Studies”, New Age International Pvt. Ltd, New Delhi, (2004). 6. Frank R. Spellman, “Handbook of EnvironmentalEngineering”, CRC Press, (2015).

Web Links and Video Lectures (E-Resources):

1. Ecology andSociety**:** https://onlinecourses.nptel.ac.in/noc24_hs149/preview
2. SustainablePower GenerationSystems**:** https://onlinecourses.nptel.ac.in/noc2 4_ge54/preview
3. Environmentand Development**:** https://onlinecourses.nptel.ac.in/noc2 4_hs150/preview

Suggested Skill Activities:

1. Why is it beneficial to follow a student centered and participatory process for environmental education?
2. Identify the endemic species of flora and fauna found nearest to your locality.
3. List the major arguments cited against the construction of dams.
4. Discuss how the symbiotic relationship between algae and bacteria is useful in the treatment of sewage in an oxidation pond.
5. List the various ways in which an individual can contribute towards pollution prevention in the society.

6. Mention any four hazardous wastes originating from households and explain their management strategies.
7. Conduct a survey and find out how chemicals and various material are distributed /cycled in your campus.
8. List the common organic materials that are suitable and unsuitable for composting.
9. List the advantages of recycling of MSW with examples.
10. What are the major obstacles in the implementation of incineration technology in developing countries

Course Code:	**24CE201**	**Course Title:**	**STRENGTH OF MATERIALS – I**
Credits:	**3**	**L – T – P**	**3-0-2**
Pre -requisite			**24ME301-ENGINEERING MECHANICS**

Course objectives:

To impart knowledge on

- The state of stresses and strains in structural components as a result of different loading conditions.
- Shear force and bending moment for all statically determinate beams by recognizing the beam type and loading.
- The concepts of internal stresses in beams of various cross sections.
- The analysis of the elements under complex state of stress by means of analytical and graphical methods.
- The behaviour of members subjected to pure torsion.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – STRESS AND STRAIN	**[9 hours]**
Stress and strain at a point – Tension, Compression, Shear Stress – Hooke"s Law – Relationship among elastic constants – Stress Strain Diagram for Mild Steel, TOR steel,	

Concrete – Ultimate Stress – Yield Stress – Factor of Safety – Thermal Stresses – Thin Cylinders and Shells – Strain Energy due to Axial Force – Resilience – Stresses due to impact and Suddenly Applied Load – Compound Bars.
Practical Topics: 1. Determine the tension test on mild steel bar. 2. Determine the double shear test.. 3. Determine the compression test on wood.

UNIT II – SHEAR FORCE AND BENDING MOMENT	**[9 hours]**
Beams and Bending- Types of loads, supports – Shear Force and Bending Moment Diagrams for statically determinate beam with concentrated load, UDL, uniformly varying load. Theory of Simple Bending – Analysis of Beams for Stresses – Stress Distribution at a cross Section due to bending moment and shear force for Cantilever, simply supported and overhanging beams with different loading conditions	
Practical Topics: 1. Determine the Rockwell Hardness test. 2. Determine the Brinell Hardness test. 3. Determine the deflection test on metal beam..	

UNIT III – BENDING OF BEAMS	**[9 hours]**
Beams – types and transverse loading on beams – shear force and bending moment in beams – Cantilever beams – Simply supported beams and over-hanging beams - Theory of simple bending – bending stress distribution – Load carrying capacity – Proportioning of sections – Leaf springs – Flitched beams – Shear stress distribution.	
Practical Topics: 1. Determine the compression test on brick. 2. Determine the compression test on concrete. 3. Determine the compression test on tiles.	

UNIT IV – COMPLEX STRESSES AND PLANE TRUSSES	**[9 hours]**
2 D State of Stress – 2 D Normal and Shear Stresses on any plane – Principal Stresses and Principal Planes – Mohr's circle - Plane trusses: Analysis of plane trusses - method of joints - method of sections.	
Practical Topics: 1. Determine the compression test on spring. 2. Determine the izod impact test. 3. Determine the charpy test.	

UNIT V – TORSION OF SHAFTS AND SPRING	**[9 hours]**
Torsion of Circular and Hollow Shafts – Elastic Theory of Torsion – Stresses and Deflection in Circular Solid and Hollow Shafts – combined bending moment and torsion of shafts - strain energy due to torsion - Modulus of Rupture – Power transmitted to shaft – Shaft in series and parallel – Closed and Open Coiled helical springs – Leaf Springs – Springs in series and parallel – Design of buffer springs.	
Practical Topics: 1. Determine the torsion test 2. Determine the compression test on spring. 3. Determine the tension test on spring..	

Laboratory Component: **[30 hours]**

Any 12 experiments have to be completed from the following list of experiments.

S.No.	**Name of the Experiment**
1	Determine the tension test on mild steel bar.
2	Determine the double shear test.
3	Determine the torsion test.
4	Determine the compression test on wood.
5	Determine the compression test on brick.
6	Determine the compression test on concrete.
7	Determine the compression test on tiles
8	Determine the izod impact test.
9	Determine the charpy test.
10	Determine the Rockwell Hardness test.
11	Determine the Brinell Hardness test.
12	Determine the deflection test on metal beam.
13	Determine the compression test on spring
14	Determine the tension test on spring
15	Determine the test on cement

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Apply the load on various structural elements and assess the nature of stresses induced in material under different loads
CO2	Identify the variation of shear force and bending moments over the statically determinate beams under different types of loads and plot the bending moment and shear force diagram
CO3	Analyze the bending of various types of beams under static loading conditions and compute the shear stress distribution for different cross sections of beams.
CO4	Identify the principal stresses due to the combination of two dimensional stresses on an element and failure mechanisms in materials.
CO5	Examine the behavior of torsional shear stress in shafts and deformations of springs.

COs and POs Mapping:

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	2	1	1	2	-	-	-	2	-	-	1
CO2	2	1	1	1	2	-	-	-	2	-	-	1
CO3	2	1	1	1	2	-	-	-	2	-	-	1
CO4	2	1	1	1	2	-	-	-	2	-	-	1
CO5	3	2	1	1	2	-	-	-	2	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or)
- All the fifteen questions have to be answered.

Assessment Pattern:

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	30	30	30
Apply	30	30	30
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Rajput.R.K. "Strength of Materials (Mechanics of Solids)", S.Chand and Co, New Delhi, 2015.
2. Bansal R.K. "Strength of materials", Laxmi Publications, New Delhi, 2018.

Reference Books:

1. Subramanian R. "Strength of materials", Oxford University Press, New Delhi, 2016.
2. Ramamrutham, S.,"Strength of Materials", DhanpatRai & Sons, 2011.
3. Bhavikatti. S., "Solid Mechanics", Vikas publishing house Pvt. Ltd, New Delhi, 2010.
4. William A. Nash, "Theory and Problems of Strength of Materials", Schaum's Outline Series, Tata McGraw-Hill publishing co., New Delhi, 2014.
5. Srinath L.S," Advanced Mechanics of Solids", Tata McGraw-Hill Publishing Co., New Delhi, 2017.
6. Gambhir. M.L., "Fundamentals of Solid Mechanics", PHI Learning Private Limited., New Delhi, 2009.

Web Links and Video Lectures (E-Resources):

1. Strength of materials for anomaterials;https://nptel.ac.in/courses/113/107/113107081/
2. Matrix method for Strength of aterials;https://nptel.ac.in/courses/105/105/105105180/
3. Strength of materials for frame structures;https://nptel.ac.in/courses/114/106/114106045/
4. Strength of materials;https://nptel.ac.in/courses/105/105/105105166/
5. Advanced topics in Strength of materials;https://nptel.ac.in/courses/105/106/105106050/

6. Strength of materials;https://nptel.ac.in/courses/105/101/105101085/
7. Strength of materials; https://nptel.ac.in/courses/105/101/105101086/

Suggested Skill Activities:

1. Before delving into complex topics, make sure you have a solid understanding of the basic concepts such as stress, strain, types of loads, deformation, and material properties. These fundamentals form the foundation of Strength of Materials.
2. Understand the different types of stress (like tensile, compressive, shear) and strain (like normal strain, shear strain). Learn how to calculate stress and strain in various situations.
3. Learn about mechanical properties like modulus of elasticity, yield strength, ultimate strength, and factors affecting the mechanical behavior of materials.
4. Beams are fundamental components in Strength of Materials. Learn about different types of beams, beam loading conditions, and how to analyze beams under different loading scenarios.
5. Familiarize yourself with the properties of materials like elasticity, plasticity, ductility, and brittleness. Understanding how materials behave under different conditions is crucial in Strength of Materials.
6. Learn about deflection and buckling of structural elements. Understand how to calculate deflections and how to prevent buckling in various structural members
7. Strength of Materials is a subject that requires practice. Solve a variety of problems to reinforce your understanding of concepts and improve problem-solving skills.
8. Use textbooks, online resources, video lectures, and study materials to enhance your learning. There are many resources available that can provide a different perspective and help clarify difficult concepts.
9. Try to relate theoretical concepts to real-world applications. Understanding how Strength of Materials principles apply to practical engineering problems can deepen your understanding of the subject.
10. Don't hesitate to ask for help from professors, tutors, or online communities if you encounter difficulties. Strength of Materials can be complex, and getting clarification on challenging topics is important for your learning progress.

Course Code:	**24ME201**	**Course Title:**	**ENGINEERING GRAPHICS AND DESIGN**
Credits:	**3**	**L – T – P**	**1-0-4**
Pre -requisite			**Nil**

Course objectives:
To impart knowledge on the

- To enable students to understand the standards and conventions of engineering drawing.
- To enhance the visualization skills to understand objects in the respective positions withrespect to principal planes.
- To comprehend general projection theory, with emphasis on orthographic projection torepresent three-dimensional objects in two-dimensional views.
- To emphasize freehand sketching and pictorial view to aid in the visualization process and toefficiently communicate ideas graphically.
- To Introduce CAD software for the creation of 3D models and 2D engineering drawings.

Teaching-Learning Process:
Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. NPTEL and Other Videos
3. Smart Class Room
4. Field visit
5. Project based learning
6. Industrial Visit

UNIT I - DRAWING FUNDAMENTALS, GEOMETRIC CONSTRUCTION, PROJECTION OF POINTS, STRAIGHT LINES AND PLANES	**[15 hours]**

Drawing BIS standards – Orthographic projections – First angle projection - Drawing instruments – Sheet layout – Conventions – Lines, Lettering, Numbering and Dimensioning
Geometric construction – Construction of regular polygons – Conic sections – Ellipse, Parabola andHyperbola by eccentricity method.
Projection of points – Points situated in all four quadrants. Projection of straight lines – Straight lines inclined to both principal planes – Finding true length of the line and true inclinations with respect to principal planes – Rotating line method.
Projection of planes – Introduction – Polygonal lamina and Circular lamina - Orientation of planes - Plane parallel to both principal planes, Planes perpendicular to both principal planes and Planes inclined to both principal planes – Rotating object method.
Orthographic projection of simple engineering components.

UNIT II - PROJECTION OF SOLIDS	[15 hours]
Projection of solids – Introduction – Types of solids – Polyhedra and solids of revolution - Projectionwith axes inclined to one of the principal planes and parallel to other – Change of Position method. 2D drafting - Basic commands – Coordinate systems, Object section methods. Line, Circle, Polyline,Rectangle, Hatch, Fillet, Chamfer, Trim, Extend, Offset, Dim style – Annotation and Layering – Object snaps - 3D modelling – Basic commands – Extraction of multiple views – Part modelling of simple components - Utensils, Hand tools & Furniture etc. - Drawing views using 3D environment.	

UNIT III - DEVELOPMENT OF SURFACES AND PICTORIAL PROJECTION	[15 hours]
Development of lateral surfaces of truncated Prisms, Pyramids, Cylinders and Cones– Parallel line methodand Radial line method. Pictorial Projection – Isometric projection – Introduction – Isometric scale – Isometric view of two right regular composite solids – Isometric projection of truncated frustum of solids – Box method. Problems onapplications of Isometric projections of simple objects / engineering components.	

UNIT IV- BASIC COMPUTER AIDED DRAWING APPLICATIONS	[15 hours]
Free hand Sketching - Sketching of geometry - multiple view projection from single pictorial view ofobjects – Illustrative examples - True free hand, Guided Free hand, Roads, Buildings, Utensils, Handtools & Furniture's etc. Drawing Simple Mechanisms - Bicycles, Tricycles, Gear trains, Ratchets, two-wheeler cart &Four-wheeler carts to dimensions etc.	

UNIT V- MULTIDISCIPLINARY APPLICATIONS AND PRACTICE	[15 hours]
Electric Wiring and lighting diagrams - Like, Automatic fire alarm, Call bell system, UPS system, Basicpower distribution system using suitable software. **Basic Building Drawing -** Draw various types of lines, graphical symbols for materials, doors and windows, symbols for sanitary, water supply and electrical installations and write abbreviations as per IS 962. Like, Architectural floor plan, basic foundation drawing, steel structures- Frames, bridges, trusses using Auto CAD or suitable software, **Electronics Engineering Drawings -** Like, Simple Electronics Circuit Drawings, practice on layers concept. **Graphs & Charts -** Like, Column chart, Pie chart, Line charts, Gantt charts, etc. using Microsoft Excel or any suitable software.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Apply principles of first angle projection in drafting plan and elevation of points, lines, planes,and solids.
CO2	Apply change of position method in the projection of solids and determine the true shape of thesection.
CO3	Apply principles of orthographic projection to extract 2D views from 3D drawing usingfreehand sketching.
CO4	Apply parallel line and radial line methods to develop lateral surfaces of solids so that studentscan understand applications in sheet metal design.
CO5	Apply box method to develop the isometric view of simple, truncated, and composite solids.
CO6	Develop simple part model in 3D and plan, elevation, and section of building using a designatedCAD software.

COs and POs Mapping:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	1	-	-	-	-	-	-	-	2	-	-	1	2	-
CO2	3	1	-	-	-	-	-	-	-	2	-	-	1	2	-
CO3	3	1	-	-	-	-	-	-	-	-	-	-	1	2	-
CO4	3	1	-	-	-	-	-	-	-	2	-	-	1	-	-
CO5	3	1	-	-	-	-	-	-	-	2	-	-	1	2	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Lab Exam	100	50	50	50
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	0	0	0
Understand	20	20	20
Apply	40	40	40
Analyze	0	0	0
Evaluate	0	0	0
Create	40	40	40

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. N.D.Bhatt,"Engineering Graphics", Charotor Publishing House, 53RD Edition 2019
2. Natrajan K.V., "A textbook of Engineering Graphics", Dhanalakshmi Publishers, Chennai(2015)

Reference Books:

1. Venugopal K. and Prabhu Raja V., "Engineering drawing + AutoCAD", New Age International (P) Limited (2022)
2. Lakhwinder pal singh, Harwinder Singh, "Engineering Drawing Principles and Applications", Cambridge University Press, 2021.
3. Cecil Johnson, Jay D Helsel and Dennis R Short, "Engineering Drawing and Design",Seventh Edition, McGraw Hill, 2007.
4. Patil, Rajashekar, "Computer Aided Engineering Graphics", New Age International Ltd,2018.
5. Chris Schroder, "Printed Circuit Board Design using AutoCAD", Newnes,1997.
6. K S Sai Ram, "Design of steel structures", Third Edition by Pearson.
7. A S Pabla, "Electrical power distribution", 6th edition, Tata Mcgrawhill.
8. K. R. Gopalakrishna, & Sudhir Gopalakrishna, "Textbook of Computer Aided EngineeringDrawing", 39th Edition, Subash Stores, Bangalore, 2017

Web Links and Video Lectures (E-Resources):

1. http://nptel.ac.in/courses/112103019
2. https://archive.nptel.ac.in/courses/112/105/112105294/

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 and 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 and SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 and SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

LABORATORY REQUIREMENTS

SYSTEM REQUIREMENTS (For a batch of 30 Students)

Hardware:

1. Intel i3 core due processor with 4GB ram with 500GB hard disk – 30 Nos.
2. Laser Printer – 1 No.

Software:

Drafting package – AutoCAD – Adequate license (Open source)

Suggested Skill Activities:

1. 2D drafting of plan and elevation of computer CPU.
2. 2D drafting of plan and elevation of a thermos flask.
3. 2D drafting of a plan and elevation of piston and cylinder.
4. Sketching the projections of a bicycle in freehand.
5. Sketching the projections of a stapler.
6. Cut and develop the lateral surface of a funnel.
7. Cut one edges vertically and develop the lateral surface of CPU cabin.
8. Cut and develop the lateral surfaces of elbow of a pipe.
9. Draw the isometric view of a simple bread toaster.
10. Draw the isometric view of the computer table.
11. Sketch the assembled view of the screw jack using the orthographic projections of its components.
12. Draft the plan, elevation and section of your home using CAD.
13. Draft the plan, elevation and section of 2 storey office building using CAD.
14. Develop the 3D model of the (a) and (b).

Course Code:	**24CS201**	**Course Title:**	**PROGRAMMING FOR PROBLEM SOLVING USING C**
Credits:	**4**	**L – T – P**	**2-0-4**
Pre -requisite			**Nil**

Course objectives:

To impart knowledge on the

- To gain knowledge on problem solving techniques
- To learn how to write simple and modular C programs
- To develop C programs using arrays and strings
- To learn the usage of pointers in accessing and manipulating memory
- To develop applications in C using structures & files

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Classroom
8. Flipped Class

UNIT1 - BASICS OF C PROGRAMMING	**[6 hours]**
Problem Solving Techniques: Introduction to Algorithm, Pseudo code, Flow Chart, Structure of 'C' program. C Tokens: Keywords, Data Types, Constants, Variables - Declaration - Qualifiers – typedef	
Practical Topics: 1. Steps in Problem Solving Drawing flowchart using yEd tool/Raptor Tool programs using simple statements. 2. Programs to illustrate the use of user-defined data types	

UNIT II – BASIC CONSTRUCTS IN C	**[6 hours]**
Managing simple Input and Output operations - Operators and Expressions - Decision Making: Branching statements, looping statements - Function: Declaration, Definition - Passing arguments by value - Recursion - Storage classes	
Practical Topics: 1. Programs using decision making statements 2. Programs using looping statements 3. Programs using user defined functions and recursive functions	

UNIT III – ARRAYS AND STRINGS IN C	**[6 hours]**
Arrays: Initialization - One dimensional, Two dimensional, and Multi-dimensional arrays - String: Basics, declaring and initializing strings, string handling functions: standard and user defined functions	
Practical Topics: 1. Build programs using arrays and array-based operations. 2. Programs using one dimensional and two dimensional arrays. 3. Implementations involving array usage for string operations.	

UNIT IV – POINTERS IN C	**[6 hours]**
Pointers - Passing arguments by address - Dynamic Memory Allocation - Pointer arithmetic - Pointers and one dimensional array - Pointers and Multi-Dimensional Array: Array of Pointers, Pointer to Pointer, Pointer to an array - void Pointer - Pointer to function	
Practical Topics: 1. Implementations involving pointers for dynamic memory allocation 2. Implementations involving pointers for string manipulation.	

UNIT V – STRUCTURES, UNIONS AND FILE HANDLING IN C	**[6 hours]**
Structure: Declaration, Definition-Array of Structures - Pointer to Structure – Nested Structures- Union: Defining union, Accessing union members. Files: File Management functions, Random access in file- Working with Text Files and Binary Files	
Practical Topics: 1. Programs to implement structures 2. Programs to implement union 3. Programs to implement various file operations.	

Laboratory Component: **[45 hours]**

Any 12 experiments have to be completed from the following list of experiments.

S.No.	Name of the Experiment
1	Steps in Problem Solving Drawing flowchart using yEd tool/Raptor Tool programs using simple statements
2	Programs to illustrate the use of user-defined data types
3	Programs using decision making statements
4	Programs using looping statements
5	Programs using user defined functions and recursive functions
6	Build programs using arrays and array-based operations.
7	Programs using one dimensional and two dimensional arrays.
8	Implementations involving array usage for string operations.
9	Implementations involving pointers for dynamic memory allocation
10	Implementations involving pointers for string manipulation.
11	Programs to implement structures
12	Programs to implement union
13	Programs to implement various file operations

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Make use of problem solving techniques to solve real world problems & outline the structure of C program
CO2	Identify the appropriate looping and control statements in C and develop applications using these statements
CO3	Make use of arrays & strings in development of simple applications
CO4	Apply the concepts of pointers and develop C programs using pointer
CO5	Develop programs for storing, retrieving and processing data using structures and files.

COs and POs Mapping

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	2	2	-	1	-	-	-		-	-	1
CO2	3	2	2	-	1	-	-	-		-	-	1
CO3	3	3	2	1	1	-	-	-		-	-	1
CO4	3	2	2	1	1	-	-	-		-	-	1
CO5	3	3	3	1	1	-	-	-		-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	15	50	50
	Lab Exam	100	35		
				Total	100

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	20	20	20
Understand	20	20	20
Apply	60	60	60
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2015.
2. Pradip Dey, Manas Ghosh, "Programming in C", AICTE Edition, Oxford University Press, 2018

Reference Books:

1. Yashavant P. Kanetkar, "Let Us C : Authentic guide to C programming

language”, Eighteenth Edition, BPB Publications, 2021
2. Ashok N Kamthane, Programming in C, Pearson, Third Edition, 2020
3. Reema Thareja, "Programming in C", Oxford University Press, Second Edition, 2016.
4. Paul Deitel and Harvey Deitel, "C How to Program with an Introduction to C++", Eighth edition, Pearson Education, 2018.
5. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", 1st Edition, Pearson Education, 2013.
6. E.Balagurusamy, "Programming in ANSI C", seventh edition, Mc Graw Hill Education,2017

Web Links and Video Lectures (E-Resources):

- Introduction To Programming In C By Prof. Satyadev Nandakumar IIT Kanpur
- http://www.cprogramming.com/tutorial/c-tutorial.html
- http://www.tutorialspoint.com/cprogramming/index.htm
- https://www.geeksforgeeks.org/c-programming-language/
- http://www.w3schools.in/c

Suggested Skill Activities:

1. Steps in Problem Solving Drawing flowchart using yEd tool/Raptor Tool
2. Write a Program to calculate and display the volume of a CUBE having its height (h=10cm), width (w=12cm) and depth (8cm).
3. Ramya has bought 50 kg of onion for Rs 40 per kg and 60 kg of potato for Rs 20 per kg. Then she sold out all the stock with the selling price of Rs 60 per kg and Rs 30 per kg for onion and potato respectively. Write a C program which computes the profit gained by her.
4. A Food delivery boy needs to walk down every street in his area in order to deliver the food. Assume that the distances between the streets along the roads are given. The food delivery boy starts at the hotel and returns back to the hotel after delivering all the foods. Implement an algorithm to help the food delivery boy to walk minimum distance for the purpose.
5. Write a program to input name, marks of 5 subjects of a student and display the name of the student, the total marks scored, percentage scored and the class of result.
6. A location in a map is represented by a pair of points as x co-ordinate and y co-ordinate. Person X wants to move towards person Y which is residing in the location L1 and L2 respectively. Write C Program to find the distance between these two person .
7. If a four-digit number is input through the keyboard, write a program to obtain the sum of the first and last digit of this number.
8. Write a program to find GCD (greatest common divisor or HCF) and LCM (least common multiple) of two numbers

9. Write a Program to multiply two 3 X 3 Matrices
10. Write a program to create a structure named company which has name, address, phone and no Of Employee as member variables. Read name of company, its address, phone and no Of Employee. Finally display these members‟ value.
11. Write a program to create array of books. Collect various details of books such as topic, author, department. Collect details for N books and display the details of books based on department name or author
12. A class has strength of N students. The class has two mentors, one person for the odd roll numbers and the other for the rest. Write a C program which reads the roll numbers of all the students and gives two lists of roll numbers corresponding to each advisor
13. Write a C program to maintain the inventory details of items sold in a super market such as item id, name, no of items available, price per item. Perform efficient data storage based on user‟s demand at runtime
14. Write a C program to use binary files for maintaining a telephone directory which includes telephone no, Owner name and address. Here address includes details such as door no, street name, locality, city and pincode. Update the door no of all people belonging to a particular street as follows: Increment the old door no by 10 to get the new door no. (Eg: If the old door no is 13, update it as 23)

Course Code:	**24GE231**	**Course Title:**	**WORKSHOP PRACTICE (Common to All Branches)**
Credits:	**1.5**	**L – T – P**	**0-0-3**
Pre -requisite			**Nil**

Course objectives:
To provide hands on training to the students in: ● Applying basic techniques to measure a field, infer masonry work and install plumbing design. ● Fabricating carpentry, foundry, sheet metal and welding works to practice on workshop tradesand making end products. ● Utilizing machining processes like turning, drilling, tapping in parts and 3D printing forperforming the jobs. ● Designing electrical wiring layout with MCBs and RCCBs, developing staircase wiring andillumination design circuits for buildings. ● Assembling simple electronic components on PCB by soldering and desoldering and testingwith IoT based interfaces. ● Developing blogs and website design for the complete access over the network.
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Project based learning 2. Industrial Visit

GROUP – A (Civil and Mechanical)

PART I - CIVIL ENGINEERING PRACTICES	**[5 hours]**
1. FIELD MEASUREMENT, MASONRY WORK AND PLUMBING a. Calculate the area of a built-up space and a small parcel of land-use standard measuring tape anddigital distance measuring devices. b. Visit a nearby site where construction is at initial stage and observe for following (if necessary,visit two/three times with a gap of a week). If drawings are available relate/match activities with the drawings. i. Digging and filling. ii. Foundation preparations. iii. Brick/stone masonry. iv. Concrete laying and curing. v. Laying of sewerage/sanitary lines. vi. Bar bending and bar laying for columns, beams and ceiling. vii. Onsite testing for quality. viii. Onsite preparation for construction work. ix. Erection and removal of form work, scaffolding, centering/shuttering. Prepare a brief report on the construction activities, methods, tools, equipment and materials being used. c. Installation of water lines for wash basin and showers faucet.	

PART II MECHANICAL ENGINEERING PRACTICES	**[5 hours]**
2. CARPENTRY, FOUNDRY, WELDING AND SHEET METAL a. Carpentry: Prepare T/L/Lap Joint from given wooden work piece and make a Box/Tray out ofplywood using modern power tools. b. Welding: Make a Butt/Lap of MS plate using Arc welding process. c. Casting: Demonstration of Pattern making by sand moulding. d. Sheet Metal: Fabrication of Sheet Metal Tray and Funnels. 3. LATHE, DRILLING MACHINE AND 3D PRINTER a. Designing a driller component using radial machine. b. Perform a job using facing and turning in lathe. c. Printing simple 3D geometric shapes using SLA printer.	

GROUP – B (ELECTRICAL, ELECTRONICS AND IT)

PART III ELECTRICAL ENGINEERING PRACTICES	**[3 hours]**
4. ELECTRICAL WIRING a. Design a wiring circuit integrating energy meter, MCBs and RCCBs. b. Develop fluorescent lamp wiring, staircase wiring and electric fan wiring circuits.	

PART IV ELECTRONICS ENGINEERING PRACTICES	[4 hours]
5. IOT BASED SOLUTIONS AND PCB a. Design a single layer PCB layout structure. b. Fabricate single layer PCB printing. c. Assembling, soldering and desoldering practice on single layer PCB. d. GPIO programming in ESP8266, sensor and actuator interfacing with internet enabledmicrocontroller device. e. Integration of microcontroller-based system with Cloud platform.	

PART V COMPUTER SCIENCE AND ENGINEERING PRACTICES	[3 hours]
6. INTERACTIVE DYNAMIC WEBSITE a. Design a website for an application using HTML and CSS. b. Convert the designed website into responsive website using Bootstrap. c. Add dynamism to the website by using JavaScript and embed the social media components to thewebsite. d. Incorporate the database interaction with the website. e. Deploy the developed website in the server.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Apply basic techniques for field measurements, masonry work and plumbing.
CO2	Make use of workshop trades like carpentry, foundry, sheet metal and welding for practicing on manufacturing of components.
CO3	Develop simple components using Lathe, Drilling Machine and 3D Printer.
CO4	Construct the electrical wiring circuits for buildings based on their requirement.
CO5	Develop IoT based solutions and PCB for real world use cases.
CO6	Build and host an interactive dynamic website.

COs and POs Mapping:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	1	1	2	-	-	-	1	1	-	1	3	2	1
CO2	3	2	1	1	2	-	-	-	1	1	-	1			
CO3	3	2	1	1	2	-	-	-	1	1	-	1			
CO4	3	2	1	1	2	-	-	-	1	1	-	1	1	-	-
CO5	3	2	1	1	2	-	-	-	1	1	-	1			
CO6	3	2	1	1	2	-	-	-	1	1	-	1	-	1	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

The weightage of Continuous Internal Evaluation (CIE) is 60% and for End Semester Examination (ESE) is 40%

S.No	Component	Type of Assessment	Max Marks	Reduced Marks	Total	Final Marks
1.	**Continuous Internal Examination(CIE) - Laboratory**	Continuous Assessment	75	75	100	60
2.		Model Lab Exam	25	25		
3.	**End Semester Examination (ESE)**	Lab Exam	100	40	40	40
					Total	100

Assessment Pattern

Bloom's Category	Terminal Examination
Remember	0
Understand	0
Apply	100
Analyze	0
Evaluate	0
Create	0

Reference Books:

1. AICTE's Prescribed Textbook: Workshop / Manufacturing Practices (with Lab Manual) ISBN: 978-93-91505-332
2. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
3. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4 th edition,Pearson Education India Edition, 2002.
4. Gowri P. Hariharan and A. Suresh Babu," Manufacturing Technology – I" Pearson Education, 2008.
5. Roy A. Lindberg, "Processes and Materials of Manufacture", 4 th edition, Prentice Hall India, 1998.
6. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House, 2017.

Course Code:	**24EN231**	**Course Title:**	**PRESENTATION AND COMMUNICATION SKILLS LABORATORY (Common to AI& DS, AE,BME,CE,CSE,CSE(AI& ML),EEE, ECE,MECH)**
Credits:	**1.5**	**L – T – P**	**0-0-3**
Pre -requisite			**24EN101 ENGLISH FOR ENGINEERS**

Course objectives:

- To apply critical listening skills.
- To make use of critical thinking skills.
- To apply stress as well as tonal variation.
- Make use of language skills to produce error free sentences
- To experiment with presentation skills.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Lab experiment videos
2. Blended Mode of Learning
3. Project based Learning
4. Smart Classroom
5. Flipped Class

	UNIT I	**[12 hours]**
	LIST OF EXERCISES	
LAB ACTIVITIES		
Sl. No.	Topic	Hours
1.	Listening to Audio (Podcasts, Audiobooks, Radio Program) and Practice Exercises, making a critical appreciation of Audio content	3
2.	Listening to BBC news	2
3.	Listening to British council/ Cambridge English (Selected topics)	2
CLASSROOM ACTIVITIES		
1.	Speaking Current issues (Selected topics)	2

2.	Making Conversation at work place, Public speaking based on a festival, Celebrations	3

UNIT II		[12 hours]
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl.No.	Topic	Hours
1	English Movie clips and software in the Lab C (Globe Rena)	3
2	Vocabulary Development through movies/ short films/ Documentaries	2
CLASSROOM ACTIVITIES		
1	Speaking- Just a minute talk and expressions for plans and decisions	2
2	Marketing of a Product	2
3	Describing a process in industry	2
4	Writing- Writing a Complaint Letter about a manufacturing defect of a product	1

UNIT III		[12 hours]
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	Topic	Hours
1.	Listening to TED talks, scientific lectures.	3
2.	Reading Comprehension strategies	2
3.	Reading- Editorials	2
CLASSROOM ACTIVITIES		
1.	Speaking- Introduction to Phonetics- Speech sounds- Vowels and Consonants- Stress- Rising/ Falling Tone	2
2.	Writing- A day in my life	2
3.	Writing- Situational Dialogues	1

UNIT IV		[12 hours]
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	Topic	Hours

1.	Reading Popular Blogs	3
2.	Creating a Blog	2
CLASSROOM ACTIVITIES		
1.	Errors in Pronunciation. Error detection	3
2.	Writing- Terminology for Engineers. Writing- Preparing day today scripts.	2 2

UNIT V		**[12 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	Topic	Hours
1.	Prepare power Point presentation for topics, selected by the students	3
2.	Reading newspaper articles	2
CLASSROOM ACTIVITIES		
1.	Present the selected topic.	3
2.	Making a short speech- Extempore	2
3.	Writing- Expanding a Proverb Writing Instructions	2

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Build communicative competence through critical listening skills.
CO2	Make use of critical thinking skills to express plans and opinions.
CO3	Apply stress as well as tonal variations for effective communication.
CO4	Make use of language skills to produce error free sentences.
CO5	Experiment with presentation skills to address confidently.

COs and POs Mapping:

COs	**POs**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1						-	-	-	-	3	-	3
CO2						-	-	-	-	3	-	3
CO3						-	-	-	-	-	-	3
CO4						-	-	-	-	-	-	3
CO5						-	-	-	-	3	-	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Name of the Test	Marks	Total	Reduced to
Continuous Assessment (Experiments 1-10)	50	100	50
Model Examination	50		
End Semester Lab Exam	100	100	50
		TOTAL	**100 MARKS**

Textbooks:

1. Raman, Meenakshi and Sangeetha Sharma. Professional Communication. Oxford University Press, Oxford, 2014.
2. Dr. Chellammal. V. Learning to Communicate. Allied Publishers, New Delhi, 2003.
3. Mohan, Krishna. And Meera Bannerjee. Developing Communication Skills. Macmillan India Ltd. 1990.

Reference Books:

1. Murphy – Raymond. English Grammar in Use BOOK with Answers: A Self-Study. Reference and Practice Book for Intermediate Learners of English. Fourth edition: Cambridge University Press – 2012.

MANUALS/ SOFTWARE: Open Sources / Websites

ROHINI **COLLEGE OF ENGINEERING AND TECHNOLOGY**

(AUTONOMOUS)

(Anjugramam-Kanyakumari Main Road, Palkulam,Variyoor P.O.-629 401, K.K.Dist.)

Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai

Accredited with A+ Grade by NAAC

B.E. Computer Science and Engineering

(B.E CSE)

Curriculum & Syllabus

(*2024-2025 Admitted Students Onwards*)

Vision Statement of RCET

To be an academic institute of continuous excellence towards education and research in rural regime and provide service to nation in terms of nurturing potentially higher social, ethical and engineering companion graduands.

Mission Statement of RCET

To foster and promote technically competent graduands by imparting the state of art Engineering education in rural regime.

To enunciate research assisted scientific learning by dissemination of knowledge towards science, agriculture, industry and national security.

Vision of the Department

To create young software professionals to compete the global challenges in the field of computer science and engineering and be researcher to meet the need of society.

Mission of the Department

- ✓ To provide quality education to develop software for real time problem in scientific and business application for various needs of industry.
- ✓ To provide learning ambience to enhance innovations, problem solving skill, leadership qualities, team spirit and ethical responsibility to serve the society.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1	The graduates will be able to design and to adapt modern tools to innovate ideas and develop computational solution for technological problem.
PEO2	The graduates will be able to develop professional skills for employment and understand the need of lifelong learning for a successful professional career.
PEO3	To develop an ability to become successful professional, entrepreneur and urge for pursuing higher studies.

PROGRAMME OUTCOMES (POs)

PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply

	these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life- long learning in the broadest context of technological change.

CREDIT INFO		
Sl.No	Category	Credits
1	Humanities and Social Science (HSS)	13
2	Basic Science Courses (BSC)	25
3	Engineering Science Courses (ESC)	25
4	Professional Core Course(PCC)	59
5	Professional Electives Courses (PEC)	18
6	Open Electives Courses (OEC)	12
7	Employability Enhancement Courses (EEC)	17
8	Mandatory Courses (MNC)	-
Total Credits		169

Humanities and Social Science (HSS)							
Sl.no	Course Code	Course Title	Course Type	L	T	P	Credit
1	24GE101	Heritage of Tamils	HSS	1	0	0	1
2	24EN101	English For Engineers	HSS	2	0	1	2.5
3	24GE201	Tamils and Technology	HSS	1	0	0	1
4	24EN231	Presentation And Language Skills Laboratory	HSS	0	0	3	1.5
5	24MG601	Product Innovation & Entrepreneurship	HSS	2	0	0	2
6	24GE701	Professional Ethics and Human Values	HSS	2	0	0	2
7	24MG701	Economics for Engineers	HSS	3	0	0	3
Basic Science Courses (BSC)							
Sl.no	Course Code	Course Title	Course Type	L	T	P	Credit
1	24MA101	Matrices and Calculus	BSC	3	1	0	4
2	24PH101	Engineering Physics	BSC	3	0	2	4
3	24CY101	Engineering Chemistry	BSC	3	0	2	4
4	24MA201	Complex Variables and Transform	BSC	3	1	0	4
5	24MA301	Probability, Random Processes and Statistics	BSC	3	1	0	4
6	24MA402	Discrete Mathematics & Linear Algebra	BSC	3	0	0	3
7	24CY401	Environmental Science and Engineering	BSC	2	0	0	2

Engineering Science Courses (ESC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24ME201	Engineering Graphics & Design	ESC	1	0	4	3
2	24CS201	Programming for Problem Solving using C	ESC	2	0	4	4
3	24EC302	Digital Logic Circuits and Design	ESC	3	0	2	4
4	24EE202	Fundamentals of Electrical and Electronics Engineering	ESC	3	0	0	3
5	24EE404	IoT - Sensors and Devices	ESC	3	0	2	4
6	24CS301	Programming for Problem Solving using Python	ESC	0	0	3	1.5
7	24GE231	Workshop Practices	ESC	0	0	3	1.5
8	24CS303	Computer Architecture and Organization	ESC	2	0	2	3
Professional Core Courses (PCC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24EC501	Microprocessors, Microcontrollers and Interfacing Techniques	PCC	3	0	2	4
2	24CS301	Data Structures and Algorithms	PCC	3	0	2	4
3	24CS302	Object Oriented Programming using Java	PCC	3	0	2	4
4	24CS304	Database Management Systems	PCC	3	0	2	4
5	24CS403	Theory of Computation	PCC	3	1	0	4
6	24CS404	Operating Systems	PCC	3	0	0	3
7	24CS405	Software Engineering & Package Development	PCC	3	0	2	4
8	24CS401	Computer Networks	PCC	2	0	2	3
9	24CS431	Operating Systems Lab	PCC	0	0	2	1
10	24CS432	Application Development Lab	PCC	0	0	2	1
11	24CS501	Compiler Design	PCC	3	0	2	4
12	24CS502	Artificial Intelligence	PCC	3	0	2	4
13	24CS503	Design and Analysis of Algorithms	PCC	3	0	2	4
14	24CS601	Object Oriented Analysis and Design	PCC	3	0	0	3
15	24CS602	Cryptography & Network Security	PCC	3	0	2	4

16	24AI701	Augmented Reality, Virtual Reality with AI	PCC	3	0	2	4
17	24AI402	Applied Machine Learning	PCC	3	0	2	4
Professional Electives Courses (PEC)							
Professional Elective I - Data Science							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24AI571	Exploratory Data Analysis	PEC	3	0	0	3
2	24AI572	Recommender Systems	PEC	3	0	0	3
3	24AI573	Big Data Analytics	PEC	3	0	0	3
4	24AI574	Cognitive Science	PEC	3	0	0	3
5	24AI575	Natural Language Processing	PEC	3	0	0	3
6	24AI576	Computer Vision	PEC	3	0	0	3
Professional Elective II - Full Stack Development							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24CS581	Agile Software Development	PEC	3	0	0	3
2	24CS582	UI and UX Design	PEC	3	0	0	3
3	24CS583	Web Frameworks	PEC	3	0	0	3
4	24CS584	App Development	PEC	3	0	0	3
5	24CS585	Software Testing and Automation	PEC	3	0	0	3
6	24CS586	DevOps	PEC	3	0	0	3
Professional Elective III - Cloud Computing and Data Center Technologies							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24CS671	Virtualization in Cloud Computing	PEC	2	0	2	3
2	24CS672	Cloud Services and Data Management	PEC	2	0	2	3
3	24CS673	Cloud Storage Technologies	PEC	2	0	2	3
4	24CS674	Cloud Automation Tools and Applications	PEC	2	0	2	3
5	24CS675	Software Defined Networks	PEC	2	0	2	3
6	24CS676	Security and Privacy in Cloud	PEC	2	0	2	3
Professional Elective IV - Cyber Security and Data Privacy							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24CS681	Cyber Security	PEC	2	0	2	3
2	24CS682	Modern Cryptography	PEC	2	0	2	3
3	24CS683	Cyber Forensics	PEC	2	0	2	3

4	24CS684	Ethical Hacking	PEC	2	0	2	3
5	24CS685	Crypto currency and Block chain Technologies	PEC	2	0	2	3
6	24CS686	Malware Analysis	PEC	2	0	2	3
Professional Elective V - Creative Media							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24CS771	Multimedia and Animation	PEC	3	0	0	3
2	24CS772	UI and UX Design	PEC	3	0	0	3
3	24CS773	Augmented Reality and Virtual Reality	PEC	3	0	0	3
4	24CS774	Game Development	PEC	3	0	0	3
5	24CS775	Video Creation and Editing	PEC	3	0	0	3
6	24CS776	Digital Marketing	PEC	3	0	0	3
Professional Elective VI – Artificial Intelligence and Machine Learning							
1	24CS781	Knowledge Engineering	PEC	3	0	0	3
2	24CS782	Soft Computing	PEC	3	0	0	3
3	24CS783	Neural Networks and Deep Learning	PEC	3	0	0	3
4	24CS784	Text and Speech Analysis	PEC	3	0	0	3
5	24CS785	Optimization Techniques	PEC	3	0	0	3
6	24CS786	Ethics and AI	PEC	3	0	0	3
Open Electives Courses (OEC)							
Open Elective I - Electronics and Communication Engineering							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24EC501	Nano Electronics	OEC	3	0	0	3
2	24EC503	Digital Signal Processing	OEC	3	0	0	3
3	24EC504	Fuzzy Logic Systems and ANN	OEC	3	0	0	3
4	24EC505	Consumer Electronics	OEC	3	0	0	3
5	24EC506	Electronic System Design	OEC	3	0	0	3
6	24EC507	Electronic Packaging	OEC	3	0	0	3
Open Elective II - Civil and Agricultural Engineering							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24AG601	Principles of Crop Production	OEC	3	0	0	3
2	24AG602	Dairy and Food Engineering	OEC	3	0	0	3
3	24AG603	Post-Harvest Technology	OEC	3	0	0	3
4	24AG604	Agricultural Finance, Banking and Cooperation	OEC	3	0	0	3
5	24CI601	Rural Development	OEC	3	0	0	3

6	24CI602	Geographic Information System	OEC	3	0	0	3
7	24CI603	Water Resources management	OEC	3	0	0	3
8	24CI604	Climate Change and its Impact	OEC	3	0	0	3
Open Elective III - Bio Medical and Electrical Engineering							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24BM701	Wearable Devices	OEC	3	0	0	3
2	24BM702	Telemedicine and Healthcare Delivery	OEC	3	0	0	3
3	24BM703	Medical Informatics	OEC	3	0	0	3
4	24BM704	Basics of Human Anatomy and Physiology	OEC	3	0	0	3
5	24EE701	Robot Process Automation	OEC	3	0	0	3
6	24EE702	Electric vehicle Technology	OEC	3	0	0	3
7	24EE703	Smart Grid	OEC	3	0	0	3
8	24EE704	Energy Conservation and Management	OEC	3	0	0	3
Open Elective IV - Mechanical and Management							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24ME701	Additive Manufacturing	OEC	3	0	0	3
2	24ME702	Rocket Propulsion	OEC	3	0	0	3
3	24ME703	Industrial Safety	OEC	3	0	0	3
4	24ME704	Marine Vehicles	OEC	3	0	0	3
5	24MG701	Digital Marketing	OEC	3	0	0	3
6	24MG702	Industrial Psychology	OEC	3	0	0	3
7	24MG703	Logistics and Supply chain Management	OEC	3	0	0	3
8	24MG704	Corporate Social Responsibility	OEC	3	0	0	3
Employability Enhancement Courses (EEC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24CS351	Mini Project-I (Design Thinking & System Thinking)	EEC	0	0	2	1
2	24CS451	Mini Project-II (Society Attachment)	EEC	0	0	2	1
3	24EN451	Soft Skills Development	EEC	0	0	2	1
4	24CS551	Mini Project-III (Industry Attachment)	EEC	0	0	2	1
5	24EN651	Business And Managerial Communications	EEC	0	0	2	1

6	24GE551	Quantitative and Reasoning Skills-I	EEC	0	0	2	1
7	24CS651	Mini Project- IV (Development of Products)	EEC	0	0	2	1
8	24GE651	Quantitative and Reasoning Skills-II	EEC	0	0	2	1
9	24CS751	Project Work Phase I (Design & Analysis)	EEC	0	0	4	2
10	24CS752	Industrial Training/Internship	EEC	0	0	0	2
11	24CS851	Project Work Phase - II (Prototype& Testing)	EEC	0	0	10	5
Mandatory Courses (MNC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24MC101	Induction Programming	MNC	THREE WEEKS			
2	24MC201	Sports and Yoga for Youth Empowerment - I	MNC	0	0	2	0
3	24MC202	NCC Credit Course Level - I	MNC	1	0	2	1#
4	24MC301	Sports and Yoga for Youth Empowerment - II	MNC	0	0	2	0
5	24MC401	NCC Credit Course Level - II	MNC	1	0	2	1#
6	24MC601	Disaster Management	MNC	1	0	0	1#
7	24MC701	Constitution of India	MNC	0	0	1	1#

 # denotes no credit

SCHEME OF INSTRUCTION FOR FIRST YEAR B.E.

I SEMESTER

S.no	Course code	Course Title	Category	L	T	P	C
THEORY COURSES							
1	24GE101	Heritage of Tamils	HSS	1	0	0	1`
2	24MA101	Matrices and Calculus	BSC	3	1	0	4
THEORY COURSE WITH LABORATORY COMPONENT							
3	24EN101	English for Engineers	HSS	2	0	1	2.5
4	24PH101	Engineering Physics	BSC	3	0	2	4
5	24CY101	Engineering Chemistry	BSC	3	0	2	4
6	24ME201	Engineering graphics & design	ESC	1	0	4	3
7	24CS201	Programming for problem solving using c	ESC	2	0	4	4
MANDATORY COURSES							
8	24MC101	Induction programming	MNC	THREE WEEKS			
TOTAL				14	1	15	22.5

II SEMESTER

S.no	Course code	Course Title	Category	L	T	P	C
THEORY COURSES							
1	24GE201	Tamil and technology	HSS	1	0	0	1`
2	24MA201	Complex Variables and Transforms	BSC	3	1	0	4
THEORY COURSE WITH LABORATORY COMPONENT							
4	24EC302	Digital logic circuits and design	ESC	3	0	2	4
5	24EE202	Fundamentals of Electrical and Electronics engineering	ESC	3	0	2	4
6	24EE404	IoT - Sensors and Devices	ESC	3	0	2	4
LABORATORY COURSES							
7	24CS301	Programming for problem solving using python	ESC	0	0	3	1.5
8	24GE231	Workshop practices	ESC	0	0	3	1.5
9	24EN231	Presentation and language Skills laboratory	HSS	0	0	3	1.5
MANDATORY COURSES							
10	24MC201	Sports and yoga for youth empowerment - II	MNC	0	0	2	0
11	24MC202	NCC CREDIT COURSE LEVEL - I	MNC	1	0	2	1#
TOTAL				13	1	15	21.5

பாடநெறி குறியீடு:	**24GE101**	***பாடத்தின் தலைப்பு:***	***தமிழர்மரபு*** (Common to AI&DS,AE,BME,CE,CSE,CSE (AI&ML),EEE,ECE,MECH)
கிரெடிட்	**1**	**L – T – P**	**1-0-0**

பாடத்திட்ட நோக்கங்கள்:
தமிழின் மதச்சார்பற்ற தன்மை, இந்திய மொழிக் குடும்பத்தின் திராவிட மொழி, திருக்குறளின் கருத்துக்கள், சமயங்களின் தாக்கம், நவீன இலக்கிய வளர்ச்சி ஆகியவற்றை நினைவு கூர்தல். தமிழர்களின் சமூக மற்றும் பொருளாதார வாழ்வில் நடுகல், சிற்பங்கள், சிலைகள் மற்றும் அழகிய கைவினைப் பொருட்கள், இசைக்கருவிகள் ஆகியவற்றின் தொடர்புடைய அறிவைக் கோடிட்டுக் காட்டுதல். தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகளை மனதில் பதிய வைத்தல். தமிழ்நாட்டின் தாவரங்கள் மற்றும் விலங்கினங்கள், சங்க நகரங்கள் மற்றும் துறைமுகங்கள், சங்க காலத்தின் ஏற்றுமதி மற்றும் இறக்குமதிகளை நினைவுபடுத்துதல், வெளிநாடுகளில் சோழர் படையெடுப்பைக் கண்டறிதல். இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கைக் கண்டறிதல், இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்குக்கு இணையாக இந்தியாவின் பிற பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கத்தை அடையாளம் காணுதல்.

அலகு I மொழி மற்றும் இலக்கியம்:	**[3hours]**
இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம்- பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும்	

பாரதிதாசன் ஆகியோரின் பங்களிப்பு.	
அலகு II மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக்கலை:	**[3hours]**
நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.	

அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:	**[3hours]**
தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.	

அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள்:	**[3hours]**
தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறைமுகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி.	

அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு:	**[3hours]**
இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தங்கங்களின் அச்சு வரலாறு.	

பாடநெறி முடிவுகள் (பாமு):

பாடநெறியின் முடிவில், மாணவர் பின்வரும் திறன்களைப் பெறுவர்:

பாமு	பாடநெறி முடிவுகள்	மிக உயர்ந்த அறிவாற்றல் நிலை
அலகு I பாமு:	தமிழின் மதச்சார்பற்ற தன்மை, திராவிட மொழியின் பங்கு, திருக்குறளின் கருத்துக்கள், சமயங்களின் தாக்கம், நவீன இலக்கிய வளர்ச்சி ஆகியவற்றையும் தெரிந்துகொள்கிறார்கள்.	கே 1
அலகு II பாமு:	தமிழர்களின் சமூக மற்றும் பொருளாதார வாழ்வில் நடுகல், சிற்பங்கள், சிலைகள் மற்றும் அழகிய கைவினைப் பொருட்கள், இசைக்கருவிகள் ஆகியவற்றை விவரிக்கும் ஆற்றலை பெறுகிறார்கள்.	கே 2
அலகு III பாமு:	தமிழர்களின் பாரம்பரிய விளையாட்டுகளை தெரிந்து கொள்ளுவதால் விளையாட வேண்டும் ஏன்ற ஆர்வத்தை பெறுகிறார்கள்.	கே 1
அலகு IV பாமு:	தமிழ்நாட்டின் தாவரங்கள் மற்றும் விலங்கினங்கள் பற்றிய அறிவையும், சங்க கால கட்டிடக்கலை, ஏற்றுமதி மற்றும் இறக்குமதி தொழில் நுட்ப அறிவை பெறுகிறார்கள்..	கே 1
அலகு V பாமு:	இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கையும், இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு இணையாக இருப்பதையும், தெரிந்து கொள்கிறார்கள்.	கே 1

பாடநெறி முடிவுகள் ***மற்றும் நிரல் முடிவுகள் ஒப்பிடுதல்***

பாமுகள்	மிக உயர்ந்த அறிவாற்றல் நிலை	பாடநெறி முடிவுகள்											
		1	2	3	4	5	6	7	8	9	10	11	12
பாமு1	கே 1	2	-	-	-	-	-	-	-	-	-	-	-
பாமு2	கே 2	1	-	-	-	-	-	-	-	-	-	-	-
பாமு3	கே 1	1	-	-	-	-	-	-	-	-	-	-	-
பாமு4	கே 1	1	-	-	-	-	-	-	-	-	-	-	-
பாமு5	கே 1	1	-	-	-	-	-	-	-	-	-	-	-

நிலை 3- அதிக ஒத்துப்போதல், நிலை 2- மிதமாக ஒத்துப்போதல், நிலை 1- குறைவாக ஒத்துப்போதல், நிலை 0- ஒத்துப்போகவில்லை

மதிப்பீட்டுத் திட்டம்:

கூறுகள்	மதிப்பீட்டின் வகை	அதிகபட்ச மதிப்பெண்கள்	குறைக்கப்பட்ட மதிப்பெண்கள்	இறுதி மதிப்பெண்கள்
தொடர்ச்சியான உள் தேர்வு	தொடர்ச்சியான உள் தேர்வு - I	100	40	40
	தொடர்ச்சியான உள் தேர்வு - II	100	40	
இறுதி பருவ தேர்வு	எழுத்து தேர்வு	100	60	60
			மொத்தம்	100

இறுதி பருவ தேர்வு: (கேள்வி முறை)

- ஒவ்வொரு யூனிட்டும் இரண்டு 2 மதிப்பெண் வினாக்களையும் ஒரு 16 மதிப்பெண் வினாவையும் (இரண்டில் ஒன்று) கொண்டுள்ளது.
- பதினைந்து கேள்விகளுக்கும் பதிலளிக்க வேண்டும்.

மதிப்பீட்டு முறை

ப்ளூமின் வகை	தொடர்ச்சியான மதிப்பீட்டு சோதனைகள்		இறுதி தேர்வு
	1	2	
நினைவில் கொள்ளுதல்	60	50	60
புரிந்து கொள்ளுதல்	40	50	40
விண்ணப்பித்தல்	0	0	0
பகுப்பாய்வுதல்	0	0	0
மதிப்பிடுதல்	0	0	0
உருவாக்குதல்	0	0	0

TEXT BOOKS:

1. தமிழகவரலாறு - மக்களும்பண்பாடும் - கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்).
2. கணினித்தமிழ் - முனைவர்இல. சுந்தரம். (விகடன்பிரசுரம்).
3. கீழடி - வைகைநதிக்கரையில்சங்ககாலநகரநாகரிகம் (தொல்லியல்துறைவெளியீடு)
4. பொருநை - ஆற்றங்கரைநாகரிகம். (தொல்லியல்துறைவெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.

REFERENCE BOOKS:

1. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
2. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
3. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department ofArchaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
4. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
5. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
6. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Course Code:	24MA101	Course Title:	**Matrices and calculus** (Common to AI&DS,AE,BME,CE,CSE,CSE(AI&ML),EEE, ECE,MECH)
Credits:	**4**	**L – T – P**	**3 – 1 – 0**
Pre-requisite			**NIL**

Course objectives:

- To provide the basic tools of calculus mainly for the purpose of modeling the engineering problems mathematically and obtaining solutions.
- To learn the concept of eigenvalues and eigenvectors and to reduce the quadratic form to canonical form.
- To learn the foundation course of Single Variable and multivariable calculus plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

Teaching-Learning Process:

These are sample strategies which teachers can use to accelerate the attainment of the various course outcomes.

Lecture method does not mean only traditional method, but different type of teaching methods may be adopted to develop the outcomes.

Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.

Topics will be introduced in a multiple representation and encourage the students to come up with their own creative ways to solve them.

Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT I – Matrices	**[12 hours]**

Eigenvalues and Eigenvectors and their properties – Diagonalization of a matrix (Symmetric matrix) – Cayley - Hamilton theorem (without proof) – Inverse and Power of a matrix by Cayley - Hamilton theorem – Quadratic forms and Nature of quadratic forms.

Application: Reduction of a quadratic form to canonical form by orthogonal transformation.

UNIT II – Differential Calculus	[12 hours]
Functions – Limit – Continuity – Derivatives – Differentiation rule – Product and quotient rules – Chain rules – Implicit differentiation – Logarithmic differentiation. Application: Maxima and Minima of functions of one variable	

UNIT III – Functions of Several Variables	[12 hours]
Partial differentiation – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables. Application: Maxima and Minima of functions of two variables using MATLAB - Lagrange's method of undetermined multipliers.	

UNIT IV – Integral Calculus	[12 hours]
Definite and Indefinite integrals - Substitution rule - Techniques of Integration: Bernoulli's theorem (without proof) – Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals. Application: Area between simple closed curves.	

UNIT V – Multiple Integrals	[12 hours]
Double integrals –Double integrals in cartesian and polar coordinates – Change of order of integration– Area enclosed by plane curves – Triple integrals – Change of variables in double and triple integrals. Application: Volume of solids, Mass of Lamina	

Course outcomes:

On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Apply the matrix algebraic techniques for eigen value related applications	K3
CO2	Understand the concepts of limit and continuity of functions	K2
CO3	Compute the derivatives and the extreme points and solve engineering problems	K3

CO4	Use the partial derivatives to find the maxima and minima of multivariable functions	K3
CO5	Use fundamental theorem of calculus to evaluate definite integrals	K3
CO6	Apply the concepts of multiple integrals to find the areas and volumes of geometrical shapes	K3

COs and POs Mapping:

COs	**POs**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	2	1	-	2	-	-	-	-	-	-	2
CO2	2	1	1	-	-	-	-	-	-	-	-	1
CO3	3	2	1	-	2	-	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	-
CO6	3	2	1	-	1	-	-	-	-	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or choice).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	20	20	20
Understand	40	20	20
Apply	40	60	60
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
3. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 2015. [For Units II & IV - Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8]

Reference Books:

1. Muthusubramanian R and Salivahanan S, "Basic Electrical and Electronics Engineering," McGraw Anton. H, Bivens. I and Davis. S, " Calculus ", Wiley, 10th Edition, 2016
2. Bali. N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
3. Jain. R.K. and Iyengar. S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition, 2016.
4. Narayanan. S. and Manicavachagom Pillai. T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.
5. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.Hill, NewDelhi, 2009.

Equivalent NPTEL/SWAYAM Courses

SI.No.	Course Title	Course Instructor	Host Institute
1	Matrix Analysis with Applications	Prof. S. K. Gupta Prof. Sanjeev Kumar	IIT Roorkee
2	Calculus of One Real Variable	Prof. Joydeep Dutta	IIT Kanpur

Web Links and Video Lectures (E-Resources):

1. System of Linear Equations, Eigenvalues and Eigenvectors: https://www.nptelvideos.com/lecture.php?id=13416
2. Concept of Domain, Limit, Continuity and Differentiability: https://www.nptelvideos.com/lecture.php?id=13422
3. Matrix Diagonalization: https://www.nptelvideos.com/lecture.php?id=13481

Course Code:	**24EN101**	**Course Title:**	**ENGLISH FOR ENGINEERS** (Common to AI&DS, AE,BME,CE,CSE,CSE(AI&ML),EEE, ECE,MECH)
Credits:	**2.5**	**L – T – P**	**2-0-1**
Pre-requisite			**NIL**

Course Objectives:

- To develop an understanding of Basic English Grammar.
- To enhance listening skills and select appropriate responses.
- To practise presentation and speaking techniques.
- To develop a quest for reading.
- To practise professional writing.

Teaching-Learning Process:
Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. Language learning softwares / Language Lab 3. Online Resources 4. Smart Class Room 5. Flipped classrooms 6. Project based Collaborative Experiential learning 7. Expert Lecture sessions

UNIT I - BASIC GRAMMAR- VOCABULARY AND EXPRESSIONS	**[8 hours]**
Grammar: Parts of speech - Types of sentences: Assertive - Imperative - Interrogative & Exclamatory - Affirmative - Negative - Gerunds & Infinitives - Tenses - Voices- Impersonal passives- Prepositions -Articles & Determiners- Cause and effect expressions - Vocabulary: Affixes- Synonyms & Antonyms - Homonyms - Homophones- Compound Nouns.	

UNIT II - ACTIVE LISTENING - RESPONDING		**[15 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
SI. No.	**Topic**	**Hours**
1.	Listening to Audio (Podcasts- Audiobooks- Radio Program) and Practice Exercise-Answering Cloze Test Based on Listening	3
2.	Listening to native speaker’s Telephone Conversations– Analyzing a Product	3
3.	Listening to Job Interviews - Sports Commentaries /	3

	Animated stories / Anecdotes / Event narration	
4.	Video Comprehension – Brainstorming and Note-Taking	3
CLASSROOM ACTIVITIES		
1.	Listening to Statistical Information and Follow-up Exercises. - Form Filling Exercises	1
2.	Debate and reviewing the performance of each participant - Panel Discussion	2

UNIT III: SPEAKING AND PRESENTATION SKILLS		**[15 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
SI. No.	**Topic**	**Hours**
1.	Speaking Development through English software S-net or Globarena and Online Content (Tenses- Voices- SV Agreement- Prepositions- Coherence Markers- Relative Clauses- Modals- Punctuation)	5
CLASSROOM ACTIVITIES		
1.	Self-Introduction - Sharing Childhood Experiences- Talking about Favorite Personalities	1
2.	Describing Recent Innovation in Technology	1
3.	Interviewing Celebrities and Entrepreneurs	1
4.	Situational Conversations (Meeting a friend in a cafe) - Narrating Personal Experience	1
5.	Group Communication- Discussing Social Issues- Current Affairs and Debate	1
6.	Role-Play- Picture/Movie Description	1
7.	Presentation – I (Book /Movie Review- Story Telling- General	2

	Presentations)	
8.	Presentation – II (Technical Presentations)	2

UNIT IV: READING BETWEEN LINES		**[12 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
SI. No.	**Topic**	**Hours**
1.	Reading Comprehension - skimming - scanning (General / Technical passages	2
2.	Reading Longer Texts with Time Frame	2
3.	Reading Data using different types of Texts- Magazines and Internet Materials	2
4.	Reading Research Papers-- Editing/Proofreading	2
CLASSROOM ACTIVITIES		
1.	Job Advertisements – Manual for Product/Service – Telephone Phrases	1
2.	Reading Cause and Effect Essays-Technical Papers and Case Studies - Sorting out jumbled Sentences in a Paragraph	2
3.	Short Stories - Critical Reading	1

UNIT V- WRITING FOR ENGINEERS	**[7+3 hours]**
Writing - Application Letters - Resume- Product Description - Essay related to Technical / Social / current topics - Interpretation of Charts - Short Articles on everyday life - letters – Enquiry- Quotation- Order- Claim - Adjustment - Response to complaints - Statement of Purpose (SoP) -Emails - Memos -Notices - Circulars - Minutes of Meetings - Internship - Accident Report - Feasibility Report- Recommendations.	

LIST OF EXERCISES

LAB ACTIVITIES		
SI. No.	**Topic**	**Hours**
1.	Mind Mapping and Brainstorming on any Social Event/Issue	1
2.	Creating a Blog/Vlog/YouTube Channel –Uploading MP3/MP4 – Practice (Movie/Book/ Gadget Review- General/Tech Talks- Interview with Celebrities)	1
3.	Creating a Product Review Blog.	1

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Domain
CO1	Identify various grammatical components- build vocabulary and apply expressions for error-free sentences	K3
CO2	Make use of appropriate words to respond by listening to general and technical online contents	K3
CO3	Experiment with the nuances of presentation and speaking skills	K3
CO4	Apply reading skills in various academic contexts	K3
CO5	Construct legible and flawless sentences proficiently with appropriate choice of words and structures for varied professional contexts	K3

COs and POs Mapping:

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	-	-	-	-	-	-	-	-	-	3	-	3
CO2	-	-	-	-	-	-	-	-	-	3	-	3
CO3	-	-	-	-	-	-	-	-	-	3	-	3
CO4	-	-	-	-	-	-	-	-	-	3	-	3
CO5	-	-	-	-	-	-	-	-	-	3	-	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max. Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - **Theory**	CIE – I	100	60	100	25
	CIE – II	100			
	Skill Assessment I (2 Assignments + 1 seminar)	40	40		
	Skill Assessment II (3 Assignments)	40			
Continuous Internal Examination (CIE) - **Laboratory**	Continuous Assessment (Lab activities & exercises)	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**Terminal Examination**
	1	**2**	
Remember	10	10	10
Understand	30	30	30
Apply	60	60	60
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Gangalakshmi- C- Rathika- B- Saranraj- L. Professional English for Engineers. New Delhi: Cengage- 2022.

2. Murphy- Raymond. English Grammar in Use Book with Answers: A Self-study Reference and Practice Book for Intermediate Learners of English. Fourth Edition: Cambridge University Press- 2012.

Reference Books:

1. Raman- Meenakshi and Sangeetha Sharma. Communication Skills. New Delhi: OUP- 2018
2. R. C. Sharma_ Krishna Mohan - Business Correspondence and Report Writing _ a Practical Approach to Business _ Technical Communication-Mc Graw Hill India (2017)

Web Links and Video Lectures (E-Resources):

MANUALS / SOFTWARE: Open Sources / British Council / Cambridge Websites

Suggested Skill Activities:

1) Listening tests materials [Select podcasts / radio programmes / YouTube videos / audiobooks / materials from British Council] - Cloze tests where students fill in missing words from transcripts – Yes or No Question Answers – one-word answers based on recording – summary of recording
2) Self-introduction / Introduce Colleague
3) Just a Minute talks
4) Extempore
5) Mock GDs
6) Mock Interviews
7) Note Taking of Engineering Lectures
8) Create videos / blogs
9) Present Technical Papers
10) Reading Comprehension Exercises
11) Writing letters – Leave letter – Letter for academic purposes

12) Writing Essays

13) Composing Mails

14) Preparing Statement of Purpose

15) Preparing Covering letter and Resume

Course Code:	**24PH101**	**Course Title:**	**ENGINEERING PHYSICS**
Credits:	**4**	**L – T – P**	**3-0-2**
Pre-requisite			**NIL**

Course Objectives:

- To make the students effectively to achieve an understanding of Mechanics
- To enable the students to gain knowledge of Elasticity.
- To enable the students to gain knowledge of Maxwell's Equation and Electromagnetic waves.
- To introduce the basics of optics and lasers.
- Equipping the students to successfully understand the importance of quantum physics.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I -MECHANICS	[9 hours]
Multiparticle dynamics: Center of mass (CM) – Rotation of rigid bodies: Rotational kinematics – Rotational kinetic energy and moment of inertia - Theorems of M .I –M.I of Uniform rod-M.I of a diatomic molecule - Torque– Rotational energy state of a rigid diatomic molecule - Gyroscope – Torsional stress and deformation-Torsional pendulum- Double pendulum.	
Practical Topics: 1. Torsional pendulum – Determination of rigidity modulus of wire and moment of inertia of disc. 2. Compound pendulum – Determination of rigidity modulus	

UNIT II - ELASTICITY	[9 hours]
Elasticity – Factors affecting Elasticity –Different types of Modulus- Moduli of elasticity and its relation -Stress - strain diagram and its applications - Bending of beams - Bending moment – Cantilever - Young's modulus : Uniform & Non-uniform bending-theory and experiment-I Shaped Girders.	
Practical Topics: 1. Determination of Young's modulus of a given material- Non uniform bending method 2. Uniform bending – Young's modulus determination.	

UNIT III - MAXWELL'S EQUATIONS AND ELECTROMAGNETIC WAVES	[9 hours]
The Maxwell's equations - wave equation- Plane electromagnetic waves in vacuum - properties of electromagnetic waves - Producing electromagnetic waves - Energy and momentum in EM waves - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium vacuum interface for normal incidence..	
Practical Topics: 1. Spectrometer – Determination of wavelength of Hg spectrum using grating. 2. Spectrometer – Angle of the prism 3. Spectrometer – Dispersive power of the prism	

UNIT IV - LASERS &FIBER OPTICS	[9 hours]
Lasers:-Einstein coefficients and their relations –-characteristics of laser - Types of Laser - Nd-YAG laser -semiconductor laser- Applications -Industrial, Medical, laser based military weapons Fiber optics: principle and classification of optical fibers – propagation of light in optical fiber - Numerical aperture and Acceptance angle– Fiber optic communication system - Applications - Displacement and pressure sensors – Endoscopy	
Practical Topics: 1. Determination the acceptance angle and numerical aperture of the given optical fiber. 2. Determination of the particle size of the given powder using laser 3. Determination of wavelength of a given laser source - Grating method	

UNIT V - QUANTUM MECHANICS	[9 hours]
Photons and light waves - Electrons and matter waves- Dual Nature of Light –-De Broglie Waves-Compton effect - The Schrodinger equation (Time dependent and time independent forms) - Physical Significance of wave function - Normalization –Free particle - particle in a infinite potential well: 1D,2D and 3D Boxes- Normalization-quantum computation.	
Practical Topics: 1, Young's Double Slit Experiment to demonstrate the wave nature of particles	

Laboratory component: **30 Hours**

Any ten experiments have to be completed from the following list ofExperiments

SI.No	Name of the experiment
1.	Apply parallel axis theorem to find the resultant of system of concurrent coplanar forces.
2.	Torsional pendulum – Determination of rigidity modulus of wire and moment of inertia of disc
3.	Compound pendulum- Determination of moment of inertia of a rigid rod.

4.	Apply the concept of bending of beams to find the Young's modulus of a given material- by Non uniform bending method
5.	Apply the concept of bending of beams to find the Young's modulus of a given material- by Uniform bending method.
6.	Determination of V-I characteristics of a solar cell.
7.	Using Ohm's law verify the laws of resistances .
8.	Using optical fiber find the acceptance angle and numerical aperture.
9.	Make use of the laser source find the particle size of the given powder.
10.	Determination of wavelength of a given laser source - Grating method.
11.	Spectrometer – Determination of wavelength of Hg spectrum using grating.
12.	Spectrometer – Dispersive power of the prism.
13.	Determination of magnetic Induction due to long current carrying conductor.
14.	Make use of the Young's Double Slit Experiment, demonstrate the wave nature of particles.
15.	Spectrometer – Angle of the prism

Course outcomes: On completion of the course, the student will have the ability to:

CO No	Corse Outcomes	Cognitive Domain
CO1	Apply the concepts of Mechanics in materials.	K3
CO2	Apply the concept of elasticity in beams.	K3
CO3	Apply the concept of electromagnetic waves in communication.	K3
CO4	Illustrate the applications of different lasers &Calculate the acceptance angle and numerical aperture of an optical fiber .	K2
CO5	Explain the quantum concepts and quantum computation.	K2

COs and POs Mapping:

COs	**POs**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	**3**	**2**	**2**	-	-	-	-	-	-	-	-	**1**
CO2	**3**	**2**	**2**	-	**1**	-	-	-	-	-	-	**1**
CO3	**3**	**2**	**2**	-	**1**	**1**	-	-	-	-	-	**1**
CO 4	**3**	**1**	**1**	-	**1**	**1**	-	-	-	-	-	**1**
CO 5	**3**	**1**	**1**	-	-	-	-	-	-	-	-	**1**

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	60	100	25
	CIE – II	100			
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

Assessment Pattern:

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

TEXT BOOKS:

1. D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw HillEducation (Indian Edition), 2017.
2. E.M.Purcell and D.J.Morin, Electricity and Magnetism, Cambridge Univ.Press,
3. 2013.
4. Bhattacharya, D.K. & Poonam, T. "Engineering Physics". Oxford University Press, 2015

REFERENCES:

1. R.Wolfson. Essential University Physics. Volume 1 & 2. Pearson Education(Indian Edition),2009.
2. Paul A. Tipler, Physic – Volume 1 & 2, CBS, (Indian Edition), 2004.
3. K.Thyagarajan and A.Ghatak. Lasers: Fundamentals and Applications, LaxmiPublications,(Indian Edition), 2019.
4. D.Halliday, R.Resnick and J.Walker. Principles of Physics, Wiley (IndianEdition), 2015.

Equivalent NPTEL/SWAYAM Courses:

SI.No	Course Name	Course Instructor	Course Conducting Agency
1	Quantum Mechanics	Prof .P.Ramadevi	IIT -Bombay

Web links and Video Lectures (e-Resources):

1. ELASTICITY

   https://youtu.be/eICv1p8WjgI?si=88hhiQw_fld7ZrBU

2. **MAXWELL'S EQUATIONS AND ELECTROMAGNETIC WAVES**

   https://youtu.be/3IPVZYf7C-U?si=PnP1nupcfGfr1C76

3. **LASERS &FIBER OPTICS**

   https://youtu.be/Ab1nxxkgjH8?si=KR2GS8iBUFayBwdp

4. **QUANTUM MECHANICS**

   https://youtu.be/AEedn_NiWN0?si=Y27pAqawlwKmthNO

Skill Assessment:

1. Explain the concept behind the balance a water bottle on a edge.
2. The leaning Tower of Pisa is able to stand tilted without toppling, what is the reason behind it.
3. Apply the elasticity concept to find the fatigue change in plastic fiber and natural fiber

4. Radio antennas emit visible light, Why
5. What does an opaque substance do when light rays fall on it.
6. Illustrate the things happen when light falls on a piece of black paper.
7. Explain the dual nature of matter.
8. Optical Fiber is used in hard to reach places in mechanical inspection explain it.
9. Is quantum communication faster than the speed of light
10. Compare electron microscope & tunneling microscope.

Course Code:	**24CY101**	**CourseTitle:**	**Engineering Chemistry** (Common to AI&DS,AE,BME,CE,CSE,CSE(AI&ML),EEE, ECE,MECH)
Credits	**4**	**L – T – P**	**3-0-2**
Pre-requisite			**NIL**

Course objectives:

- To provide a comprehensive understanding of water quality parameters, water treatment techniques and wastewater systems.
- To use the fundamental science and engineering principles relevant to materials that includes characterization, properties and processing of engineering materials.
- To familiarize with the principles, working and applications of electrochemistry and storage devices for safe, effective and efficient operations.
- To study, measure, monitor, control and prevent corrosion processes, economically andsafely.
- To classify different types of fuel and fuel analysis techniques that assists to choose mostconvenient fuel for a process involving combustion.

Teaching-Learning Process:
Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. Blended Mode of Learning 3. Experiential Learning 4. NPTEL and Other Videos for theory topics 5. Flipped Class 6. Lab Experiment Videos

UNIT I - WATER TREATMENT	**[9 hours]**
Water Sources- Water Quality parameters - Hardness of water – types-units and calcium carbonate equivalent. -Determination of hardness of water by EDTA method. Scale and sludge, caustic embrittlement, priming and foaming and boiler corrosion. Water softening methods – internal and external conditioning –zeolite process and ion exchange process. Desalination – reverse osmosis and electro dialysis- Municipal water treatment and waste water treatment process.	
Practical Topics: 1. Determination of total hardness by EDTA method. 2. Estimation of alkalinity by Indicator method. 3. Estimation of chlorine content in water sample by Argentometric method. 4. Determination of BOD in water samples.	

UNIT II - CHEMISTRY OF ENGINEERING MATERIALS	[9 hours]
Adhesives: Introduction- requisites of a good adhesive-adhesive action- industrial applications of adhesives. Insulating Materials: Introduction- requirements- Glass and ceramics - preparation, properties andapplications - fabrication of ceramic ware. Lubricants-Classification of lubricants with examples-characteristics of a good lubricants - mechanism of lubrication (thick film, thin film and extreme pressure) - properties of lubricants: viscosity, cloud point, pour point, flash point and fire point. Electronic materials: Introduction-types, properties and applications of semiconducting materials and transistors, materials used in IC's, fibers and cables- properties and applications, organic solar cells - types and applications.	
Practical Topics: 1. Determination of viscosity of oils using Oswald viscometer. 2. Determination of cloud point and pour point of oils.	

UNIT III -ELECTROCHEMISTRY	[9 hours]
Introduction – Electrode potential – Nernst equation and problems - Electrochemical series - Conductometric titrations (acid - base & precipitation titration) Electrodes: Construction, working and applications of Standard and reference electrode (Hydrogen & Calomel) – Ion selective (glass electrode) – determination of pH using glass electrode.Batteries and Fuel Cells – Types of batteries —dry cell -Lead Storage battery–Nickel-Cadmium Battery – Lithium battery – Battery hazards - Biological Batteries. Fuel Cells – Hydrogen-Oxygen FuelCell.	
Practical Topics: 1. Estimation of strength of hydrochloric acid by pHmetry. 2. Determination of strength of acids in a mixture of acids using conductivity meter.	

3. Determination of charging and discharging rate of batteries.	
UNIT IV -CORROSION AND ITS CONTROL	**[9 hours]**
Corrosion – causes, factors, types, Chemical and Electrochemical Corrosion (Galvanic, Differential aeration) –galvanic series-factors influencing rate of corrosion-measurement of corrosion. Determination of corrosion rate by weight loss method. Control Methods-Electrochemical protection – Sacrificial Anodic method – Impressed Current Cathodic Protection – Corrosion Inhibitors – Bio corrosion Protective Coatings – Paints, Constituents, Functions- Surface coating - Surface preparation for metallic coatings, Electroplating and Electro-lessPlating- ceramic coatings, thermal vaporization coating, HVOF coating	
Practical Topics: 1. Estimation of the Ferrous ions in mild steel by Spectrophotometry. 2. Determination of rate of corrosion of by weight loss method	

UNIT V- FUELS AND COMBUSTION	**[9 hours]**
Fuels: Introduction: Classification of fuels; solid fuel -Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Liquid fuels -Manufacture of synthetic petrol –hydrogenation of coal (Bergius process), Knocking – octane number, diesel oil – cetane number; Power alcohol and biodiesel. Combustion of fuels: Introduction: Calorific value – higher and lower calorific values, Theoretical calculation of calorific value by Dulong's formula - Ignition temperature: spontaneous ignition temperature, Explosive range; Flue gas analysis – ORSAT Method.	
Practical Topics: 1. Determination of flash point and fire point of fuels.	

Laboratory component: **30 Hours**

Any ten experiments have to be completed from the following list of experiments

SI.No.	Name of the experiment
1	Determine the total hardness of water sample by EDTA method.
2	Analyze the alkalinity of water sample by Indicator method.
3	Analyze the chlorine content in water sample by Argentometric method.
4	Determine the BOD of water samples.
5	Describe the procedure to determine the viscosity of oil using an Oswald viscometer.
6	Identify the cloud point and pour point of oils.
7	Make use of glass electrode to determine the strength of hydrochloric acid.
8	Make use of conductivity meter to determine the strength of acids in a mixture of acids.
9	Determine quantitatively the amount of Ferrous ions in mild steel by Spectrophotometry.
10	Determine the of rate of corrosion of by weight loss method.
11	Describe the procedure to determine the flash point and fire point of fuels.
12	Conduct a study to find out the charging and discharging rate of batteries.

Course outcomes: On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Level
CO1	Analyze the water quality parameters and choose appropriate water treatment methods for use in industries and daily life.	K4
CO2	Make use of the applications of the materials in different engineering disciplines.	K3
CO3	Utilize the principles of electrochemistry and find the materials for energy conversion and storage.	K4
CO4	Determine the corrosion rate to propose suitable protection methods for environmental considerations	K3
CO5	Choose suitable fuels for engineering processes and automobile applications.	K3

COs and POs Mapping

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	**3**	**2**	-	-	-	**1**	-	-	-	-	-	-
CO2	**3**	**2**	**1**	**1**	-	-	-	-	-	-	-	-
CO3	**3**	**2**	**1**	**1**	-	-	-	-	-	-	-	-
CO4	**2**	**1**	**1**	-	-	**1**	**2**	-	-	-	-	-
CO5	**3**	**2**	-	-	-	-	-	-	-	-	-	-

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	60	100	25
	CIE – II	100			
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	10	10	10
Understand	30	30	30
Apply	40	40	40
Analyze	20	20	20
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Jain P.C. and Jain M, Engineering Chemistry, Dhanpat Rai Publishing Company, New Delhi, 17th Edition,2021.
2. Dara S S and Umare S.S, A Text Book of Engineering Chemistry, S.Chand & Company Limited, 20thEdition, 2018.

Reference Books:

1. Benjamin M. M, Water Chemistry, Waveland Press, 2nd Edition, 2019.
2. Cicek V, Corrosion Engineering, Springer Publishing, 1st Edition, 2021.
3. Shahinpoor. M, Fundamentals of Smart Materials, Publisher: Royal Society of Chemistry, 1st Edition,2020.
4. Berg H, Bernhardsson S, and Johansson P, Electric Vehicle Batteries: Moving from Research towardsInnovation, Publisher: Springer, 1st Edition, 2019.
5. B.K.Sharma "Engineering chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2014).

Web links and Video Lectures (e-Resources):

1. Water and wastewater treatment - https://onlinecourses.nptel.ac.in/noc23_ce12/preview
2. SemiconductorDevices and circuits. - https://nptel.ac.in/courses/108108112
3. Corrosion ProtectionMethods - https://onlinecourses.nptel.ac.in/noc23_mm01/preview
4. Elementary Electrochemistry - https://onlinecourses.nptel.ac.in/noc23_cy19/preview
5. Fuel and combustionTechnology -https://archive.nptel.ac.in/courses/103/105/103105110/

Suggested Skill Activities:

1. Measure the TDS, PH & electrical conductivity of a home water.
2. Removal of temporary hardness of any water sample by suitable method.
3. Find the charging and discharging rate of mobile batteries when it is use or not.
4. The need of engineering material is essential in our day today life. - Justify the answer.
5. Measure the corrosion rate of iron bar when it is exposed in the environment.
6. List out the recent engineering materials used in emerging field.
7. Calculate the higher and lower calorific value of a fuel by using Dulong's formula.

8. List out the type of coatings applied on materials which are used in our daily life.
9. Improper disposal of batteries leads to environmental hazard. Suggest the suitable disposable method.
10. Pure Iron material undergo corrosion more fast than other materials. Give reasons.

Course Code:	**24ME201**	**Course Title:**	**Engineering Graphics and Design**
Credits:	**3**	**L – T – P**	**1-0-4**
Pre-requisite			**NIL**

Course objectives:

To impart knowledge on the

- To enable students to understand the standards and conventions of engineering drawing.
- To enhance the visualization skills to understand objects in the respective positions with respect to principal planes.
- To comprehend general projection theory, with emphasis on orthographic projection to represent three-dimensional objects in two-dimensional views.
- To emphasize freehand sketching and pictorial view to aid in the visualization process and to efficiently communicate ideas graphically.
- To Introduce CAD software for the creation of 3D models and 2D engineering drawings.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. NPTEL and Other Videos
3. Smart Class Room
4. Project based learning

UNIT I - DRAWING FUNDAMENTALS, GEOMETRIC CONSTRUCTION, PROJECTION OF POINTS, STRAIGHT LINES AND PLANES	[15 hours]
Drawing BIS standards – Orthographic projections – First angle projection - Drawing instruments – Sheet layout – Conventions – Lines, Lettering, Numbering and Dimensioning Geometric construction – Construction of regular polygons – Conic sections – Ellipse, Parabola and Hyperbola by eccentricity method.Projection of points – Points situated in all four quadrants. Projection of straight lines – Straight lines inclined to both principal planes – Finding true length of the line and true inclinations with respect to principal planes – Rotating line method. Projection of planes – Introduction – Polygonal lamina and Circular lamina - Orientation of planes - Plane parallel to both principal planes, Planes perpendicular to both principal planes and Planes inclined to both principal planes – Rotating object method.Orthographic projection of simple engineering components.	

UNIT II - PROJECTION OF SOLIDS	[15 hours]
Projection of solids – Introduction – Types of solids – Polyhedra and solids of revolution - Projection with axes inclined to one of the principal planes and parallel to other – Change of Position method. 2D drafting - Basic commands – Coordinate systems, Object section methods. Line, Circle, Polyline, Rectangle, Hatch, Fillet, Chamfer, Trim, Extend, Offset, Dim style – Annotation and Layering – Object snaps - 3D modelling – Basic commands – Extraction of multiple views – Part modelling of simple components - Utensils, Hand tools & Furniture etc. - Drawing views using 3D environment.	

UNIT III - DEVELOPMENT OF SURFACES AND PICTORIAL PROJECTION	[15 hours]
Development of lateral surfaces of truncated Prisms, Pyramids, Cylinders and Cones– Parallel line method and Radial line method. Pictorial Projection – Isometric projection – Introduction – Isometric scale – Isometric view of two right regular composite solids – Isometric projection of truncated frustum of solids – Box method. Problems on applications of Isometric projections of simple objects / engineering components.	

UNIT IV- BASIC COMPUTER AIDED DRAWING APPLICATIONS	[15 hours]
Free hand Sketching - Sketching of geometry - multiple view projection from single pictorial view of objects – Illustrative examples - True free hand, Guided Free hand, Roads, Buildings, Utensils, Hand tools & Furniture's etc.Drawing Simple Mechanisms - Bicycles, Tricycles, Gear trains, Ratchets, two-wheeler cart &Four-wheeler carts to dimensions etc.	

UNIT V- MULTIDISCIPLINARY APPLICATIONS AND PRACTICE	[15 hours]
Electric Wiring and lighting diagrams - Like, Automatic fire alarm, Call bell system, UPS system, Basic power distribution system using suitable software. Basic Building Drawing - Draw various types of lines, graphical symbols for materials, doors and windows, symbols for sanitary, water supply and electrical installations and write abbreviations as per IS 962. Like, Architectural floor plan, basic foundation drawing, steel structures- Frames, bridges, trusses using Auto CAD or suitable software, Electronics Engineering Drawings - Like, Simple Electronics Circuit Drawings, practice on layers concept. Graphs & Charts - Like, Column chart, Pie chart, Line charts, Gantt charts, etc. using Microsoft Excel or any suitable software.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Level
CO1	Apply principles of first angle projection in drafting plan and elevation of points, lines, planes, and solids.	K3
CO2	Apply change of position method in the projection of solids and determine the true shape of the section.	K3
CO3	Apply principles of orthographic projection to extract 2D views from 3D drawing using freehand sketching.	K3
CO4	Apply parallel line and radial line methods to develop lateral surfaces of solids so that students can understand applications in sheet metal design.	K3
CO5	Apply box method to develop the isometric view of simple, truncated, and composite solids.	K3

CO6	Develop simple part model in 3D and plan, elevation, and section of building using a designated CAD software.	K6

COs and POs Mapping:

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	-	-	-	-	-	-	-	2	-	-	1	2	-
CO2	3	1	-	-	-	-	-	-	-	2	-	-	1	2	-
CO3	3	1	-	-	-	-	-	-	-	-	-	-	1	2	-
CO4	3	1	-	-	-	-	-	-	-	2	-	-	1	-	-
CO5	3	1	-	-	-	-	-	-	-	2	-	-	1	2	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Lab Exam	100	50	50	50
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. N.D.Bhatt,“Engineering Graphics”, Charotor Publishing House, 53RD Edition 2019
2. Natrajan K.V., “A textbook of Engineering Graphics”, Dhanalakshmi Publishers, Chennai (2015)

Reference Books:

1. Venugopal K. and Prabhu Raja V., “Engineering drawing + AutoCAD”, New Age International (P) Limited (2022)
2. Lakhwinder pal singh, Harwinder Singh, “Engineering Drawing Principles and Applications”, Cambridge University Press, 2021.
3. Cecil Johnson, Jay D Helsel and Dennis R Short, “Engineering Drawing and Design”, Seventh Edition, McGraw Hill, 2007.
4. Patil, Rajashekar, “Computer Aided Engineering Graphics”, New Age International Ltd,2018.
5. Chris Schroder, “Printed Circuit Board Design using AutoCAD”, Newnes,1997.
6. K S Sai Ram, “Design of steel structures”, Third Edition by Pearson.
7. A S Pabla, “Electrical power distribution”, 6th edition, Tata Mcgrawhill.
8. K. R. Gopalakrishna, & Sudhir Gopalakrishna, “Textbook of Computer Aided Engineering Drawing”, 39th Edition, Subash Stores, Bangalore, 2017

Web Links and Video Lectures (E-Resources):

1. **http://nptel.ac.in/courses/112103019**
2. https://archive.nptel.ac.in/courses/112/105/112105294/

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 and 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 and SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 and SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

LABORATORY REQUIREMENTS

SYSTEM REQUIREMENTS (For a batch of 30 Students)

Hardware:

1. Intel i3 core due processor with 4GB ram with 500GB hard disk – 30 Nos.
2. Laser Printer – 1 No.

Software:

Drafting package – AutoCAD – Adequate license (Open source)

Suggested Skill Activities:

1. 2D drafting of plan and elevation of computer CPU.
2. 2D drafting of plan and elevation of a thermos flask.
3. 2D drafting of a plan and elevation of piston and cylinder.
4. Sketching the projections of a bicycle in freehand.
5. Sketching the projections of a stapler.
6. Cut and develop the lateral surface of a funnel.
7. Cut one edges vertically and develop the lateral surface of CPU cabin.
8. Cut and develop the lateral surfaces of elbow of a pipe.
9. Draw the isometric view of a simple bread toaster.
10. Draw the isometric view of the computer table.
11. Sketch the assembled view of the screw jack using the orthographic projections of its components.
12. Draft the plan, elevation and section of your home using CAD.
13. Draft the plan, elevation and section of 2 storey office building using CAD.
14. Develop the 3D model of the (a) and (b).

Course Code:	24CS201	Course Title:	PROGRAMMING FOR PROBLEM SOLVING USING C
Credits:	4	L – T – P	2-0-4
Pre-requisite			NIL

Course objectives:

To impart knowledge on the

- To gain knowledge on problem solving techniques
- To learn how to write simple and modular C programs
- To develop C programs using arrays and strings
- To learn the usage of pointers in accessing and manipulating memory
- To develop applications in C using structures & files

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Classroom
8. Flipped Class

UNIT I - BASICS OF C PROGRAMMING	[6 hours]
Problem Solving Techniques: Introduction to Algorithm, Pseudo code, Flow Chart, Structure of ‘C’ program. C Tokens: Keywords, Data Types, Constants, Variables - Declaration - Qualifiers – typedef	

Practical Topics:

1. Steps in Problem Solving Drawing flowchart using yEd tool/Raptor Tool programs using simple statements.

2. Programs to illustrate the use of user-defined data types

UNIT II – BASIC CONSTRUCTS IN C	[6 hours]
Managing simple Input and Output operations - Operators and Expressions - Decision Making: Branching statements, looping statements - Function: Declaration, Definition - Passing arguments by value - Recursion - Storage classes	
Practical Topics: 1. Programs using decision making statements 2. Programs using looping statements 3. Programs using user defined functions and recursive functions	

UNIT III – ARRAYS AND STRINGS IN C	[6 hours]
Arrays: Initialization - One dimensional, Two dimensional, and Multi-dimensional arrays - String: Basics, declaring and initializing strings, string handling functions: standard and user defined functions	
Practical Topics: 1. Build programs using arrays and array-based operations. 2. Programs using one dimensional and two dimensional arrays. 3. Implementations involving array usage for string operations.	

UNIT IV – POINTERS IN C	[6 hours]
Pointers - Passing arguments by address - Dynamic Memory Allocation - Pointer arithmetic - Pointers and one dimensional array - Pointers and Multi-Dimensional Array: Array of Pointers, Pointer to Pointer, Pointer to an array - void Pointer - Pointer to function	
Practical Topics: 1. Implementations involving pointers for dynamic memory allocation 2. Implementations involving pointers for string manipulation.	

UNIT V – STRUCTURES, UNIONS AND FILE HANDLING IN C	[6 hours]
Structure: Declaration, Definition-Array of Structures - Pointer to Structure – Nested Structures- Union: Defining union, Accessing union members. Files: File Management functions, Random access in file- Working with Text Files and Binary Files	
Practical Topics: 1. Programs to implement structures 2. Programs to implement union 3. Programs to implement various file operations.	

Laboratory Component: **[45 hours]**

Any 12 experiments have to be completed from the following list of experiments.

S.No.	Name of the Experiment
1	Steps in Problem Solving Drawing flowchart using yEd tool/Raptor Tool programs using simple statements
2	Programs to illustrate the use of user-defined data types
3	Programs using decision making statements
4	Programs using looping statements
5	Programs using user defined functions and recursive functions
6	Build programs using arrays and array-based operations.
7	Programs using one dimensional and two dimensional arrays.
8	Implementations involving array usage for string operations.
9	Implementations involving pointers for dynamic memory allocation
10	Implementations involving pointers for string manipulation.
11	Programs to implement structures
12	Programs to implement union
13	Programs to implement various file operations

Course outcomes:

On completion of the course, the student will have the ability to:

CO No	Corse Outcomes	Cognitive Domain
CO1	Make use of problem solving techniques to solve real world problems & outline the structure of C program	K3
CO2	Identify the appropriate looping and control statements in C and develop applications using these statements	K3
CO3	Make use of arrays & strings in development of simple applications	K3
CO4	Apply the concepts of pointers and develop C programs using pointer	K3
CO5	Develop programs for storing, retrieving and processing data using structures and files.	K3

COs and POs Mapping

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	3	2	-	1	-	-	-		-	-	1
CO2	3	3	2	-	1	-	-	-		-	-	1
CO3	3	3	2	1	1	-	-	-		-	-	1
CO4	3	3	2	1	1	-	-	-		-	-	1
CO5	3	3	3	1	1	-	-	-		-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	15	50	50
	Lab Exam	100	35		
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	20	20	20
Understand	20	20	20
Apply	60	60	60
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2015.
2. Pradip Dey, Manas Ghosh, “Programming in C”, AICTE Edition, Oxford University Press, 2018

Reference Books:

1. Yashavant P. Kanetkar, "Let Us C : Authentic guide to C programming language", Eighteenth Edition, BPB Publications, 2021
2. Ashok N Kamthane, Programming in C, Pearson, Third Edition, 2020
3. Reema Thareja, "Programming in C", Oxford University Press, Second Edition, 2016.
4. Paul Deitel and Harvey Deitel, "C How to Program with an Introduction to C++", Eighth edition, Pearson Education, 2018.
5. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", 1st Edition, Pearson Education, 2013.
6. E.Balagurusamy, "Programming in ANSI C", seventh edition, Mc Graw Hill Education,2017

Suggested Skill Activities:

1. Steps in Problem Solving Drawing flowchart using yEd tool/Raptor Tool
2. Write a Program to calculate and display the volume of a CUBE having its height (h=10cm), width (w=12cm) and depth (8cm).
3. Ramya has bought 50 kg of onion for Rs 40 per kg and 60 kg of potato for Rs 20 per kg. Then she sold out all the stock with the selling price of Rs 60 per kg and Rs 30 per kg for onion and potato respectively. Write a C program which computes the profit gained by her.
4. A Food delivery boy needs to walk down every street in his area in order to deliver the food. Assume that the distances between the streets along the roads are given. The food delivery boy starts at the hotel and returns back to the hotel after delivering all the foods. Implement an algorithm to help the food delivery boy to walk minimum distance for the purpose.
5. Write a program to input name, marks of 5 subjects of a student and display the name of the student, the total marks scored, percentage scored and the class of result.
6. A location in a map is represented by a pair of points as x co-ordinate and y co-ordinate. Person X wants to move towards person Y which is residing in the location

L1 and L2 respectively. Write C Program to find the distance between these two person .

7. If a four-digit number is input through the keyboard, write a program to obtain the sum of the first and last digit of this number.
8. Write a program to find GCD (greatest common divisor or HCF) and LCM (least common multiple) of two numbers
9. Write a Program to multiply two 3 X 3 Matrices.
10. Write a program to create a structure named company which has name, address, phone and no Of Employee as member variables. Read name of company, its address, phone and no Of Employee. Finally display these members" value.
11. Write a program to create array of books. Collect various details of books such as topic, author, department. Collect details for N books and display the details of books based on department name or author
12. A class has strength of N students. The class has two mentors, one person for the odd roll numbers and the other for the rest. Write a C program which reads the roll numbers of all the students and gives two lists of roll numbers corresponding to each advisor
13. Write a C program to maintain the inventory details of items sold in a super market such as item id, name, no of items available, price per item. Perform efficient data storage based on user"s demand at runtime
14. Write a C program to use binary files for maintaining a telephone directory which includes telephone no, Owner name and address. Here address includes details such as door no, street name, locality, city and pincode. Update the door no of all people belonging to a particular street as follows: Increment the old door no by 10 to get the new door no. (Eg: If the old door no is 13, update it as 23)

பாடநெறி குறியீடு:	**24GE201**	பாடத்தின் தலைப்பு:	தமிழரும்தொழில்நுட்பமும்
கிரெடிட்	**1**	**L – T – P**	**1-0-0**

பாடத்திட்டநோக்கங்கள்:

1. சங்ககாலத்து நெசவுத்தொழிலை விவரிப்பதற்கும் மட்பாண்டத்தொழில் நுட்பத்தைக் கண்டறிவதற்கும்.
2. சங்ககால கட்டுமானம், மேடை அமைப்பு, சிற்பங்கள், கோவில்கள், அம்மன்கோவில், திருமலைநாயக்கர் மஹால், செட்டிநாட்டு வீடுகள், இந்தோ - சாரோசெனிக் கட்டிடக்கலை ஆகியவற்றைக் கண்டறிந்து மேற்கோள் காட்ட.
3. கப்பல் கட்டுதல் மற்றும் இரும்புத் தொழிலைக் கண்டறிதல், சிலப்பதிகாரத்தில் நாணயங்கள், மணி தயாரிக்கும் தொழிற்சாலைகள், மணிகளின் வகைகள் ஆகியவற்றைப் படிக்க.
4. நீர்நிலைகளின் முக்கியத்துவத்தைகாட்ட, கால்நடை வளர்ப்பு மற்றும் கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகளை கண்காணிக்க, விவசாயம், மீன்பிடி, முத்து மற்றும் முத்துகலாச்சாரம் மற்றும் கடல் பற்றிய பண்டைய அறிவை அங்கீகரிக்க.
5. அறிவியல் தமிழின் வளர்ச்சி மற்றும் தமிழ்க்கணிப்பொறியின் வளர்ச்சியைக் கவனிக்க, இணையத்தில் தமிழ்மென்பொருள் மேம்பாடு, தமிழ் அகராதிகளை மேற்கோள் காட்ட.

அலகு I நெசவு மற்றும் பானைத்தொழில்நுட்பம்:	**[3 hours]**
சங்ககாலத்தில் நெசவுத்தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்புபாண்டங்கள் - பண்டங்களில் கீறல் குறியீடுகள்.	

அலகு II வடிவமைப்பு மற்றும் கட்டிடத்தொழில்நுட்பம்:	**[3 hours]**
சங்ககாலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்ககாலத்தில் வீட்டுப்பொருட்களில் வடிவமைப்பு - சங்ககாலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடைஅமைப்பு பற்றியவிவரங்கள் - மாமல்லபுரச்சிற்பங்களும், கோவில்களும் - சோழர்காலத்துப் பெருங்கோவில்கள் மற்றும் வழிபாட்டுத்தலங்கள் - நாயக்கர்காலக்கோயில்கள் மாதிரி கட்டமைப்பு பற்றி அறிதல்,மதுரைமீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலைநாயக்கர்மஹால் - செட்டி நாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ - சாரோசெனிக் கட்டிடக்கலை.	

அலகு III உற்பத்தித் தொழில்நுட்பம்	[3 hours]
கப்பல் கட்டும் கலை - உலோகவியல் - இரும்பு தொழிற்சாலை - இரும்பை உருக்குதல், எ்ஃகு வரலாற்றுச்சான்றுகளாக செம்பு மற்றும் தங்கநாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சங்கு மணிகள் - எலும்புத்துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.	

அலகு IV வேளாண்மை மற்றும் நீர்பாசனத்தொழில்நுட்பம்	[3 hours]
அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக்கு குமுழித்தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மைச்சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன் வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்.	

அலகு V அறிவியல் தமிழ் மற்றும் கணிதத்தமிழ்:	[3 hours]
அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி -தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ்மென்பொருள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.	

பாடநெறி முடிவுகள் (பாமு):

பாடநெறியின் முடிவில், மாணவர் பின்வரும் திறன்களைப் பெறுவார்:

பாமு	பாடநெறி முடிவுகள்	மிக உயர்ந்த அறிவாற்றல் நிலை
அலகு I பாமு:	சங்க கால ஐவுளி தொழில் மற்றும் மட்பாண்ட தொழில்நுட்பம் பற்றி அறிவார்கள்.	கே 1
அலகு II பாமு:	சங்க கால கட்டுமானம், மேடை அமைப்பு, சிற்பங்கள், கோவில்கள், அம்மன் கோவில், திருமலை நாயக்கர் மஹால், செட்டிநாட்டு வீடுகள், இந்தோ-சராசனிக் கட்டிடக்கலை ஆகியவற்றை விவரிக்க இயலும்.	கே 2

அலகு III பாமு:	கப்பல் கட்டுதல், இரும்புத் தொழில், நாணயம் தயாரித்தல் மற்றும் மணி தயாரிக்கும் தொழில்கள் பற்றி அறிந்து கொள்கிறார்கள்.	கே 1
அலகு IV பாமு:	நீர்நிலைகளின் முக்கியத்துவம், கால்நடை வளர்ப்பு, கிணறு, விவசாயம், மீன்பிடி, முத்து மற்றும் முத்து கலாச்சாரம் மற்றும் கடல் பற்றிய போதுமான அறிவை பெற்றுகொள்கிறார்கள் .	கே 1
அலகு V பாமு:	அறிவியல் தமிழின் வளர்ச்சி, தமிழ்க் கணிப்பொறியின் வளர்ச்சி, இணையத்தில் தமிழ் மென்பொருள் மேம்பாடு, தமிழ் அகராதிகளை சந்தேகம் இன்றி முழுமையாக தெரிந்து கொள்கிறார்கள்.	கே 1

பாடநெறி முடிவுகள் *மற்றும் நிரல் முடிவுகள் ஒப்பிடுதல்*

பாமு கள்	மிக உயர்ந்த அறிவாற்றல் நிலை	பாடநெறி முடிவுகள்											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
பாமு **1**	கே 1	**2**	-	-	-	-	-	-	-	-	-	-	-
பாமு **2**	கே 2	**1**	-	-	-	-	-	-	-	-	-	-	-
பாமு **3**	கே 1	**1**	-	-	-	-	-	-	-	-	-	-	-
பாமு **4**	கே 1	**1**	-	-	-	-	-	-	-	-	-	-	-
பாமு **5**	கே 1	**1**	-	-	-	-	-	-	-	-	-	-	-

நிலை 3- அதிக ஒத்துப்போதல், நிலை 2- மிதமாக ஒத்துப்போதல், நிலை 1- குறைவாக ஒத்துப்போதல், நிலை 0- ஒத்துப்போகவில்லை

மதிப்பீட்டுத் திட்டம்:

கூறுகள்	மதிப்பீட்டின் வகை	அதிகபட்ச மதிப்பெண்கள்	குறைக்கப்பட்ட மதிப்பெண்கள்	இறுதி மதிப்பெண்கள்
தொடர்ச்சியான உள் தேர்வு	தொடர்ச்சியான உள் தேர்வு - I	100	40	40
	தொடர்ச்சியான உள் தேர்வு - II	100	40	
இறுதி பருவ தேர்வு	எழுத்து தேர்வு	100	60	60
மொத்தம்				100

இறுதி பருவ தேர்வு: (கேள்வி முறை)

- ஒவ்வொரு யூனிட்டும் இரண்டு 2 மதிப்பெண் வினாக்களையும் ஒரு 16 மதிப்பெண் வினாவையும் (இரண்டில் ஒன்று) கொண்டுள்ளது.
- பதினைந்து கேள்விகளுக்கும் பதிலளிக்க வேண்டும்.

மதிப்பீட்டு முறை

ப்ளூமின் வகை	தொடர்ச்சியான மதிப்பீட்டு சோதனைகள்		இறுதி தேர்வு
	1	2	
நினைவில் கொள்ளுதல்	60	50	60
புரிந்து கொள்ளுதல்	40	50	40
விண்ணப்பித்தல்	0	0	0
பகுப்பாய்வுதல்	0	0	0
மதிப்பிடுதல்	0	0	0
உருவாக்குதல்	0	0	0

TEXT BOOKS

1. தமிழகவரலாறு - மக்களும்பண்பாடும் - கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்).

2. கணினித்தமிழ் - முனைவர்இல. சுந்தரம். (விகடன்பிரசுரம்).

3. கீழடி - வைகைநதிக்கரையில்சங்ககாலநகரநாகரிகம் (தொல்லியல்துறைவெளியீடு)

4. பொருநை - ஆற்றங்கரைநாகரிகம். (தொல்லியல்துறைவெளியீடு)

5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)

6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).

REFERENCE BOOKS

1. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).

2. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)

3. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

4. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)

5. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)

6. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Course Code:	**24MA201**	**Course Title:**	**Complex Variables and Transforms** (Common to Common to AI&DS,AE,BME,CE,CSE,CSE(AI&ML),EEE, ECE,MECH)
Credits:	**4**	**L – T – P**	**3 – 1 – 0**
Pre-requisite			**24MA101- Matrices and Calculus**

Course objectives:

- To impart analytical ability in solving mathematical problems as applied to the respective branches of Engineering.
- To familiarize the students with complex integration techniques and contour integration techniques which can be used in real integrals.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.

Teaching-Learning Process:

These are sample strategies which teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method does not mean only traditional method, but different type of teaching methods may be adopted to develop the outcomes.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Topics will be introduced in a multiple representation and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT I – Complex Differentiation	**[12 hours]**
Function of a complex variable – Analytic functions – Necessary conditions and sufficient conditions (excluding proof) – Cauchy – Riemann equations –– Properties of analytic function – Harmonic conjugate – Construction of Analytic functions - Conformal mapping: w = z+a, az, 1/z, and bilinear transformation.	
UNIT II – Complex Integration	**[12 hours]**
Statement and application of Cauchy's integral theorem and integral formula – Taylor and Laurent expansions – Isolated singularities – Residues - Cauchy's residue theorem. Applications: Contour integration over unit circle and semicircular contours (excluding poles on axis).	

UNIT III – Laplace Transforms	**[12 hours]**
Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems – Transforms of derivatives and integrals – Initial and Final Value Theorem – Inverse Laplace Transform – Convolution Theorem (Statement only) – Solution of linear second order Ordinary differential equations with constant coefficients using Laplace transforms.	

UNIT IV – Fourier Series and Fourier Transforms	**[12 hours]**
Dirichlet's conditions – General Fourier series – Odd and even functions – Half range series – Harmonic analysis - Statement of Fourier integral theorem – Fourier transform pair – Parseval's identity.	

UNIT V – Partial Differential Equation	[12 hours]
Formation of partial differential equations - Classification of partial differential equations - Solutions of one dimensional wave equation, One dimensional heat equation (excluding insulated ends) – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges).	

Course outcomes:

On completion of the course, the student will have the ability to:

CO	Course Outcome	Cognitive domain
CO1	Construct analytic functions and use their conformal mapping property in Engineering problems.	K3
CO2	Solve real and complex integrals using the Cauchy's integral formula and residue theorem.	K3
CO3	Apply Laplace transforms techniques in system modelling, digital signal processing, process control, solving boundary value problems	K3
CO4	Apply Fourier series to solve the steady state two-dimensional heat equation in cartesian coordinates.	K3
CO5	Apply the effective mathematical tools for solutions of partial differential equations that model physical phenomena and engineering problems.	K3

COs and POs Mapping:

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	1
CO5	3	2	1	-	-	-	-	-	-	-	-	-
CO6	3	2	1	-	-	-	-	-	-	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	**2**	
Remember	20	20	20
Understand	20	20	20
Apply	60	60	60
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
3. Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012
4. Kandasamy. P., Thilagavathy. K, and Gunavathy. K, Engineering Mathematics Volume I & II, S. Chand & Co, New Delhi, 2005.Reference Books:

Equivalent NPTEL/SWAYAM Courses

S. No.	Course Title	Course Instructor	Host Institute
1	Partial Differential Equations	Prof. Sivaji Ganesh	IIT Bombay
2	Introduction to Fourier Analysis	Prof. Parasar Mohanty	IIT Kanpur
3	Complex Analysis	Prof. Pranav Haridas	IIT Madras

Web Links and Video Lectures (E-Resources):

1. Analytic Functions, C-R Equations: https://www.nptelvideos.com/lecture.php?id=13416
2. Laplace Transform and its Existence: https://www.nptelvideos.com/lecture.php?id=13433
3. Taylor's, Laurent Series of f(z) and Singularities: https://www.nptelvideos.com/lecture.php?id=13431
4. Applications of Fourier Transform to PDEs: https://www.nptelvideos.com/lecture.php?id=13442

Course Code:	24EC302	Course Title:	Digital Logic Circuits and Design
Credits:	**4**	**L – T – P**	**3-0-2**
Pre-requisite			**24MA101- Matrices and Calculus** **24PH101 – Engineering Physics**

Course objectives:

To impart knowledge on the

- To Study the fundamentals of Boolean Algebra and simplification of logic gates.
- To Study the design of various combinational circuits and logic family.
- To study the design procedure of Sequential circuits
- To study the design procedures for State Machines
- To learn the programmable logic and Memory devices

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Project based Learning
3. Experiential Learning
4. NPTEL and Other Videos
5. Smart Class Room

6. Flipped Class 7. Experimental Learning 8. NPTEL and Other Videos 9. Smart Class Room

UNIT I – Boolean Algebra And Logic Gates	**[9 hours]**
Basic gates and truth table, De-Morgan's theorem, SOP and POS, K Map up to five variables, Two bits and three bits binary addition and Subtraction.	
Practical Topics: 1. To Verify the truth tables of various logic gates. 2. To Implement the Given Boolean Function using Logic Gates. 3. To Verify and Study NAND and NOR gate as Universal Gates.	

UNIT II – Combinational Circuits And Logic Family	**[9 hours]**
Code converters, Magnitude comparator, Multiplexers and DE multiplexers, Decoders, Encoders, Priority Encoder, Combinational Circuits design-RTL, DTL, TTL & CMOS logic families	
Practical Topics: 1.To study binary to gray and gray to binary converter and verify it for all possible combinations. 2. To implement and verify the truth table of 4x1 Multiplexer and 1x4 De multiplexer. 3. To implement and verify the truth table of Encoders and Decoders.	

UNIT III – Sequential Logic	**[9 hours]**
74xx series Integrated Circuits, Flip-Flops, Triggering of Flip-Flops, Design of Clocked Sequential Circuits Moore and Melay model- Flip-Flop Excitation Tables , Master Slave Flip-flop , Shift Registers and Counters.	
Practical Topics: 1. Flip-flop: assemble, test and investigate operation of SR, D and JK Flip-flops 2. Shift Register: Design and investigate the operation of all type of shift registers with parallel load. 3. Counters: Design, assemble and test various ripple and synchronous counters-decimal counter, Binary counter with parallel load.	

UNIT IV – State Machine Design	[9 hours]
ASM Chart, State table , State condition and Diagrams, State minimization and hazards – analysis of asynchronous sequential logic circuits	
Practical Topics: 1. Clock-pulse generator: design, implement and test. 2. Develop an Health track monitor App to measure any 3 parameters heart rate , pressure and temperature monitoring system.	

UNIT V – Programmable Logic And Memory Devices	[9 hours]
Introduction PLA and PAL, CPLDs and FPGA - Memory Devices - ROM, RAM- Volatile and Non Volatile RAM, SDRAM,DRAM, PROM,EPROM,EEPROM, FRAM,ASIC	
Practical Topics: Investigate the behavior of RAM unit and its storage capacity -16 X 4 RAM: testing, simulating and memory expansion.	

Laboratory Component **30 hours**

S.No.	Name of the Experiment
1	To Verify the truth tables of various logic gates.
2	To Implement the Given Boolean Function using Logic Gates.
3	To Verify and Study NAND and NOR gate as Universal Gates.
4	To study binary to gray and gray to binary converter and verify it for all possible combinations.
5	To implement and verify the truth table of 4x1 Multiplexer and 1x4 DE multiplexer.
6	To implement and verify the truth table of Encoders and Decoders.
7	Flip-flop: assemble, test and investigate operation of SR, D and JK Flip-flop.
8	Shift Register: Design and investigate the operation of all type of shift registers with parallel load.
9	Counters: Design, assemble and test various ripple and synchronous counters with parallel load.
10	Clock-pulse generator: design, implement and test.
11	Develop an Health track monitor App to measure any 3 parameters heart rate , pressure and temperature monitoring system

12	Investigate the behavior of RAM unit and its storage capacity -16 X 4 RAM: testing, simulating and memory expansion Using HDL/VHDL/ Pspice Simulators

Course outcomes: On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Domain
CO1	Illustrate the concepts of Boolean Algebra and its Simplification procedures relevant to digital logic gates.	K2
CO2	Construct combinational logic circuits to perform various operations on data .	K3
CO3	Apply the concepts of sequential logic circuit to make state Machines .	K3
CO4	Construct an ASM chart to describe the sequential operations of a digital circuit.	K3
CO5	Interpret the concepts of Programmable Logic And Memory Devices to build digital circuits .	K2

COs and POs Mapping:

COs	**POs**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	2	1	-	-	-	-	-	2	-	-	1
CO2	3	2	1	1	-	-	-	-	2	-	-	1
CO3	3	2	1	-	1	-	-	-	2	-	-	1
CO4	3	2	1	1	1	-	-	-	2	-	-	1
CO5	3	2	1	1	1	-	-	-	2	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

Assessment Pattern:

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	40	40	40
Apply	40	40	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions.
- One 16 marks question (either or) will be from any one of the five units.
- All the fifteen questions have to be answered.

TEXT BOOKS

1. M. Morris Mano and Michael D. Ciletti, 'Digital Design', Pearson, 6th Edition, 2018.

REFERENCE BOOKS

1. Charles H. Roth, Jr, 'Fundamentals of Logic Design', Jaico Books, 4th Edition, 2002.
2. William I. Fletcher, "An Engineering Approach to Digital Design", Prentice- Hall of India, 1980.
3. Floyd T.L., "Digital Fundamentals", Charles E. Merril publishing company,1982.

4. John. F. Wakerly, "Digital Design Principles and Practices", Pearson Education, 4 th Edition,2007.
5. Donald D. Givone (2002), Digital Principles and Design, Tata McGraw Hill, India

WEB LINKS AND VIDEO LECTURES (E-RESOURCES):

1. Introduction To Digital Circuits : https://nptel.ac.in/courses/117106086/
2. Combinational Circuits https : https://nptel.ac.in/courses/117106086/
3. Code Converters : https://nptel.ac.in/courses/117106086/
4. S,R,JK, D Flip Flops :https://nptel.ac.in/courses/117106086/
5. Design of Synchronous Sequential Circuits : https://nptel.ac.in/courses/117106086
6. Programmable Logic Devices : https://nptel.ac.in/courses/117106086

SKILLED BASED ASSESSMENTS

1. Design a fingerprint attendance system circuit, using a Fingerprint Sensor module to authenticate a true person or employee by taking their finger input in the system Employ 4 push buttons to enrol, Delete, UP/Down. ENROLL and DEL key has triple features.
2. Design a Touchless heart rate, pulse rate monitoring and image recognition app to detect changes in face's reflectivity for automobilist safety, based on cutting-edge research and science conducted at the MIT Media Lab and there by allowing the app to calculate a persons heart rate.
3. Design an Obstacle Avoiding Robot Car Using an Ultrasonic Sensor by interfacing three ultrasonic sensors with arduino uno. Run an algorithm according to which you are going to manipulate your desire distance for obstacle detection then you are going to control your motor rotation direction for movement of your bot. 50cm (Front), 15cm (Each Side).
4. Design and implement a Digital code lock System using Arduino. Employ a LCD display which is used
to interface with the project to output lock status to be used in places where we need more security.
5. Design a Luggage Security System using GSM to inform about the status of the luggage to the owner, by making of an integrated IR Transmitter Receiver circuit and IR diodes which sense any object about certain range. Make the algorithm tailor-made to the specific requirements of the user.

Course Code:	24EE202	Course Title:	Basics of Electrical and Electronics Engineering
Credits:	4	L – T – P	3-0-2
Pre-requisite			NIL

Course objectives:

To impart knowledge on the

- Basics of DC electric circuits and its analysis
- Analysis of AC circuits and magnetic circuits
- Working principles and application of DC machines and transformers
- Digital devices and their characteristics
- Functional elements and working of sensors and actuators used for smart systems.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I –DC Circuits	[9 hours]
Introduction to DC Circuits – Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws –Nodal Analysis, Mesh analysis with independent sources only – Appliances.	
Practical Topics: 1. Model an electrical circuit and simulate it to verify Ohms Law. 2. Model an electrical circuit and simulate it to verify Kirchhoff's Voltage Law. 3. Model an electrical circuit and simulate it to verify Kirchhoff's Current Law.	

UNIT II – AC Circuits and Magnetic Circuits	[9 hours]
Introduction to poly-phase circuits - Representation of sinusoidal waveform – peak and rms values, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations – Converters: rectifiers	

and inverters; Basics of magnetic circuits – Flux – Flux density – Magnetic resonance – Self-inductance – mutual-inductance – Coupling.
Practical Topics: 1. Demonstrate the measurement of power in an RLC circuit using wattmeter method. 2. Interpret the DC output of an RLC circuit using half wave rectifier. 3. Interpret the DC output of an RLC circuit using full wave rectifier.

UNIT III – DC Machines and Transformers	**[9 hours]**
Construction, principle of operation, characteristic and application – DC Motor and DC Generator, Types of DC motors and generators – Application: Electric Vehicle – Structure of electric power system – Introduction to single phase transformers –Construction, principle of operation, characteristics and application.	
Practical Topics: 1. Conduct the load test on DC shunt motor to outline its characteristics. 2. Outline the study on the starting methods of DC series motor. 3. Conduct a study on transformer construction for real-time applications.	

UNIT IV – Electronic Devices	**[9 hours]**
Introduction to semiconductor – PN Diode – Zener Diode – BJT and its configurations – CE, CB, CC – SCR – Optoelectronic devices – LED – OLED – Seven segment displays.	
Practical Topics: 1. Experiment with PN junction diode in an AC circuit to verify its characteristics. 2. Experiment with Zener diode in an AC circuit to verify its characteristics. 3. Experiment with SCRin an AC circuit to verify its characteristics.	

UNIT V – Sensors and its Applications	**[9 hours]**
Sensors in IoT – Mobile based sensors, Resistance Temperature sensor, Humidity sensor –Medical sensor – Neural sensor – Motion sensor – PIR sensor, Piezoelectric sensor, Air quality sensor – CO_2 Sensor, RFID sensor, Water leakage detection sensor, Light sensors - Introduction to actuators in automation – Applications: smart homes – smart cities – smart parking system.	
Practical Topics: 1. Utilize Arduino and Bluetooth module for automating home appliances. 2. UtilizeESP8266 processorfor automating home appliances. 3. Construct an Arduino based solar tracker for solar irradiation measurement.	

Laboratory Component: **[30 hours]**

Any 12experiments have to be completed from the following list of experiments.

S.No	Name of the Experiment
1	Model an electrical circuit and simulate it to verify Ohms Law.
2	Model an electrical circuit and simulate it to verify Kirchhoff's Voltage Law.
3	Model an electrical circuit and simulate it to verify Kirchhoff's Current Law.
4	Demonstrate the measurement of power in an RLC circuit using wattmeter method.
5	Interpret the DC output of an RLC circuit using half wave rectifier.
6	Interpret the DC output of an RLC circuit using full wave rectifier.
7	Conduct the load test on DC shunt motor to outline its characteristics.
8	Outline the study on the starting methods of DC series motor.
9	Conduct a study on transformer construction for real-time applications.
10	Experiment with PN junction diode in an AC circuit to verify its characteristics.
11	Experiment with Zener diode in an AC circuit to verify its characteristics
12	Experiment with SCR in an AC circuit to verify its characteristics.
13	Utilize Arduino and Bluetooth module for automating home appliances.
14	UtilizeESP8266 processorfor automating home appliances.
15	Construct an Arduino based solar tracker for solar irradiation measurement.

Course outcomes:

On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Apply the circuit laws and theorems to compute the electrical parameters of domestic and industrial appliances.	**K3**
CO2	Compare the behavior of AC circuits & magnetic circuits for a given input.	**K2**
CO3	Explain the construction, working, and application of electrical machine and transformer to infer its characteristics.	**K2**
CO4	Apply the semiconductor principles using diodes, transistors, thyristors and displays for developing electronic switches and displays.	**K3**
CO5	Identify the sensors for applications in Engineering.	**K3**

COs and POs Mapping:

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	2	1	1	2	-	-	-	2	-	-	1
CO2	2	1	1	-	2	-	-	-	2	-	-	1
CO3	2	1	1	-	2	-	-	-	2	-	-	1
CO4	3	2	1	1	2	-	-	-	2	-	-	1
CO5	3	2	1	1	2	-	-	-	2	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Typeof assessment</th><th>Max Marks</th><th>Reduce d Marks</th><th>Tota l</th><th>Final mark s</th></tr>
<tr><td rowspan="5">Continuous Internal Examination (CIE) - Theory</td><td>CIE – I</td><td>100</td><td rowspan="2">50</td><td rowspan="5">10 0</td><td rowspan="5">25</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>MCQ</td><td>20</td><td>10</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td rowspan="2">Continuous Internal Examination (CIE) - Laboratory</td><td>Continuous Assessment</td><td>75</td><td>75</td><td rowspan="2">10 0</td><td rowspan="2">25</td></tr>
<tr><td>Model Lab Exam</td><td>25</td><td>25</td></tr>
<tr><td rowspan="2">End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>35</td><td rowspan="2">50</td><td rowspan="2">50</td></tr>
<tr><td>Lab Exam</td><td>100</td><td>15</td></tr>
<tr><td colspan="5">Total</td><td>100</td></tr>
</table>

Assessment Pattern

Bloom's Category	Internal Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	60	40	40
Apply	20	40	40
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. D P Kothari and I.J Nagarath, "Basic Electrical and Electronics Engineering," McGraw Hill Education (India)Private Limited, Second Edition, 2020
2. A.K.Sawhney and PuneetSawhney,"A Course in Electrical & Electronic Measurements & Instrumentation,"DhanpatRai and Co, 2015.

Reference Books:

1. John Bird, "Electrical Circuit theory and technology", Routledge; 2017.
2. Muthusubramanian R and Salivahanan S, "Basic Electrical and Electronics Engineering,"McGraw Hill, NewDelhi,2009.
3. Nagsarkar T K and Sukhija M S, "Basics of Electrical Engineering," Oxford University press, 2012.
4. V K Mehta, Rohitmehta "Principles of Electronics," S.Chand& Company Ltd, 2015.
5. Mahmood Nahvi and Joseph A.Edminister, "Electric Circuits," Schaum' Outline Series, McGraw Hill, 2009.
6. H.S. Kalsi, "Electronic Instrumentation," Tata McGraw-Hill, New Delhi, 2010.
7. Ian Sinclair, "Sensors and Transducers," Elsevier Science, 3rd Edition, 2000.
8. Perry Lea, "Internet of things for architects," Packt, 2018.
9. V N Mittle and Arvind Mittle "Basic Electrical Engineering," McGraw Hill, New Delhi, 2005.
10. R.S. Sedha, "A Textbook of Applied Electronics," S. Chand & Co., 2008.
11. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry and Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017.

Web Links and Video Lectures (E-Resources):

1. A Basic Course on Electric and Magnetic Circuits : https://onlinecourses.nptel.ac.in/noc24_ee125/preview
2. Basic Electrical Circuits: https://onlinecourses.nptel.ac.in/noc24_ee112/preview
3. Digital Circuits: https://onlinecourses.nptel.ac.in/noc24_ee147/preview
4. Electrical Machines – I: https://onlinecourses.nptel.ac.in/noc24_ee103/preview
5. Sensor Technologies: Physics, Fabrication and Circuits: https://onlinecourses.nptel.ac.in/noc24_ee83/preview
6. Semiconductor Devices and Circuits: https://onlinecourses.nptel.ac.in/noc24_ee143/preview

Suggested Skill Activities:

1. List the different electrical loads available in home, college and prepare their rating chart.
2. Design the residential house wiring using fuse, switch, indicator, lamp, circuit breaker, energy meter and apply Thevenin's theorem to find the current in particular branch.
3. Take a room in your home and replace the fluorescent lamp to LED lamp to calculate the monthly electrical charge and compare with the previous month.
4. Write the parts of the fan and electric mixer in home and draw the wiring diagram for fan and electric mixer.
5. Visit the nearby substation and list out the details of safety measures followed by electrical engineers.
6. List out the rating of electrical machines used in home appliances.
7. Identify the semiconductor devices in electronic appliances.
8. Develop IOT based solutions for engineering applications.
9. Draw the wiring diagram of EV and mentions its parts.
10. Visit nearby power plant and demonstrate the various components, working, power generation and distribution in power plant as a report.

Course Code:	**24EE404**	**Course Title:**	**IOT - SENSORS AND DEVICES**
Credits:	**4**	**L – T – P**	**3-0-2**
Pre-requisite			**NIL**

Course objectives:

To impart knowledge on the

- Basic electronic components and Sensors.
- Fundamental concepts of Microcontrollers
- Different types of Microcontrollers
- Different protocols for communication
- Interfacing of Arduino microcontrollers with different applications.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Interactive Simulations
4. Lab experiment videos
5. Blended Mode of Learning
6. Project based Learning
7. Experiential Learning
8. NPTEL and Other Videos
9. Smart Class Room
10. Flipped Class

UNIT I - Sensors for IoT **[6 hours]**

Active and Passive Sensors, Different Types of Sensors such as Capacitive, Resistive, and Surface Acoustic Wave Sensors for Pressure, Humidity, Toxic Gas; Sensors for Water (pH) quality, Accelerometer, Gyroscope, Moisture, Hall effect and Humidity

Practical Topics:

1. Building basic circuit diagrams using breadboard and Working of a Multimeter.
2. Simple circuit using IC on breadboard.
3. Simple Relay circuit design for ON-OFF condition.

UNIT II: Microcontroller	**[6 hours]**
Introduction to microcontrollers and microprocessors, Different microcontrollers, Arduino:Types, UNO Architecture, ADC, DAC, Data acquisition	
Practical Topics: 1. Switch on an LED if a button is pressed. 2. Changing brightness of LED using potentiometer.	

UNIT III: Arduino Programming	**[6 hours]**
Digital Pins as Input and Output, Reading Analog Quantities, PWM Pin- Arduino's Serial Port and Serial Communication. Interfacing of DC Motor and Relay	
Practical Topics: 1. Change the brightness of LED (Fade in/ Fade out) using PWM 2. DC motor speed control using serial communication.	

UNIT IV – IoT System	**[6 hours]**
Basics of IoT, IoT Levels, Things and Connections, Building Blocks of IoT connectivity(Client-Server, Web Interface, and API: Qualitative Analysis only), Protocols and Communication (Zigbee, Bluetooth, Wi-Fi, MQTT: Qualitative Analysis only), Bluetooth and Wi-Fi Modules for Arduino	
Practical Topics: 1.Interfacing Wi-Fi module with Arduino 2.Design a simple circuit to measure the pH value of wastewater. 3.Design a simple circuit to apply Hall effect sensor	

UNIT V – IoT Applications	**[6 hours]**
Application of IoT in the industry, buildings, smart city, logistics, environment, health care, agriculture, and lifestyle product	
Practical Topics: 1. Sending information about the patient in home to the doctor's PC/mobile. 2. Develop an IoT System for smart home applications	

Laboratory Component **30 hours**

SI.No.	Name of the Experiment
1	Building basic circuit diagrams using breadboard and Working of a Multimeter.
2	Simple circuit using IC on breadboard.
3	Simple Relay circuit design for ON-OFF condition.
4	Switch on an LED if a button is pressed.
5	Changing brightness of LED using potentiometer.
6	Change the brightness of LED (Fade in/ Fade out) using PWM.
7	DC motor speed control using serial communication.
8	Interfacing Wi-Fi module with Arduino.
9	Design a simple circuit to measure the pH value of wastewater.
10	Design a simple circuit to apply Hall effect sensor
11	Sending information about the patient in home to the doctor's PC/mobile.
12	Develop an IoT System for real time applications.

Course outcomes:

On completion of the course, the student will have the ability to:

CO	Course Outcome	Cognitive domain
CO1	Illustrate the working principles of different types of sensors.	**K2**
CO2	Describe the basic concepts of the different types of Microcontrollers.	**K2**
CO3	Apply the knowledge of PWM and Serial communication in different circuits.	**K3**
CO4	Explain the working of Wi-Fi module and different protocols for communication for usage in IoT.	**K2**
CO5	Apply the sensor to build an IoT System for Real time applications.	**K3**

COs and POs Mapping:

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	2	1	2	2	-	-	-	-	-	-	-	-
CO2	2	1	2	3	-	-	-	-	-	-	-	-
CO3	3	2	3	3	1	-	-	-	1	-	-	-
CO4	2	2	1	2	1	-	-	-	1	-	-	-
CO5	3	2	1	2	1	-	-	-	1	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final marks</th></tr>
<tr><td rowspan="5">Continuous Internal Examination (CIE) - Theory</td><td>CIE – I</td><td>100</td><td rowspan="2">50</td><td rowspan="5">100</td><td rowspan="5">25</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>MCQ</td><td>20</td><td>10</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td rowspan="2">Continuous Internal Examination (CIE) - Laboratory</td><td>Continuous Assessment</td><td>75</td><td>75</td><td rowspan="2">100</td><td rowspan="2">25</td></tr>
<tr><td>Model Lab Exam</td><td>25</td><td>25</td></tr>
<tr><td rowspan="2">End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>35</td><td rowspan="2">50</td><td rowspan="2">50</td></tr>
<tr><td>Lab Exam</td><td>100</td><td>15</td></tr>
<tr><td colspan="5" align="right">Total</td><td>100</td></tr>
</table>

Assessment Pattern

<table>
<tr><th rowspan="2">Bloom's Category</th><th colspan="2">Internal Assessment Tests</th><th rowspan="2">Terminal Examination</th></tr>
<tr><th>1</th><th>2</th></tr>
<tr><td>Remember</td><td>20</td><td>20</td><td>20</td></tr>
<tr><td>Understand</td><td>60</td><td>40</td><td>40</td></tr>
<tr><td>Apply</td><td>20</td><td>40</td><td>40</td></tr>
<tr><td>Analyse</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Evaluate</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Create</td><td>0</td><td>0</td><td>0</td></tr>
</table>

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books

1. Peter Dalmaris, “Basic Electronics for Arduino Makers”, Packt Publishing, 2017.
2. Tim Pulver, “Hands-On Internet of Things with MQTT: Build Connected IoT Devices with Arduino and MQ Telemetry Transport (MQTT)”, Packt Publishing, 2019.
3. Marco Schwartz, “Internet of Things with Arduino Cookbook”, Packt Publishing, 2016.

Reference Books:

1. Jody Culkin, Eric Hagan, “Learn Electronics with Arduino: An Illustrated Beginner's Guide to Physical Computing” Make Community, LLC, 2017.
2. Michael Margolis, "Arduino Cookbook" O’Reilly, 2011.
3. Julien Bayle, “C Programming for Arduino”, Packt Publishing Ltd., 2013.

Web Links and Video Lectures (E-Resources):

1. Sensors for IoT- https://youtube.com/watch?v=njgixrZOT1E
2. Microcontroller- https://www.youtube.com/watch?v=l9DC9ZpQ5yo
3. Arduino Programming- https://www.youtube.com/watch?v=QO_Jlz1qpDw
4. IoT System- https://www.youtube.com/watch?v=9KlHDeW6bO4
5. IoT Applications- https://www.youtube.com/watch?v=91aXs9E0qAI

Online Courses:

1. http://nptel.ac.in
2. https://swayam.gov.in

Suggested Skill Activities:

1.How to control multiple LEDs / Traffic LEDs using tinker cad software
2.Sending Data to LCD Display using tinker cad software
3.Design a simple circuit to Measure Heart Rate and SpO2
4.Design a simple circuit to maintain the CO2 level inside the room
5.Rainfall Monitoring Using Arduino

Course Code:	24CS301	Course Title:	PROGRAMMING FOR PROBLEM SOLVING USING PYTHON
Credits:	**1.5**	**L – T – P**	**0-0-3**
Pre-requisite			**NIL**

Course objectives:

To impart knowledge on the

- To explain basic concepts in Python
- To implement programs using functions, loops, and conditional statements.
- To demonstrate the concepts of data structures
- To make use of strings and exception handling in Python
- To demonstrate file handling and python modules

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

9. Lab experiment videos
10. Project based Learning

Laboratory Component: **[20 hours]**

SI.No	Name of the Experiment
1	Develop simple python programs using basic data types
2	Develop simple python programs using operators and expressions
3	Develop Python programs using conditional statements
4	Develop Python programs using various Loops
5	Develop python programs using Functions.
6	Develop programs to demonstrate the use of List, and Tuples
7	Develop programs to demonstrate the use of Dictionaries
8	Demonstrate the various string manipulation functions
9	Develop programs to show Exception Handling in tasks
10	Execute programs using Numpy in Jupiter notebook
11	Python program using File I/O, random access file handling methods and Zipping and Unzipping of files
12	Develop Python programs using packages

Course outcomes:

On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Develop basic programs using fundamental data types	K3
CO2	Solve the given problem statement using programming concepts such as operators, conditional and looping statements and functions.	K3
CO3	Make use of data structures such as lists, tuples, and dictionaries to manage and manipulate data in development of simple applications	K3
CO4	Create programs using string handling functions and apply exception handling, and make use of NumPy to solve problems	K3
CO5	Make use of file operations and packages in development of simple applications	K3

COs and POs Mapping

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	3	3	-	1	-	-	-		-	-	1
CO2	3	3	3	-	1	-	-	-		-	-	1
CO3	3	2	2	1	1	-	-	-		-	-	1
CO4	3	2	2	1	1	-	-	-		-	-	1
CO5	3	3	3	1	1	-	-	-		-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

The weightage of Continuous Internal Evaluation (CIE) is 60% and for End Semester Examination (ESE) is 40%.

S.No	Component	Type of Assessment	Max Marks	Reduced Marks	Total	Final Marks
1.	**Continuous Internal Examination(CIE)-Laboratory**	Continuous Assessment	75	75	100	60
2.		Model Lab Exam	25	25		
3.	**End Semester Examination (ESE)**	Lab Exam	100	40	40	40
					Total	100

Course Code:	**24GE231**	**Course Title:**	**WORKSHOP PRACTICE**
Credits:	**1.5**	**L – T – P**	**0-0-3**
Pre-requisite			**NIL**

Course objectives: To provide hands on training to the students in: ● Applying basic techniques to measure a field, infer masonry work and install plumbing design. ● Fabricating carpentry, foundry, sheet metal and welding works to practice on workshop trades and making end products. ● Utilizing machining processes like turning, drilling, tapping in parts and 3D printing for performing the jobs. ● Designing electrical wiring layout with MCBs and RCCBs, developing staircase wiring and illumination design circuits for buildings. ● Assembling simple electronic components on PCB by soldering and desoldering and testing with IoT based interfaces. ● Developing blogs and website design for the complete access over the network.
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Project based learning 2. Industrial Visit

GROUP – A (Civil and Mechanical)

PART I - CIVIL ENGINEERING PRACTICES	**[5 hours]**
1. FIELD MEASUREMENT, MASONRY WORK AND PLUMBING a. Calculate the area of a built-up space and a small parcel of land-use standard measuring tape and digital distance measuring devices. b. Visit a nearby site where construction is at initial stage and observe for following (if necessary, visit two/three times with a gap of a week). If drawings are available relate/match activities with the drawings. i. Digging and filling.	

ii.	Foundation preparations.
iii.	Brick/stone masonry.
iv.	Concrete laying and curing.
v.	Laying of sewerage/sanitary lines.
vi.	Bar bending and bar laying for columns, beams and ceiling.
vii.	Onsite testing for quality.
viii.	Onsite preparation for construction work.
ix.	Erection and removal of form work, scaffolding, centering/shuttering.

Prepare a brief report on the construction activities, methods, tools, equipments and materials being used.

c. Installation of water lines for wash basin and showers faucet.

PART II MECHANICAL ENGINEERING PRACTICES	[5 hours]

2. CARPENTRY, FOUNDRY, WELDING AND SHEET METAL
   a. Carpentry: Prepare T/L/Lap Joint from given wooden work piece and make a Box/Tray out of plywood using modern power tools.
   b. Welding: Make a Butt/Lap of MS plate using Arc welding process.
   c. Casting: Demonstration of Pattern making by sand moulding.
   d. Sheet Metal: Fabrication of Sheet Metal Tray and Funnels.
3. LATHE, DRILLING MACHINE AND 3D PRINTER
   a. Designing a driller component using radial machine.
   b. Perform a job using facing and turning in lathe.
   c. Printing simple 3D geometric shapes using SLA printer.

GROUP – B (Electrical, Electronics and IT)

PART III ELECTRICAL ENGINEERING PRACTICES	[3 hours]

4. ELECTRICAL WIRING
   a. Design a wiring circuit integrating energy meter, MCBs and RCCBs.
   b. Develop fluorescent lamp wiring, staircase wiring and electric fan wiring circuits.

PART IV ELECTRONICS ENGINEERING PRACTICES	[4 hours]

5. IOT BASED SOLUTIONS AND PCB
   a. Design a single layer PCB layout structure.
   b. Fabricate single layer PCB printing.
   c. Assembling, soldering and desoldering practice on single layer PCB.
   d. GPIO programming in ESP8266, sensor and actuator interfacing with internet enabled microcontroller device.
   e. Integration of microcontroller-based system with Cloud platform.

PART V COMPUTER SCIENCE AND ENGINEERING PRACTICES	[3 hours]

6. INTERACTIVE DYNAMIC WEBSITE
   a. Design a website for an application using HTML and CSS.
   b. Convert the designed website into responsive website using Bootstrap.
   c. Add dynamism to the website by using JavaScript and embed the social media components to the website.
   d. Incorporate the database interaction with the website.
   e. Deploy the developed website in the server.

Course outcomes:

On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Apply basic techniques for field measurements, masonry work and plumbing.	K3
CO2	Make use of workshop trades like carpentry, foundry, sheet metal and welding for practicing on manufacturing of components.	K3
CO3	Develop simple components using Lathe, Drilling Machine and 3D Printer.	K3
CO4	Construct the electrical wiring circuits for buildings based on their requirement.	K3
CO5	Develop IoT based solutions and PCB for real world use cases.	K3
CO6	Build and host an interactive dynamic website.	K3

COs and POs Mapping:

COs	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	1	2	-	-	-	1	1	-	1	3	2	1
CO2	3	2	1	1	2	-	-	-	1	1	-	1			
CO3	3	2	1	1	2	-	-	-	1	1	-	1			
CO4	3	2	1	1	2	-	-	-	1	1	-	1	1	-	-
CO5	3	2	1	1	2	-	-	-	1	1	-	1			
CO6	3	2	1	1	2	-	-	-	1	1	-	1	-	1	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

The weightage of Continuous Internal Evaluation (CIE) is 60% and for End Semester Examination (ESE) is 40%.

S.No	Component	Type of Assessment	Max Marks	Reduced Marks	Total	Final Marks
4.	**Continuous Internal Examination(CIE)-Laboratory**	Continuous Assessment	75	75	100	60
5.		Model Lab Exam	25	25		
6.	**End Semester Examination (ESE)**	Lab Exam	100	40	40	40
					Total	100

Text Books:

1. AICTE’s Prescribed Textbook: Workshop / Manufacturing Practices (with Lab Manual) ISBN: 978-93-91505-332
2. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., “Elements of Workshop Technology”, Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.

Reference Books:

1. Kalpakjian S. And Steven S. Schmid, “Manufacturing Engineering and Technology”, 4 th edition, Pearson Education India Edition, 2002.
2. Gowri P. Hariharan and A. Suresh Babu,” Manufacturing Technology – I” Pearson Education, 2008.
3. Roy A. Lindberg, “Processes and Materials of Manufacture”, 4 th edition, Prentice Hall India, 1998.
4. Rao P.N., “Manufacturing Technology”, Vol. I and Vol. II, Tata McGraw Hill House, 2017.

Course Code:	**24EN201**	**Course Title:**	**Presentation and Language Skills Laboratory** (Common to AI&DS,AE,BME,CE,CSE,CSE(AI&ML), EEE, ECE,MECH)
Credits:	**1.5**	**L – T – P**	**0-0-3**
Pre-requisite			**24EN101 English for Engineers**

Course Objectives:

- To apply critical listening skills.
- To make use of critical thinking skills.
- To apply stress as well as tonal variation.
- Make use of language skills to produce error free sentences
- To experiment with presentation skills.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Lab experiment videos
2. Blended Mode of Learning
3. Project based Learning
4. Smart Classroom
5. Flipped Class

UNIT I		**[12 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	**Topics**	**Hours**
1.	Listening to audios (online platforms) and making a critical appreciation of audio content	3
2.	Listening to breaking news	2
3.	Listening to British council / Cambridge English (Selected topics)	2
CLASSROOM ACTIVITIES		
1	Speaking current issues (selected topics)	2
2	Making conversations at work place, Public Speaking (based on festivals and celebrations)	3

UNIT II		**[12 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	**Topic**	**Hours**

1	English Movie clips and software in the Lab C (Globarena)	3
2	Vocabulary Development through movies/ short films/ Documentaries	3
CLASSROOM ACTIVITIES		
1	Speaking - Just a minute talk and expressions for plans and decisions	3
2	Describing a product	3

UNIT III		**[12 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	**Topic**	**Hours**
1.	Listening to TED talks, scientific lectures.	3
2.	Reading Comprehension strategies	2
3.	Reading- Editorials	2
CLASSROOM ACTIVITIES		
1.	Speaking- Introduction to Phonetics- Speech sounds- Vowels and Consonants- Stress- Rising/ Falling Tone	2
2.	Writing- A day in my life	2
3.	Writing- Situational Dialogues	1

UNIT IV		**[12 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl.No.	**Topic**	**Hours**
1.	Reading Popular Blogs Listening Editorials	3
2.	Creating a Blog	2
CLASSROOM ACTIVITIES		
1.	Errors in Pronunciation. Error detection	3
2.	Writing - Terminology for Engineers. Writing Articles and preparing day to day scripts.	2 2

UNIT V		**[12 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	**Topic**	**Hours**
1.	Prepare PowerPoint presentation (topics selected by	3

	students)	
2.	Reading newspaper articles	2
CLASSROOM ACTIVITIES		
1.	Present the selected topic.	3
2.	Making a short speech / Extempore	2
3.	Writing - Expanding a Proverb Writing Instructions	2

S.No.	Name of the Experiments
1	Making conversation at workplace
2	Writing articles
3	Making expressions for plans and decisions
4	Describing a product
5	Day in my life
6	Writing Terminology for engineers
7	Spotting errors
8	Expansion of proverbs
9	Instructions
10	Reading comprehension

Course Outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Domain
CO1	Build communicative competence through critical listening skills.	K3
CO2	Make use of critical thinking skills to express plans and opinions.	K3
CO3	Apply stress as well as tonal variations for effective communication.	K3
CO4	Make use of language skills to produce error free sentences.	K3
CO5	Experiment with presentation skills to address confidently.	K3

COs and POs Mapping:

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	-	-	-	-	-	-	-	-	-	3	-	3
CO2	-	-	-	-	-	-	-	-	-	3	-	3
CO3	-	-	-	-	-	-	-	-	-	3	-	3
CO4	-	-	-	-	-	-	-	-	-	-	-	3
CO5	-	-	-	-	-	-	-	-	-	3	-	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Assessment Pattern:

<table>
<tr><th>Name of the Test</th><th>Marks</th><th>Total</th><th>Reduced to</th></tr>
<tr><td>Continuous Assessment (Experiments 1-10)</td><td>50</td><td rowspan="2">100</td><td rowspan="2">50</td></tr>
<tr><td>Model Examination</td><td>50</td></tr>
<tr><td>End Semester Lab Exam</td><td>100</td><td>100</td><td>50</td></tr>
<tr><td colspan="3">TOTAL</td><td>100 MARKS</td></tr>
</table>

Textbooks:

1. Raman, Meenakshi and Sangeetha Sharma. Professional Communication. Oxford University Press, Oxford, 2014.
2. Dr. Chellammal. V. Learning to Communicate. Allied Publishers, New Delhi, 2003.
3. Mohan, Krishna. And Meera Bannerjee. Developing Communication Skills. Macmillan India Ltd. 1990.

Reference Books:

Murphy – Raymond. English Grammar in Use BOOK with Answers: A Self-Study. Reference and Practice Book for Intermediate Learners of English. Fourth edition: Cambridge University Press – 2012.

MANUALS/ SOFTWARE: Open Sources / Websites

ROHINI **COLLEGE OF ENGINEERING AND TECHNOLOGY**

(AUTONOMOUS)

(Anjugramam-Kanyakumari Main Road, Palkulam,Variyoor P.O.-629 401, K.K.Dist.)

Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai

Accredited with A+ Grade by NAAC

B.E. Computer Science and Engineering

(Artificial Intelligence and Machine Learning)

(B.E CSE AIML)

Curriculum & Syllabus

(*2024-2025 Admitted Students Onwards*)

Vision Statement of RCET

To be an academic institute of continuous excellence towards education and research in rural regime and provide service to nation in terms of nurturing potentially higher social, ethical and engineering companion graduands.

Mission Statement of RCET

To foster and promote technically competent graduands by imparting the state of art Engineering education in rural regime.

To enunciate research assisted scientific learning by dissemination of knowledge towards science, agriculture, industry and national security.

Vision of the Department

To create young software professionals to compete the global challenges in the field of computer science and engineering and be researcher to meet the need of society.

Mission of the Department

- ✓ To provide quality education to develop software for real time problem in scientific and business application for various needs of industry.
- ✓ To provide learning ambience to enhance innovations, problem solving skill, leadership qualities, team spirit and ethical responsibility to serve the society.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1	The graduates will be able to design and to adapt modern tools to innovate ideas and develop computational solution for technological problem.
PEO2	The graduates will be able to develop professional skills for employment and understand the need of lifelong learning for a successful professional career.
PEO3	To develop an ability to become successful professional, entrepreneur and urge for pursuing higher studies.

PROGRAMME OUTCOMES (POs)

PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life- long learning in the broadest context of technological change.

Programme Specific Outcomes (PSO)

PSO1	To solve complex engineering problems by applying fundamental concepts of Computer Science and Engineering across the various domains including Artificial Intelligence, Cyber Security, Software Engineering and Data mining
PSO2	To apply programming skills to provide sustainable solutions for problems in computer science and Engineering related to environment and society
PSO3	Design and develop innovative solutions and products by adapting ethical principles of software engineering to meet the societal needs thereby emerging as an entrepreneur.

CREDIT INFO		
Sl.No	Category	Credits
1	Humanities and Social Science (HSS)	13
2	Basic Science Courses (BSC)	25
3	Engineering Science Courses (ESC)	25
4	Professional Core Course(PCC)	59
5	Professional Electives Courses (PEC)	18
6	Open Electives Courses (OEC)	12
7	Employability Enhancement Courses (EEC)	17
8	Mandatory Courses (MNC)	-
Total Credits		169

Humanities and Social Science (HSS)							
Sl.no	Course Code	Course Title	Course Type	L	T	P	Credit
1	24GE101	Heritage of Tamils	HSS	1	0	0	1
2	24EN101	English For Engineers	HSS	2	0	1	2.5
3	24GE201	Tamil and Technology	HSS	1	0	0	1
4	24EN231	Presentation And Language Skills Laboratory	HSS	0	0	3	1.5
5	24MG601	Product Innovation & Entrepreneurship	HSS	2	0	0	2
6	24GE701	Professional Ethics and Human Values	HSS	2	0	0	2
7	24MG701	Economics for Engineers	HSS	3	0	0	3
Basic Science Courses (BSC)							
Sl.no	Course Code	Course Title	Course Type	L	T	P	Credit
1	24MA101	Matrices and Calculus	BSC	3	1	0	4
2	24PH101	Engineering Physics	BSC	3	0	2	4
3	24CY101	Engineering Chemistry	BSC	3	0	2	4
4	24MA201	Complex Variables and Transform	BSC	3	1	0	4
5	24MA301	Probability, Random Processes and Statistics	BSC	3	1	0	4
6	24MA402	Discrete Mathematics & Linear Algebra	BSC	3	0	0	3
7	24CY401	Environmental Science and Engineering	BSC	2	0	0	2
Engineering Science Courses (ESC)							

S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24ME201	Engineering Graphics & Design	ESC	1	0	4	3
2	24CS201	Programming for Problem Solving using C	ESC	2	0	4	4
3	24EC302	Digital Logic Circuits and Design	ESC	3	0	2	4
4	24EE202	Fundamentals of Electrical and Electronics Engineering	ESC	3	0	0	3
5	24EE404	IoT - Sensors and Devices	ESC	3	0	2	4
6	24CS301	Programming for Problem Solving using Python	ESC	0	0	3	1.5
7	24GE231	Workshop Practices	ESC	0	0	3	1.5
8	24ML301	Principles of Programming Languages	PCC	2	0	2	3
Professional Core Courses(PCC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24EC501	Microprocessors, Microcontrollers and Interfacing Techniques	PCC	3	0	2	4
2	24CS301	Data Structures and Algorithms	PCC	3	0	2	4
3	24CS302	Object Oriented Programming using Java	PCC	3	0	2	4
4	24CS304	Database Management Systems	PCC	3	0	2	4
5	24CS403	Theory of Computation	PCC	3	1	0	4
6	24CS404	Operating Systems	PCC	3	0	0	3
7	24CS502	Artificial Intelligence	PCC	3	0	2	4
8	24CS405	Software Engineering & Package Development	PCC	3	0	2	4
9	24ML431	Application Development Lab	PCC	0	0	2	1
10	24ML501	Machine Learning	PCC	3	0	2	4
11	24ML502	Internet Programming	PCC	3	0	2	4
12	24ML503	Data Privacy and Security	PCC	2	0	2	3
13	24ML601	Deep Learning	PCC	3	0	2	4
14	24ML602	Machine Vision	PCC	3	0	2	4
15	24ML701	Big data and Modern database system	PCC	3	0	2	4
16	24ML702	Reinforcement Learning	PCC	3	0	2	4
Professional Electives Courses (PEC)							
Professional Elective I - Applied Machine Learning							

S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24ML571	Self Driving Car	PEC	3	0	0	3
2	24ML572	Game Programming	PEC	3	0	0	3
3	24ML573	Machine Learning for Bioinformatics	PEC	3	0	0	3
4	24ML574	Natural Language Processing	PEC	3	0	0	3
5	24ML575	Autonomous Drones	PEC	3	0	0	3
6	24ML576	Speech and Language Processing	PEC	3	0	0	3
Professional Elective II - Full Stack Development							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24CS581	Agile Software Development	PEC	3	0	0	3
2	24CS582	UI and UX Design	PEC	3	0	0	3
3	24CS583	Web Frameworks	PEC	3	0	0	3
4	24CS584	App Development	PEC	3	0	0	3
5	24CS585	Software Testing and Automation	PEC	3	0	0	3
6	24CS586	DevOps	PEC	3	0	0	3
Professional Elective III - Cloud Computing and Data Center Technologies							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24CS671	Virtualization in Cloud Computing	PEC	2	0	2	3
2	24CS672	Cloud Services and Data Management	PEC	2	0	2	3
3	24CS673	Cloud Storage Technologies	PEC	2	0	2	3
4	24CS674	Cloud Automation Tools and Applications	PEC	2	0	2	3
5	24CS675	Software Defined Networks	PEC	2	0	2	3
6	24CS676	Security and Privacy in Cloud	PEC	2	0	2	3
Professional Elective IV - Cyber Security and Data Privacy							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24CS681	Cyber Security	PEC	2	0	2	3
2	24CS682	Modern Cryptography	PEC	2	0	2	3
3	24CS683	Cyber Forensics	PEC	2	0	2	3
4	24CS684	Ethical Hacking	PEC	2	0	2	3
5	24CS685	Crypto currency and Block chain Technologies	PEC	2	0	2	3
6	24CS686	Malware Analysis	PEC	2	0	2	3

Professional Elective V - Creative Media							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24CS771	Multimedia and Animation	PEC	3	0	0	3
2	24CS772	UI and UX Design	PEC	3	0	0	3
3	24CS773	Augmented Reality and Virtual Reality	PEC	3	0	0	3
4	24CS774	Game Development	PEC	3	0	0	3
5	24CS775	Video Creation and Editing	PEC	3	0	0	3
6	24CS776	Digital Marketing	PEC	3	0	0	3
Professional Elective VI – Artificial Intelligence and Robotics							
1	24AI771	Robotic Process Automation	PEC	3	0	0	3
2	24AI772	Intelligent Robots and Drone Technology	PEC	3	0	0	3
3	24AI773	Intelligent Transportation System	PEC	3	0	0	3
4	24AI774	Expert Systems	PEC	3	0	0	3
5	24AI775	Edge Computing	PEC	3	0	0	3
6	24AI776	Applications of Artificial Intelligence in Healthcare	PEC	3	0	0	3
Open Electives Courses (OEC)							
Open Elective I - Electronics and Communication Engineering							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24EC501	Nano Electronics	OEC	3	0	0	3
2	24EC503	Digital Signal Processing	OEC	3	0	0	3
3	24EC504	Fuzzy Logic Systems and ANN	OEC	3	0	0	3
4	24EC505	Consumer Electronics	OEC	3	0	0	3
5	24EC506	Electronic System Design	OEC	3	0	0	3
6	24EC507	Electronic Packaging	OEC	3	0	0	3
Open Elective II - Civil and Agricultural Engineering							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24AG601	Principles of Crop Production	OEC	3	0	0	3
2	24AG602	Dairy and Food Engineering	OEC	3	0	0	3
3	24AG603	Post-Harvest Technology	OEC	3	0	0	3
4	24AG604	Agricultural Finance, Banking and Co-operation	OEC	3	0	0	3
5	24CI601	Rural Development	OEC	3	0	0	3
6	24CI602	Geographic Information System	OEC	3	0	0	3

7	24CI603	Water Resources management	OEC	3	0	0	3
8	24CI604	Climate Change and its Impact	OEC	3	0	0	3
Open Elective III - Bio Medical and Electrical Engineering							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24BM701	Wearable Devices	OEC	3	0	0	3
2	24BM702	Telemedicine and Healthcare Delivery	OEC	3	0	0	3
3	24BM703	Medical Informatics	OEC	3	0	0	3
4	24BM704	Basics of Human Anatomy and Physiology	OEC	3	0	0	3
5	24EE701	Robot Process Automation	OEC	3	0	0	3
6	24EE702	Electric vehicle Technology	OEC	3	0	0	3
7	24EE703	Smart Grid	OEC	3	0	0	3
8	24EE704	Energy Conservation and Management	OEC	3	0	0	3
Open Elective IV – Mechanical and Management							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24ME701	Additive Manufacturing	OEC	3	0	0	3
2	24ME702	Rocket Propulsion	OEC	3	0	0	3
3	24ME703	Industrial Safety	OEC	3	0	0	3
4	24ME704	Marine Vehicles	OEC	3	0	0	3
5	24MG701	Digital Marketing	OEC	3	0	0	3
6	24MG702	Industrial Psychology	OEC	3	0	0	3
7	24MG703	Logistics and Supply chain Management	OEC	3	0	0	3
8	24MG704	Corporate Social Responsibility	OEC	3	0	0	3
Employability Enhancement Courses (EEC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24ML351	Mini Project-I (Design Thinking & System Thinking)	EEC	0	0	2	1
2	24ML451	Mini Project-II (Society Attachment)	EEC	0	0	2	1
3	24EN451	Soft Skills Development	EEC	0	0	2	1
4	24ML551	Mini Project-III (Industry Attachment)	EEC	0	0	2	1
5	24EN651	Business And Managerial Communications	EEC	0	0	2	1
6	24GE551	Quantitative and Reasoning Skills-I	EEC	0	0	2	1

7	24ML651	Mini Project- IV (Development of Products)	EEC	0	0	2	1
8	24GE651	Quantitative and Reasoning Skills-II	EEC	0	0	2	1
9	24ML751	Project Work Phase I (Design & Analysis)	EEC	0	0	4	2
10	24ML752	Industrial Training/Internship	EEC	0	0	0	2
11	24ML851	Project Work Phase - II (Prototype& Testing)	EEC	0	0	10	5
Mandatory Courses (MNC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24MC101	Induction Programming	MNC	THREE WEEKS			
2	24MC201	Sports and Yoga for Youth Empowerment - I	MNC	0	0	2	0
3	24MC202	NCC Credit Course Level - I	MNC	1	0	2	1#
4	24MC301	Sports and Yoga for Youth Empowerment - II	MNC	0	0	2	0
5	24MC401	NCC Credit Course Level - II	MNC	1	0	2	1#
6	24MC601	Disaster Management	MNC	1	0	0	1#
7	24MC701	Constitution of India	MNC	0	0	1	1#

 # denotes no credit

SCHEME OF INSTRUCTION FOR FIRST YEAR B.E.

I SEMESTER

S.no	Course code	Course Title	Category	L	T	P	C
THEORY COURSES							
1	24GE101	Heritage of Tamils	HSS	1	0	0	1`
2	24MA101	Matrices and Calculus	BSC	3	1	0	4
THEORY COURSE WITH LABORATORY COMPONENT							
3	24EN101	English for Engineers	HSS	2	0	1	2.5
4	24PH101	Engineering Physics	BSC	3	0	2	4
5	24CY101	Engineering Chemistry	BSC	3	0	2	4
6	24ME201	Engineering graphics & design	ESC	1	0	4	3
7	24CS201	Programming for problem solving using c	ESC	2	0	4	4
MANDATORY COURSES							
8	24MC101	Induction programming	MNC	THREE WEEKS			
TOTAL				14	1	15	22.5

II SEMESTER

S.no	Course code	Course Title	Category	L	T	P	C
THEORY COURSES							
1	24GE201	Tamil and technology	HSS	1	0	0	1`
2	24MA201	Complex Variables and Transforms	BSC	3	1	0	4
THEORY COURSE WITH LABORATORY COMPONENT							
4	24EC302	Digital logic circuits and design	ESC	3	0	2	4
5	24EE202	Fundamentals of Electrical and Electronics engineering	ESC	3	0	2	4
6	24EE404	IoT - Sensors and Devices	ESC	3	0	2	4
LABORATORY COURSES							
7	24CS301	Programming for problem solving using python	ESC	0	0	3	1.5
8	24GE231	Workshop practices	ESC	0	0	3	1.5
9	24EN231	Presentation and language Skills laboratory	HSS	0	0	3	1.5
MANDATORY COURSES							
10	24MC201	Sports and yoga for youth empowerment - II	MNC	0	0	2	0
11	24MC202	NCC CREDIT COURSE LEVEL - I	MNC	1	0	2	1#
TOTAL				13	1	15	21.5

பாடநெறி குறியீடு:	**24GE101**	***பாடத்தின் தலைப்பு:***	***தமிழர்மரபு*** (Common to AI&DS,AE,BME,CE,CSE,CSE (AI&ML),EEE,ECE,MECH)
கிரெடிட்	**1**	**L – T – P**	**1-0-0**

பாடத்திட்ட நோக்கங்கள்:
தமிழின் மதச்சார்பற்ற தன்மை, இந்திய மொழிக் குடும்பத்தின் திராவிட மொழி, திருக்குறளின் கருத்துக்கள், சமயங்களின் தாக்கம், நவீன இலக்கிய வளர்ச்சி ஆகியவற்றை நினைவு கூர்தல். தமிழர்களின் சமூக மற்றும் பொருளாதார வாழ்வில் நடுகல், சிற்பங்கள், சிலைகள் மற்றும் அழகிய கைவினைப் பொருட்கள், இசைக்கருவிகள் ஆகியவற்றின் தொடர்புடைய அறிவைக் கோடிட்டுக் காட்டுதல். தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகளை மனதில் பதிய வைத்தல். தமிழ்நாட்டின் தாவரங்கள் மற்றும் விலங்கினங்கள், சங்க நகரங்கள் மற்றும் துறைமுகங்கள், சங்க காலத்தின் ஏற்றுமதி மற்றும் இறக்குமதிகளை நினைவுபடுத்துதல், வெளிநாடுகளில் சோழர் படையெடுப்பைக் கண்டறிதல். இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கைக் கண்டறிதல், இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்குக்கு இணையாக இந்தியாவின் பிற பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கத்தை அடையாளம் காணுதல்.

அலகு I மொழி மற்றும் இலக்கியம்:	**[3hours]**
இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம்- பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும்	

பாரதிதாசன் ஆகியோரின் பங்களிப்பு.	
அலகு II மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக்கலை:	**[3hours]**
நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.	

அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:	**[3hours]**
தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.	

அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள்:	**[3hours]**
தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறைமுகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி.	

அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு:	**[3hours]**
இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தங்கங்களின் அச்சு வரலாறு.	

பாடநெறி முடிவுகள் (பாமு):

பாடநெறியின் முடிவில், மாணவர் பின்வரும் திறன்களைப் பெறுவர்:

பாமு	**பாடநெறி முடிவுகள்**	**மிக உயர்ந்த அறிவாற்றல் நிலை**
அலகு I பாமு:	தமிழின் மதச்சார்பற்ற தன்மை, திராவிட மொழியின் பங்கு, திருக்குறளின் கருத்துக்கள், சமயங்களின் தாக்கம், நவீன இலக்கிய வளர்ச்சி ஆகியவற்றையும் தெரிந்துகொள்கிறார்கள்.	கே 1
அலகு II பாமு:	தமிழர்களின் சமூக மற்றும் பொருளாதார வாழ்வில் நடுகல், சிற்பங்கள், சிலைகள் மற்றும் அழகிய கைவினைப் பொருட்கள், இசைக்கருவிகள் ஆகியவற்றை விவரிக்கும் ஆற்றலை பெறுகிறார்கள்.	கே 2
அலகு III பாமு:	தமிழர்களின் பாரம்பரிய விளையாட்டுகளை தெரிந்து கொள்ளுவதால் விளையாட வேண்டும் ஏன்ற ஆர்வத்தை பெறுகிறார்கள்.	கே 1
அலகு IV பாமு:	தமிழ்நாட்டின் தாவரங்கள் மற்றும் விலங்கினங்கள் பற்றிய அறிவையும், சங்க கால கட்டிடக்கலை, ஏற்றுமதி மற்றும் இறக்குமதி தொழில் நுட்ப அறிவை பெறுகிறார்கள்..	கே 1
அலகு V பாமு:	இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கையும், இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு இணையாக இருப்பதையும், தெரிந்து கொள்கிறார்கள்.	கே 1

பாடநெறி முடிவுகள் ***மற்றும் நிரல் முடிவுகள் ஒப்பிடுதல்***

பாமுகள்	மிக உயர்ந்த அறிவாற்றல் நிலை	பாடநெறி முடிவுகள்											
		1	2	3	4	5	6	7	8	9	10	11	12
பாமு1	கே 1	2	-	-	-	-	-	-	-	-	-	-	-
பாமு2	கே 2	1	-	-	-	-	-	-	-	-	-	-	-
பாமு3	கே 1	1	-	-	-	-	-	-	-	-	-	-	-
பாமு4	கே 1	1	-	-	-	-	-	-	-	-	-	-	-
பாமு5	கே 1	1	-	-	-	-	-	-	-	-	-	-	-

நிலை 3- அதிக ஒத்துப்போதல், நிலை 2- மிதமாக ஒத்துப்போதல், நிலை 1- குறைவாக ஒத்துப்போதல், நிலை 0- ஒத்துப்போகவில்லை

மதிப்பீட்டுத் திட்டம்:

கூறுகள்	மதிப்பீட்டின் வகை	அதிகபட்ச மதிப்பெண்கள்	குறைக்கப்பட்ட மதிப்பெண்கள்	இறுதி மதிப்பெண்கள்
தொடர்ச்சியான உள் தேர்வு	தொடர்ச்சியான உள் தேர்வு - I	100	40	40
	தொடர்ச்சியான உள் தேர்வு - II	100	40	
இறுதி பருவ தேர்வு	எழுத்து தேர்வு	100	60	60
			மொத்தம்	100

இறுதி பருவ தேர்வு: (கேள்வி முறை)

- ஒவ்வொரு யூனிட்டும் இரண்டு 2 மதிப்பெண் வினாக்களையும் ஒரு 16 மதிப்பெண் வினாவையும் (இரண்டில் ஒன்று) கொண்டுள்ளது.
- பதினைந்து கேள்விகளுக்கும் பதிலளிக்க வேண்டும்.

மதிப்பீட்டு முறை

ப்ளூமின் வகை	தொடர்ச்சியான மதிப்பீட்டு சோதனைகள்		இறுதி தேர்வு
	1	2	
நினைவில் கொள்ளுதல்	60	50	60
புரிந்து கொள்ளுதல்	40	50	40
விண்ணப்பித்தல்	0	0	0
பகுப்பாய்வுதல்	0	0	0
மதிப்பிடுதல்	0	0	0
உருவாக்குதல்	0	0	0

TEXT BOOKS:

1. தமிழகவரலாறு - மக்களும்பண்பாடும் - கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்).
2. கணினித்தமிழ் - முனைவர்இல. சுந்தரம். (விகடன்பிரசுரம்).
3. கீழடி - வைகைநதிக்கரையில்சங்ககாலநகரநாகரிகம் (தொல்லியல்துறைவெளியீடு)
4. பொருநை - ஆற்றங்கரைநாகரிகம். (தொல்லியல்துறைவெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.

REFERENCE BOOKS:

1. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
2. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
3. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department ofArchaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
4. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
5. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
6. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Course Code:	24MA101	Course Title:	**Matrices and calculus** (Common to AI&DS,AE,BME,CE,CSE,CSE(AI&ML),EEE, ECE,MECH)
Credits:	**4**	**L – T – P**	**3 – 1 – 0**
Pre-requisite			**NIL**

Course objectives:

- To provide the basic tools of calculus mainly for the purpose of modeling the engineering problems mathematically and obtaining solutions.
- To learn the concept of eigenvalues and eigenvectors and to reduce the quadratic form to canonical form.
- To learn the foundation course of Single Variable and multivariable calculus plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

Teaching-Learning Process:

These are sample strategies which teachers can use to accelerate the attainment of the various course outcomes.

Lecture method does not mean only traditional method, but different type of teaching methods may be adopted to develop the outcomes.
Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
Topics will be introduced in a multiple representation and encourage the students to come up with their own creative ways to solve them.
Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT I – Matrices	**[12 hours]**

Eigenvalues and Eigenvectors and their properties – Diagonalization of a matrix (Symmetric matrix) – Cayley - Hamilton theorem (without proof) – Inverse and Power of a matrix by Cayley - Hamilton theorem – Quadratic forms and Nature of quadratic forms.

Application: Reduction of a quadratic form to canonical form by orthogonal transformation.

UNIT II – Differential Calculus	[12 hours]
Functions – Limit – Continuity – Derivatives – Differentiation rule – Product and quotient rules – Chain rules – Implicit differentiation – Logarithmic differentiation. Application: Maxima and Minima of functions of one variable	

UNIT III – Functions of Several Variables	[12 hours]
Partial differentiation – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables. Application: Maxima and Minima of functions of two variables using MATLAB - Lagrange's method of undetermined multipliers.	

UNIT IV – Integral Calculus	[12 hours]
Definite and Indefinite integrals - Substitution rule - Techniques of Integration: Bernoulli's theorem (without proof) – Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals. Application: Area between simple closed curves.	

UNIT V – Multiple Integrals	[12 hours]
Double integrals –Double integrals in cartesian and polar coordinates – Change of order of integration– Area enclosed by plane curves – Triple integrals – Change of variables in double and triple integrals. Application: Volume of solids, Mass of Lamina	

Course outcomes:

On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Apply the matrix algebraic techniques for eigen value related applications	K3
CO2	Understand the concepts of limit and continuity of functions	K2
CO3	Compute the derivatives and the extreme points and solve engineering problems	K3

CO4	Use the partial derivatives to find the maxima and minima of multivariable functions	K3
CO5	Use fundamental theorem of calculus to evaluate definite integrals	K3
CO6	Apply the concepts of multiple integrals to find the areas and volumes of geometrical shapes	K3

COs and POs Mapping:

COs	**POs**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	2	1	-	2	-	-	-	-	-	-	2
CO2	2	1	1	-	-	-	-	-	-	-	-	1
CO3	3	2	1	-	2	-	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	-
CO6	3	2	1	-	1	-	-	-	-	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or choice).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	20	20	20
Understand	40	20	20
Apply	40	60	60
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
3. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 2015. [For Units II & IV - Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8]

Reference Books:

1. Muthusubramanian R and Salivahanan S, "Basic Electrical and Electronics Engineering," McGraw Anton. H, Bivens. I and Davis. S, " Calculus ", Wiley, 10th Edition, 2016
2. Bali. N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
3. Jain. R.K. and Iyengar. S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition, 2016.
4. Narayanan. S. and Manicavachagom Pillai. T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.
5. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.Hill, NewDelhi, 2009.

Equivalent NPTEL/SWAYAM Courses

SI.No.	Course Title	Course Instructor	Host Institute
1	Matrix Analysis with Applications	Prof. S. K. Gupta Prof. Sanjeev Kumar	IIT Roorkee
2	Calculus of One Real Variable	Prof. Joydeep Dutta	IIT Kanpur

Web Links and Video Lectures (E-Resources):

1. System of Linear Equations, Eigenvalues and Eigenvectors: https://www.nptelvideos.com/lecture.php?id=13416
2. Concept of Domain, Limit, Continuity and Differentiability: https://www.nptelvideos.com/lecture.php?id=13422
3. Matrix Diagonalization: https://www.nptelvideos.com/lecture.php?id=13481

Course Code:	**24EN101**	**Course Title:**	**ENGLISH FOR ENGINEERS** (Common to AI&DS, AE,BME,CE,CSE,CSE(AI&ML),EEE, ECE,MECH)
Credits:	**2.5**	**L – T – P**	**2-0-1**
Pre-requisite			**NIL**

Course Objectives:

- To develop an understanding of Basic English Grammar.
- To enhance listening skills and select appropriate responses.
- To practise presentation and speaking techniques.
- To develop a quest for reading.
- To practise professional writing.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Language learning softwares / Language Lab
3. Online Resources
4. Smart Class Room
5. Flipped classrooms
6. Project based Collaborative Experiential learning
7. Expert Lecture sessions

UNIT I - BASIC GRAMMAR- VOCABULARY AND EXPRESSIONS	[8 hours]
Grammar: Parts of speech - Types of sentences: Assertive - Imperative - Interrogative & Exclamatory - Affirmative - Negative - Gerunds & Infinitives - Tenses - Voices- Impersonal passives- Prepositions -Articles & Determiners- Cause and effect expressions - Vocabulary: Affixes- Synonyms & Antonyms - Homonyms - Homophones- Compound Nouns.	

UNIT II - ACTIVE LISTENING - RESPONDING		[15 hours]
LIST OF EXERCISES		
LAB ACTIVITIES		
SI. No.	Topic	Hours
1.	Listening to Audio (Podcasts- Audiobooks- Radio Program) and Practice Exercise-Answering Cloze Test Based on Listening	3
2.	Listening to native speaker’s Telephone Conversations– Analyzing a Product	3
3.	Listening to Job Interviews - Sports Commentaries /	3

	Animated stories / Anecdotes / Event narration	
4.	Video Comprehension – Brainstorming and Note-Taking	3
	CLASSROOM ACTIVITIES	
1.	Listening to Statistical Information and Follow-up Exercises. - Form Filling Exercises	1
2.	Debate and reviewing the performance of each participant - Panel Discussion	2

UNIT III: SPEAKING AND PRESENTATION SKILLS		**[15 hours]**
	LIST OF EXERCISES	
	LAB ACTIVITIES	
SI. No.	**Topic**	**Hours**
1.	Speaking Development through English software S-net or Globarena and Online Content (Tenses- Voices- SV Agreement- Prepositions- Coherence Markers- Relative Clauses- Modals- Punctuation)	5
	CLASSROOM ACTIVITIES	
1.	Self-Introduction - Sharing Childhood Experiences- Talking about Favorite Personalities	1
2.	Describing Recent Innovation in Technology	1
3.	Interviewing Celebrities and Entrepreneurs	1
4.	Situational Conversations (Meeting a friend in a cafe) - Narrating Personal Experience	1
5.	Group Communication- Discussing Social Issues- Current Affairs and Debate	1
6.	Role-Play- Picture/Movie Description	1
7.	Presentation – I (Book /Movie Review- Story Telling- General	2

	Presentations)	
8.	Presentation – II (Technical Presentations)	2

UNIT IV: READING BETWEEN LINES		**[12 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
SI. No.	**Topic**	**Hours**
1.	Reading Comprehension - skimming - scanning (General / Technical passages	2
2.	Reading Longer Texts with Time Frame	2
3.	Reading Data using different types of Texts- Magazines and Internet Materials	2
4.	Reading Research Papers-- Editing/Proofreading	2
CLASSROOM ACTIVITIES		
1.	Job Advertisements – Manual for Product/Service – Telephone Phrases	1
2.	Reading Cause and Effect Essays-Technical Papers and Case Studies - Sorting out jumbled Sentences in a Paragraph	2
3.	Short Stories - Critical Reading	1

UNIT V- WRITING FOR ENGINEERS	**[7+3 hours]**
Writing - Application Letters - Resume- Product Description - Essay related to Technical / Social / current topics - Interpretation of Charts - Short Articles on everyday life - letters – Enquiry- Quotation- Order- Claim - Adjustment - Response to complaints - Statement of Purpose (SoP) -Emails - Memos -Notices - Circulars - Minutes of Meetings - Internship - Accident Report - Feasibility Report- Recommendations.	

LIST OF EXERCISES

LAB ACTIVITIES		
SI. No.	**Topic**	**Hours**
1.	Mind Mapping and Brainstorming on any Social Event/Issue	1
2.	Creating a Blog/Vlog/YouTube Channel –Uploading MP3/MP4 – Practice (Movie/Book/ Gadget Review- General/Tech Talks- Interview with Celebrities)	1
3.	Creating a Product Review Blog.	1

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Domain
CO1	Identify various grammatical components- build vocabulary and apply expressions for error-free sentences	K3
CO2	Make use of appropriate words to respond by listening to general and technical online contents	K3
CO3	Experiment with the nuances of presentation and speaking skills	K3
CO4	Apply reading skills in various academic contexts	K3
CO5	Construct legible and flawless sentences proficiently with appropriate choice of words and structures for varied professional contexts	K3

COs and POs Mapping:

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	-	-	-	-	-	-	-	-	-	3	-	3
CO2	-	-	-	-	-	-	-	-	-	3	-	3
CO3	-	-	-	-	-	-	-	-	-	3	-	3
CO4	-	-	-	-	-	-	-	-	-	3	-	3
CO5	-	-	-	-	-	-	-	-	-	3	-	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max. Marks</th><th>Reduced Marks</th><th>Total</th><th>Final marks</th></tr>
<tr><td rowspan="4">Continuous Internal Examination (CIE) - Theory</td><td>CIE – I</td><td>100</td><td rowspan="2">60</td><td rowspan="4">100</td><td rowspan="4">25</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>Skill Assessment I (2 Assignments + 1 seminar)</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment II (3 Assignments)</td><td>40</td></tr>
<tr><td rowspan="2">Continuous Internal Examination (CIE) - Laboratory</td><td>Continuous Assessment (Lab activities & exercises)</td><td>75</td><td>75</td><td rowspan="2">100</td><td rowspan="2">25</td></tr>
<tr><td>Model Lab Exam</td><td>25</td><td>25</td></tr>
<tr><td rowspan="2">End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>35</td><td rowspan="2">50</td><td rowspan="2">50</td></tr>
<tr><td>Lab Exam</td><td>100</td><td>15</td></tr>
<tr><td colspan="5">Total</td><td>100</td></tr>
</table>

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	10	10	10
Understand	30	30	30
Apply	60	60	60
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Gangalakshmi- C- Rathika- B- Saranraj- L. Professional English for Engineers. New Delhi: Cengage- 2022.

2. Murphy- Raymond. English Grammar in Use Book with Answers: A Self-study Reference and Practice Book for Intermediate Learners of English. Fourth Edition: Cambridge University Press- 2012.

Reference Books:

1. Raman- Meenakshi and Sangeetha Sharma. Communication Skills. New Delhi: OUP- 2018
2. R. C. Sharma_ Krishna Mohan - Business Correspondence and Report Writing _ a Practical Approach to Business _ Technical Communication-Mc Graw Hill India (2017)

Web Links and Video Lectures (E-Resources):

MANUALS / SOFTWARE: Open Sources / British Council / Cambridge Websites

Suggested Skill Activities:

1) Listening tests materials [Select podcasts / radio programmes / YouTube videos / audiobooks / materials from British Council] - Cloze tests where students fill in missing words from transcripts – Yes or No Question Answers – one-word answers based on recording – summary of recording
2) Self-introduction / Introduce Colleague
3) Just a Minute talks
4) Extempore
5) Mock GDs
6) Mock Interviews
7) Note Taking of Engineering Lectures
8) Create videos / blogs
9) Present Technical Papers
10) Reading Comprehension Exercises
11) Writing letters – Leave letter – Letter for academic purposes

12) Writing Essays

13) Composing Mails

14) Preparing Statement of Purpose

15) Preparing Covering letter and Resume

Course Code:	**24PH101**	**Course Title:**	**ENGINEERING PHYSICS**
Credits:	**4**	**L – T – P**	**3-0-2**
Pre-requisite			**NIL**

Course Objectives:

- To make the students effectively to achieve an understanding of Mechanics
- To enable the students to gain knowledge of Elasticity.
- To enable the students to gain knowledge of Maxwell's Equation and Electromagnetic waves.
- To introduce the basics of optics and lasers.
- Equipping the students to successfully understand the importance of quantum physics.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I -MECHANICS	[9 hours]
Multiparticle dynamics: Center of mass (CM) – Rotation of rigid bodies: Rotational kinematics – Rotational kinetic energy and moment of inertia - Theorems of M .I –M.I of Uniform rod-M.I of a diatomic molecule - Torque– Rotational energy state of a rigid diatomic molecule - Gyroscope – Torsional stress and deformation-Torsional pendulum- Double pendulum.	
Practical Topics: 1. Torsional pendulum – Determination of rigidity modulus of wire and moment of inertia of disc. 2. Compound pendulum – Determination of rigidity modulus	

UNIT II - ELASTICITY	[9 hours]
Elasticity – Factors affecting Elasticity –Different types of Modulus- Moduli of elasticity and its relation -Stress - strain diagram and its applications - Bending of beams - Bending moment – Cantilever - Young's modulus : Uniform & Non-uniform bending-theory and experiment-I Shaped Girders.	
Practical Topics: 1. Determination of Young's modulus of a given material- Non uniform bending method 2. Uniform bending – Young's modulus determination.	

UNIT III - MAXWELL'S EQUATIONS AND ELECTROMAGNETIC WAVES	[9 hours]
The Maxwell's equations - wave equation- Plane electromagnetic waves in vacuum - properties of electromagnetic waves - Producing electromagnetic waves - Energy and momentum in EM waves - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium vacuum interface for normal incidence..	
Practical Topics: 1. Spectrometer – Determination of wavelength of Hg spectrum using grating. 2. Spectrometer – Angle of the prism 3. Spectrometer – Dispersive power of the prism	

UNIT IV - LASERS &FIBER OPTICS	[9 hours]
Lasers:-Einstein coefficients and their relations –-characteristics of laser - Types of Laser - Nd-YAG laser -semiconductor laser- Applications -Industrial, Medical, laser based military weapons Fiber optics: principle and classification of optical fibers – propagation of light in optical fiber - Numerical aperture and Acceptance angle– Fiber optic communication system - Applications - Displacement and pressure sensors – Endoscopy	
Practical Topics: 1. Determination the acceptance angle and numerical aperture of the given optical fiber. 2. Determination of the particle size of the given powder using laser 3. Determination of wavelength of a given laser source - Grating method	

UNIT V - QUANTUM MECHANICS	[9 hours]
Photons and light waves - Electrons and matter waves- Dual Nature of Light –-De Broglie Waves-Compton effect - The Schrodinger equation (Time dependent and time independent forms) - Physical Significance of wave function - Normalization –Free particle - particle in a infinite potential well: 1D,2D and 3D Boxes- Normalization-quantum computation.	
Practical Topics: 1, Young's Double Slit Experiment to demonstrate the wave nature of particles	

Laboratory component: **30 Hours**

Any ten experiments have to be completed from the following list ofExperiments

SI.No	Name of the experiment
1.	Apply parallel axis theorem to find the resultant of system of concurrent coplanar forces.
2.	Torsional pendulum – Determination of rigidity modulus of wire and moment of inertia of disc
3.	Compound pendulum- Determination of moment of inertia of a rigid rod.

4.	Apply the concept of bending of beams to find the Young's modulus of a given material- by Non uniform bending method
5.	Apply the concept of bending of beams to find the Young's modulus of a given material- by Uniform bending method.
6.	Determination of V-I characteristics of a solar cell.
7.	Using Ohm's law verify the laws of resistances .
8.	Using optical fiber find the acceptance angle and numerical aperture.
9.	Make use of the laser source find the particle size of the given powder.
10.	Determination of wavelength of a given laser source - Grating method.
11.	Spectrometer – Determination of wavelength of Hg spectrum using grating.
12.	Spectrometer – Dispersive power of the prism.
13.	Determination of magnetic Induction due to long current carrying conductor.
14.	Make use of the Young's Double Slit Experiment, demonstrate the wave nature of particles.
15.	Spectrometer – Angle of the prism

Course outcomes: On completion of the course, the student will have the ability to:

CO No	Corse Outcomes	Cognitive Domain
CO1	Apply the concepts of Mechanics in materials.	K3
CO2	Apply the concept of elasticity in beams.	K3
CO3	Apply the concept of electromagnetic waves in communication.	K3
CO4	Illustrate the applications of different lasers &Calculate the acceptance angle and numerical aperture of an optical fiber .	K2
CO5	Explain the quantum concepts and quantum computation.	K2

COs and POs Mapping:

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2	2	-	-	-	-	-	-	-	-	1
CO2	3	2	2	-	1	-	-	-	-	-	-	1
CO3	3	2	2	-	1	1	-	-	-	-	-	1
CO 4	3	1	1	-	1	1	-	-	-	-	-	1
CO 5	3	1	1	-	-	-	-	-	-	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	60	100	25
	CIE – II	100			
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

Assessment Pattern:

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

TEXT BOOKS:

1. D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw HillEducation (Indian Edition), 2017.
2. E.M.Purcell and D.J.Morin, Electricity and Magnetism, Cambridge Univ.Press,
3. 2013.
4. Bhattacharya, D.K. & Poonam, T. "Engineering Physics". Oxford University Press, 2015

REFERENCES:

1. R.Wolfson. Essential University Physics. Volume 1 & 2. Pearson Education(Indian Edition),2009.

2. Paul A. Tipler, Physic – Volume 1 & 2, CBS, (Indian Edition), 2004.

3. K.Thyagarajan and A.Ghatak. Lasers: Fundamentals and Applications, LaxmiPublications,(Indian Edition), 2019.

4. D.Halliday, R.Resnick and J.Walker. Principles of Physics, Wiley (IndianEdition), 2015.

Equivalent NPTEL/SWAYAM Courses:

SI.No	Course Name	Course Instructor	Course Conducting Agency
1	Quantum Mechanics	Prof .P.Ramadevi	IIT -Bombay

Web links and Video Lectures (e-Resources):

1. ELASTICITY

   https://youtu.be/eICv1p8WjgI?si=88hhiQw_fld7ZrBU

2. **MAXWELL'S EQUATIONS AND ELECTROMAGNETIC WAVES**

   https://youtu.be/3IPVZYf7C-U?si=PnP1nupcfGfr1C76

3. **LASERS &FIBER OPTICS**

   https://youtu.be/Ab1nxxkgjH8?si=KR2GS8iBUFayBwdp

4. **QUANTUM MECHANICS**

   https://youtu.be/AEedn_NiWN0?si=Y27pAqawlwKmthNO

Skill Assessment:

1. Explain the concept behind the balance a water bottle on a edge.
2. The leaning Tower of Pisa is able to stand tilted without toppling, what is the reason behind it.
3. Apply the elasticity concept to find the fatigue change in plastic fiber and natural fiber

4. Radio antennas emit visible light, Why
5. What does an opaque substance do when light rays fall on it.
6. Illustrate the things happen when light falls on a piece of black paper.
7. Explain the dual nature of matter.
8. Optical Fiber is used in hard to reach places in mechanical inspection explain it.
9. Is quantum communication faster than the speed of light
10. Compare electron microscope & tunneling microscope.

Course Code:	**24CY101**	**CourseTitle:**	**Engineering Chemistry** (Common to AI&DS,AE,BME,CE,CSE,CSE(AI&ML),EEE, ECE,MECH)
Credits	**4**	**L – T – P**	**3-0-2**
Pre-requisite			**NIL**

Course objectives:

- To provide a comprehensive understanding of water quality parameters, water treatment techniques and wastewater systems.
- To use the fundamental science and engineering principles relevant to materials that includes characterization, properties and processing of engineering materials.
- To familiarize with the principles, working and applications of electrochemistry and storage devices for safe, effective and efficient operations.
- To study, measure, monitor, control and prevent corrosion processes, economically andsafely.
- To classify different types of fuel and fuel analysis techniques that assists to choose mostconvenient fuel for a process involving combustion.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Blended Mode of Learning
3. Experiential Learning
4. NPTEL and Other Videos for theory topics
5. Flipped Class
6. Lab Experiment Videos

UNIT I - WATER TREATMENT	**[9 hours]**
Water Sources- Water Quality parameters - Hardness of water – types-units and calcium carbonate equivalent. -Determination of hardness of water by EDTA method. Scale and sludge, caustic embrittlement, priming and foaming and boiler corrosion. Water softening methods – internal and external conditioning –zeolite process and ion exchange process. Desalination – reverse osmosis and electro dialysis- Municipal water treatment and waste water treatment process.	

Practical Topics:

1. Determination of total hardness by EDTA method.
2. Estimation of alkalinity by Indicator method.
3. Estimation of chlorine content in water sample by Argentometric method.
4. Determination of BOD in water samples.

UNIT II - CHEMISTRY OF ENGINEERING MATERIALS	[9 hours]
Adhesives: Introduction- requisites of a good adhesive-adhesive action- industrial applications of adhesives. Insulating Materials: Introduction- requirements- Glass and ceramics - preparation, properties andapplications - fabrication of ceramic ware. Lubricants-Classification of lubricants with examples-characteristics of a good lubricants - mechanism of lubrication (thick film, thin film and extreme pressure) - properties of lubricants: viscosity, cloud point, pour point, flash point and fire point. Electronic materials: Introduction-types, properties and applications of semiconducting materials and transistors, materials used in IC's, fibers and cables- properties and applications, organic solar cells - types and applications.	
Practical Topics: 1. Determination of viscosity of oils using Oswald viscometer. 2. Determination of cloud point and pour point of oils.	

UNIT III -ELECTROCHEMISTRY	[9 hours]
Introduction – Electrode potential – Nernst equation and problems - Electrochemical series - Conductometric titrations (acid - base & precipitation titration) Electrodes: Construction, working and applications of Standard and reference electrode (Hydrogen & Calomel) – Ion selective (glass electrode) – determination of pH using glass electrode.Batteries and Fuel Cells – Types of batteries —dry cell -Lead Storage battery–Nickel-Cadmium Battery – Lithium battery – Battery hazards - Biological Batteries. Fuel Cells – Hydrogen-Oxygen FuelCell.	
Practical Topics: 1. Estimation of strength of hydrochloric acid by pHmetry. 2. Determination of strength of acids in a mixture of acids using conductivity meter.	

3. Determination of charging and discharging rate of batteries.	
UNIT IV -CORROSION AND ITS CONTROL	**[9 hours]**
Corrosion – causes, factors, types, Chemical and Electrochemical Corrosion (Galvanic, Differential aeration) –galvanic series-factors influencing rate of corrosion-measurement of corrosion. Determination of corrosion rate by weight loss method. Control Methods-Electrochemical protection – Sacrificial Anodic method – Impressed Current Cathodic Protection – Corrosion Inhibitors – Bio corrosion Protective Coatings – Paints, Constituents, Functions- Surface coating - Surface preparation for metallic coatings, Electroplating and Electro-lessPlating- ceramic coatings, thermal vaporization coating, HVOF coating	
Practical Topics: 1. Estimation of the Ferrous ions in mild steel by Spectrophotometry. 2. Determination of rate of corrosion of by weight loss method	

UNIT V- FUELS AND COMBUSTION	**[9 hours]**
Fuels: Introduction: Classification of fuels; solid fuel -Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Liquid fuels -Manufacture of synthetic petrol –hydrogenation of coal (Bergius process), Knocking – octane number, diesel oil – cetane number; Power alcohol and biodiesel. Combustion of fuels: Introduction: Calorific value – higher and lower calorific values, Theoretical calculation of calorific value by Dulong's formula - Ignition temperature: spontaneous ignition temperature, Explosive range; Flue gas analysis – ORSAT Method.	
Practical Topics: 1. Determination of flash point and fire point of fuels.	

Laboratory component: **30 Hours**

Any ten experiments have to be completed from the following list of experiments

SI.No.	Name of the experiment
1	Determine the total hardness of water sample by EDTA method.
2	Analyze the alkalinity of water sample by Indicator method.
3	Analyze the chlorine content in water sample by Argentometric method.
4	Determine the BOD of water samples.
5	Describe the procedure to determine the viscosity of oil using an Oswald viscometer.
6	Identify the cloud point and pour point of oils.
7	Make use of glass electrode to determine the strength of hydrochloric acid.
8	Make use of conductivity meter to determine the strength of acids in a mixture of acids.
9	Determine quantitatively the amount of Ferrous ions in mild steel by Spectrophotometry.
10	Determine the of rate of corrosion of by weight loss method.
11	Describe the procedure to determine the flash point and fire point of fuels.
12	Conduct a study to find out the charging and discharging rate of batteries.

Course outcomes: On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Level
CO1	Analyze the water quality parameters and choose appropriate water treatment methods for use in industries and daily life.	K4
CO2	Make use of the applications of the materials in different engineering disciplines.	K3
CO3	Utilize the principles of electrochemistry and find the materials for energy conversion and storage.	K4
CO4	Determine the corrosion rate to propose suitable protection methods for environmental considerations	K3
CO5	Choose suitable fuels for engineering processes and automobile applications.	K3

COs and POs Mapping

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2	-	-	-	1	-	-	-	-	-	-
CO2	3	2	1	1	-	-	-	-	-	-	-	-
CO3	3	2	1	1	-	-	-	-	-	-	-	-
CO4	2	1	1	-	-	1	2	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	60	100	25
	CIE – II	100			
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	10	10	10
Understand	30	30	30
Apply	40	40	40
Analyze	20	20	20
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Jain P.C. and Jain M, Engineering Chemistry, Dhanpat Rai Publishing Company, New Delhi, 17th Edition,2021.
2. Dara S S and Umare S.S, A Text Book of Engineering Chemistry, S.Chand & Company Limited, 20thEdition, 2018.

Reference Books:

1. Benjamin M. M, Water Chemistry, Waveland Press, 2nd Edition, 2019.
2. Cicek V, Corrosion Engineering, Springer Publishing, 1st Edition, 2021.
3. Shahinpoor. M, Fundamentals of Smart Materials, Publisher: Royal Society of Chemistry, 1st Edition,2020.
4. Berg H, Bernhardsson S, and Johansson P, Electric Vehicle Batteries: Moving from Research towardsInnovation, Publisher: Springer, 1st Edition, 2019.
5. B.K.Sharma "Engineering chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2014).

Web links and Video Lectures (e-Resources):

1. Water and wastewater treatment - https://onlinecourses.nptel.ac.in/noc23_ce12/preview
2. SemiconductorDevices and circuits. - https://nptel.ac.in/courses/108108112
3. Corrosion ProtectionMethods - https://onlinecourses.nptel.ac.in/noc23_mm01/preview
4. Elementary Electrochemistry - https://onlinecourses.nptel.ac.in/noc23_cy19/preview
5. Fuel and combustionTechnology -https://archive.nptel.ac.in/courses/103/105/103105110/

Suggested Skill Activities:

1. Measure the TDS, PH & electrical conductivity of a home water.
2. Removal of temporary hardness of any water sample by suitable method.
3. Find the charging and discharging rate of mobile batteries when it is use or not.
4. The need of engineering material is essential in our day today life. - Justify the answer.
5. Measure the corrosion rate of iron bar when it is exposed in the environment.
6. List out the recent engineering materials used in emerging field.
7. Calculate the higher and lower calorific value of a fuel by using Dulong's formula.

8. List out the type of coatings applied on materials which are used in our daily life.
9. Improper disposal of batteries leads to environmental hazard. Suggest the suitable disposable method.
10. Pure Iron material undergo corrosion more fast than other materials. Give reasons.

Course Code:	**24ME201**	**Course Title:**	**Engineering Graphics and Design**
Credits:	**3**	**L – T – P**	**1-0-4**
Pre-requisite			**NIL**

Course objectives:

To impart knowledge on the

- To enable students to understand the standards and conventions of engineering drawing.
- To enhance the visualization skills to understand objects in the respective positions with respect to principal planes.
- To comprehend general projection theory, with emphasis on orthographic projection to represent three-dimensional objects in two-dimensional views.
- To emphasize freehand sketching and pictorial view to aid in the visualization process and to efficiently communicate ideas graphically.
- To Introduce CAD software for the creation of 3D models and 2D engineering drawings.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. NPTEL and Other Videos
3. Smart Class Room
4. Project based learning

UNIT I - DRAWING FUNDAMENTALS, GEOMETRIC CONSTRUCTION, PROJECTION OF POINTS, STRAIGHT LINES AND PLANES	[15 hours]
Drawing BIS standards – Orthographic projections – First angle projection - Drawing instruments – Sheet layout – Conventions – Lines, Lettering, Numbering and Dimensioning Geometric construction – Construction of regular polygons – Conic sections – Ellipse, Parabola and Hyperbola by eccentricity method.Projection of points – Points situated in all four quadrants. Projection of straight lines – Straight lines inclined to both principal planes – Finding true length of the line and true inclinations with respect to principal planes – Rotating line method. Projection of planes – Introduction – Polygonal lamina and Circular lamina - Orientation of planes - Plane parallel to both principal planes, Planes perpendicular to both principal planes and Planes inclined to both principal planes – Rotating object method.Orthographic projection of simple engineering components.	

UNIT II - PROJECTION OF SOLIDS	[15 hours]
Projection of solids – Introduction – Types of solids – Polyhedra and solids of revolution - Projection with axes inclined to one of the principal planes and parallel to other – Change of Position method. 2D drafting - Basic commands – Coordinate systems, Object section methods. Line, Circle, Polyline, Rectangle, Hatch, Fillet, Chamfer, Trim, Extend, Offset, Dim style – Annotation and Layering – Object snaps - 3D modelling – Basic commands – Extraction of multiple views – Part modelling of simple components - Utensils, Hand tools & Furniture etc. - Drawing views using 3D environment.	

UNIT III - DEVELOPMENT OF SURFACES AND PICTORIAL PROJECTION	[15 hours]
Development of lateral surfaces of truncated Prisms, Pyramids, Cylinders and Cones– Parallel line method and Radial line method. Pictorial Projection – Isometric projection – Introduction – Isometric scale – Isometric view of two right regular composite solids – Isometric projection of truncated frustum of solids – Box method. Problems on applications of Isometric projections of simple objects / engineering components.	

UNIT IV- BASIC COMPUTER AIDED DRAWING APPLICATIONS	[15 hours]
Free hand Sketching - Sketching of geometry - multiple view projection from single pictorial view of objects – Illustrative examples - True free hand, Guided Free hand, Roads, Buildings, Utensils, Hand tools & Furniture's etc.Drawing Simple Mechanisms - Bicycles, Tricycles, Gear trains, Ratchets, two-wheeler cart &Four-wheeler carts to dimensions etc.	

UNIT V- MULTIDISCIPLINARY APPLICATIONS AND PRACTICE	[15 hours]
Electric Wiring and lighting diagrams - Like, Automatic fire alarm, Call bell system, UPS system, Basic power distribution system using suitable software. Basic Building Drawing - Draw various types of lines, graphical symbols for materials, doors and windows, symbols for sanitary, water supply and electrical installations and write abbreviations as per IS 962. Like, Architectural floor plan, basic foundation drawing, steel structures- Frames, bridges, trusses using Auto CAD or suitable software, Electronics Engineering Drawings - Like, Simple Electronics Circuit Drawings, practice on layers concept. Graphs & Charts - Like, Column chart, Pie chart, Line charts, Gantt charts, etc. using Microsoft Excel or any suitable software.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Level
CO1	Apply principles of first angle projection in drafting plan and elevation of points, lines, planes, and solids.	K3
CO2	Apply change of position method in the projection of solids and determine the true shape of the section.	K3
CO3	Apply principles of orthographic projection to extract 2D views from 3D drawing using freehand sketching.	K3
CO4	Apply parallel line and radial line methods to develop lateral surfaces of solids so that students can understand applications in sheet metal design.	K3
CO5	Apply box method to develop the isometric view of simple, truncated, and composite solids.	K3

CO6	Develop simple part model in 3D and plan, elevation, and section of building using a designated CAD software.	K6

COs and POs Mapping:

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	-	-	-	-	-	-	-	2	-	-	1	2	-
CO2	3	1	-	-	-	-	-	-	-	2	-	-	1	2	-
CO3	3	1	-	-	-	-	-	-	-	-	-	-	1	2	-
CO4	3	1	-	-	-	-	-	-	-	2	-	-	1	-	-
CO5	3	1	-	-	-	-	-	-	-	2	-	-	1	2	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final marks</th></tr>
<tr><td rowspan="5">Continuous Internal Examination (CIE) - Theory</td><td>CIE – I</td><td>100</td><td rowspan="2">50</td><td rowspan="5">100</td><td rowspan="5">25</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>MCQ</td><td>20</td><td>10</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td rowspan="2">Continuous Internal Examination (CIE) - Laboratory</td><td>Continuous Assessment</td><td>75</td><td>75</td><td rowspan="2">100</td><td rowspan="2">25</td></tr>
<tr><td>Model Lab Exam</td><td>25</td><td>25</td></tr>
<tr><td>End Semester Examination (ESE)</td><td>Lab Exam</td><td>100</td><td>50</td><td>50</td><td>50</td></tr>
<tr><td colspan="5">Total</td><td>100</td></tr>
</table>

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. N.D.Bhatt,"Engineering Graphics", Charotor Publishing House, 53RD Edition 2019
2. Natrajan K.V., "A textbook of Engineering Graphics", Dhanalakshmi Publishers, Chennai (2015)

Reference Books:

1. Venugopal K. and Prabhu Raja V., "Engineering drawing + AutoCAD", New Age International (P) Limited (2022)
2. Lakhwinder pal singh, Harwinder Singh, "Engineering Drawing Principles and Applications", Cambridge University Press, 2021.
3. Cecil Johnson, Jay D Helsel and Dennis R Short, "Engineering Drawing and Design", Seventh Edition, McGraw Hill, 2007.
4. Patil, Rajashekar, "Computer Aided Engineering Graphics", New Age International Ltd,2018.
5. Chris Schroder, "Printed Circuit Board Design using AutoCAD", Newnes,1997.
6. K S Sai Ram, "Design of steel structures", Third Edition by Pearson.
7. A S Pabla, "Electrical power distribution", 6th edition, Tata Mcgrawhill.
8. K. R. Gopalakrishna, & Sudhir Gopalakrishna, "Textbook of Computer Aided Engineering Drawing", 39th Edition, Subash Stores, Bangalore, 2017

Web Links and Video Lectures (E-Resources):

1. **http://nptel.ac.in/courses/112103019**
2. https://archive.nptel.ac.in/courses/112/105/112105294/

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 and 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 and SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 and SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

LABORATORY REQUIREMENTS

SYSTEM REQUIREMENTS (For a batch of 30 Students)

Hardware:

1. Intel i3 core due processor with 4GB ram with 500GB hard disk – 30 Nos.
2. Laser Printer – 1 No.

Software:

Drafting package – AutoCAD – Adequate license (Open source)

Suggested Skill Activities:

1. 2D drafting of plan and elevation of computer CPU.
2. 2D drafting of plan and elevation of a thermos flask.
3. 2D drafting of a plan and elevation of piston and cylinder.
4. Sketching the projections of a bicycle in freehand.
5. Sketching the projections of a stapler.
6. Cut and develop the lateral surface of a funnel.
7. Cut one edges vertically and develop the lateral surface of CPU cabin.
8. Cut and develop the lateral surfaces of elbow of a pipe.
9. Draw the isometric view of a simple bread toaster.
10. Draw the isometric view of the computer table.
11. Sketch the assembled view of the screw jack using the orthographic projections of its components.
12. Draft the plan, elevation and section of your home using CAD.
13. Draft the plan, elevation and section of 2 storey office building using CAD.
14. Develop the 3D model of the (a) and (b).

Course Code:	24CS201	Course Title:	PROGRAMMING FOR PROBLEM SOLVING USING C
Credits:	4	L – T – P	2-0-4
Pre-requisite			NIL

Course objectives:

To impart knowledge on the

- To gain knowledge on problem solving techniques
- To learn how to write simple and modular C programs
- To develop C programs using arrays and strings
- To learn the usage of pointers in accessing and manipulating memory
- To develop applications in C using structures & files

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Classroom
8. Flipped Class

UNIT I - BASICS OF C PROGRAMMING	[6 hours]

Problem Solving Techniques: Introduction to Algorithm, Pseudo code, Flow Chart, Structure of ‘C’ program. C Tokens: Keywords, Data Types, Constants, Variables - Declaration - Qualifiers – typedef

Practical Topics:

1. Steps in Problem Solving Drawing flowchart using yEd tool/Raptor Tool programs using simple statements.

2. Programs to illustrate the use of user-defined data types

UNIT II – BASIC CONSTRUCTS IN C	[6 hours]
Managing simple Input and Output operations - Operators and Expressions - Decision Making: Branching statements, looping statements - Function: Declaration, Definition - Passing arguments by value - Recursion - Storage classes	
Practical Topics: 1. Programs using decision making statements 2. Programs using looping statements 3. Programs using user defined functions and recursive functions	

UNIT III – ARRAYS AND STRINGS IN C	[6 hours]
Arrays: Initialization - One dimensional, Two dimensional, and Multi-dimensional arrays - String: Basics, declaring and initializing strings, string handling functions: standard and user defined functions	
Practical Topics: 1. Build programs using arrays and array-based operations. 2. Programs using one dimensional and two dimensional arrays. 3. Implementations involving array usage for string operations.	

UNIT IV – POINTERS IN C	[6 hours]
Pointers - Passing arguments by address - Dynamic Memory Allocation - Pointer arithmetic - Pointers and one dimensional array - Pointers and Multi-Dimensional Array: Array of Pointers, Pointer to Pointer, Pointer to an array - void Pointer - Pointer to function	
Practical Topics: 1. Implementations involving pointers for dynamic memory allocation 2. Implementations involving pointers for string manipulation.	

UNIT V – STRUCTURES, UNIONS AND FILE HANDLING IN C	[6 hours]
Structure: Declaration, Definition-Array of Structures - Pointer to Structure – Nested Structures- Union: Defining union, Accessing union members. Files: File Management functions, Random access in file- Working with Text Files and Binary Files	
Practical Topics: 1. Programs to implement structures 2. Programs to implement union 3. Programs to implement various file operations.	

Laboratory Component: **[45 hours]**

Any 12 experiments have to be completed from the following list of experiments.

S.No.	Name of the Experiment
1	Steps in Problem Solving Drawing flowchart using yEd tool/Raptor Tool programs using simple statements
2	Programs to illustrate the use of user-defined data types
3	Programs using decision making statements
4	Programs using looping statements
5	Programs using user defined functions and recursive functions
6	Build programs using arrays and array-based operations.
7	Programs using one dimensional and two dimensional arrays.
8	Implementations involving array usage for string operations.
9	Implementations involving pointers for dynamic memory allocation
10	Implementations involving pointers for string manipulation.
11	Programs to implement structures
12	Programs to implement union
13	Programs to implement various file operations

Course outcomes:

On completion of the course, the student will have the ability to:

CO No	Corse Outcomes	Cognitive Domain
CO1	Make use of problem solving techniques to solve real world problems & outline the structure of C program	K3
CO2	Identify the appropriate looping and control statements in C and develop applications using these statements	K3
CO3	Make use of arrays & strings in development of simple applications	K3
CO4	Apply the concepts of pointers and develop C programs using pointer	K3
CO5	Develop programs for storing, retrieving and processing data using structures and files.	K3

COs and POs Mapping

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	**3**	**3**	2	-	1	-	-	-		-	-	1
CO2	**3**	**3**	2	-	1	-	-	-		-	-	1
CO3	**3**	**3**	2	1	1	-	-	-		-	-	1
CO4	**3**	**3**	2	1	1	-	-	-		-	-	1
CO5	**3**	**3**	3	1	1	-	-	-		-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	15	50	50
	Lab Exam	100	35		
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Internal Examination 1	Continuous Internal Examination 2	End Semester Examination
Remember	20	20	20
Understand	20	20	20
Apply	60	60	60
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2015.
2. Pradip Dey, Manas Ghosh, "Programming in C", AICTE Edition, Oxford University Press, 2018

Reference Books:

1. Yashavant P. Kanetkar, “Let Us C : Authentic guide to C programming language”, Eighteenth Edition, BPB Publications, 2021
2. Ashok N Kamthane, Programming in C, Pearson, Third Edition, 2020
3. Reema Thareja, "Programming in C", Oxford University Press, Second Edition, 2016.
4. Paul Deitel and Harvey Deitel, "C How to Program with an Introduction to C++", Eighth edition, Pearson Education, 2018.
5. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", 1st Edition, Pearson Education, 2013.
6. E.Balagurusamy, "Programming in ANSI C", seventh edition, Mc Graw Hill Education,2017

Suggested Skill Activities:

1. Steps in Problem Solving Drawing flowchart using yEd tool/Raptor Tool
2. Write a Program to calculate and display the volume of a CUBE having its height (h=10cm), width (w=12cm) and depth (8cm).
3. Ramya has bought 50 kg of onion for Rs 40 per kg and 60 kg of potato for Rs 20 per kg. Then she sold out all the stock with the selling price of Rs 60 per kg and Rs 30 per kg for onion and potato respectively. Write a C program which computes the profit gained by her.
4. A Food delivery boy needs to walk down every street in his area in order to deliver the food. Assume that the distances between the streets along the roads are given. The food delivery boy starts at the hotel and returns back to the hotel after delivering all the foods. Implement an algorithm to help the food delivery boy to walk minimum distance for the purpose.
5. Write a program to input name, marks of 5 subjects of a student and display the name of the student, the total marks scored, percentage scored and the class of result.
6. A location in a map is represented by a pair of points as x co-ordinate and y co-ordinate. Person X wants to move towards person Y which is residing in the location

L1 and L2 respectively. Write C Program to find the distance between these two person .

7. If a four-digit number is input through the keyboard, write a program to obtain the sum of the first and last digit of this number.
8. Write a program to find GCD (greatest common divisor or HCF) and LCM (least common multiple) of two numbers
9. Write a Program to multiply two 3 X 3 Matrices.
10. Write a program to create a structure named company which has name, address, phone and no Of Employee as member variables. Read name of company, its address, phone and no Of Employee. Finally display these members‟ value.
11. Write a program to create array of books. Collect various details of books such as topic, author, department. Collect details for N books and display the details of books based on department name or author
12. A class has strength of N students. The class has two mentors, one person for the odd roll numbers and the other for the rest. Write a C program which reads the roll numbers of all the students and gives two lists of roll numbers corresponding to each advisor
13. Write a C program to maintain the inventory details of items sold in a super market such as item id, name, no of items available, price per item. Perform efficient data storage based on user‟s demand at runtime
14. Write a C program to use binary files for maintaining a telephone directory which includes telephone no, Owner name and address. Here address includes details such as door no, street name, locality, city and pincode. Update the door no of all people belonging to a particular street as follows: Increment the old door no by 10 to get the new door no. (Eg: If the old door no is 13, update it as 23)

பாடநெறி குறியீடு:	24GE201	பாடத்தின் தலைப்பு:	தமிழரும்தொழில்நுட்பமும்
கிரெடிட்	1	L – T – P	1-0-0

பாடத்திட்டநோக்கங்கள்:

1. சங்ககாலத்து நெசவுத்தொழிலை விவரிப்பதற்கும் மட்பாண்டத்தொழில் நுட்பத்தைக் கண்டறிவதற்கும்.
2. சங்ககால கட்டுமானம், மேடை அமைப்பு, சிற்பங்கள், கோவில்கள், அம்மன்கோவில், திருமலைநாயக்கர் மஹால், செட்டிநாட்டு வீடுகள், இந்தோ - சாரோசெனிக் கட்டிடக்கலை ஆகியவற்றைக் கண்டறிந்து மேற்கோள் காட்ட.
3. கப்பல் கட்டுதல் மற்றும் இரும்புத் தொழிலைக் கண்டறிதல், சிலப்பதிகாரத்தில் நாணயங்கள், மணி தயாரிக்கும் தொழிற்சாலைகள், மணிகளின் வகைகள் ஆகியவற்றைப் படிக்க.
4. நீர்நிலைகளின் முக்கியத்துவத்தைகாட்ட, கால்நடை வளர்ப்பு மற்றும் கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகளை கண்காணிக்க, விவசாயம், மீன்பிடி, முத்து மற்றும் முத்துகலாச்சாரம் மற்றும் கடல் பற்றிய பண்டைய அறிவை அங்கீகரிக்க.
5. அறிவியல் தமிழின் வளர்ச்சி மற்றும் தமிழ்க்கணிப்பொறியின் வளர்ச்சியைக் கவனிக்க, இணையத்தில் தமிழ்மென்பொருள் மேம்பாடு, தமிழ் அகராதிகளை மேற்கோள் காட்ட.

அலகு I நெசவு மற்றும் பானைத்தொழில்நுட்பம்:	[3 hours]
சங்ககாலத்தில் நெசவுத்தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்புபாண்டங்கள் - பண்டங்களில் கீறல் குறியீடுகள்.	

அலகு II வடிவமைப்பு மற்றும் கட்டிடத்தொழில்நுட்பம்:	[3 hours]
சங்ககாலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்ககாலத்தில் வீட்டுப்பொருட்களில் வடிவமைப்பு - சங்ககாலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடைஅமைப்பு பற்றியவிவரங்கள் - மாமல்லபுரச்சிற்பங்களும், கோவில்களும் - சோழர்காலத்துப் பெருங்கோவில்கள் மற்றும் வழிபாட்டுத்தலங்கள் - நாயக்கர்காலக்கோயில்கள் மாதிரி கட்டமைப்பு பற்றி அறிதல்,மதுரைமீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலைநாயக்கர்மஹால் - செட்டி நாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ - சாரோசெனிக் கட்டிடக்கலை.	

அலகு III உற்பத்தித் தொழில்நுட்பம்	[3 hours]
கப்பல் கட்டும் கலை - உலோகவியல் - இரும்பு தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு வரலாற்றுச்சான்றுகளாக செம்பு மற்றும் தங்கநாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சங்கு மணிகள் - எலும்புத்துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.	

அலகு IV வேளாண்மை மற்றும் நீர்பாசனத்தொழில்நுட்பம்	[3 hours]
அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக்கு குமுழித்தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மைச்சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன் வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்.	

அலகு V அறிவியல் தமிழ் மற்றும் கணிதத்தமிழ்:	[3 hours]
அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி -தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ்மென்பொருள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.	

பாடநெறி முடிவுகள் (பாமு):

பாடநெறியின் முடிவில், மாணவர் பின்வரும் திறன்களைப் பெறுவார்:

பாமு	பாடநெறி முடிவுகள்	மிக உயர்ந்த அறிவாற்றல் நிலை
அலகு I பாமு:	சங்க கால ஐவுளி தொழில் மற்றும் மட்பாண்ட தொழில்நுட்பம் பற்றி அறிவார்கள்.	கே 1
அலகு II பாமு:	சங்க கால கட்டுமானம், மேடை அமைப்பு, சிற்பங்கள், கோவில்கள், அம்மன் கோவில், திருமலை நாயக்கர் மஹால், செட்டிநாட்டு வீடுகள், இந்தோ-சராசனிக் கட்டிடக்கலை ஆகியவற்றை விவரிக்க இயலும்.	கே 2

அலகு III பாமு:	கப்பல் கட்டுதல், இரும்புத் தொழில், நாணயம் தயாரித்தல் மற்றும் மணி தயாரிக்கும் தொழில்கள் பற்றி அறிந்து கொள்கிறார்கள்.	கே 1
அலகு IV பாமு:	நீர்நிலைகளின் முக்கியத்துவம், கால்நடை வளர்ப்பு, கிணறு, விவசாயம், மீன்பிடி, முத்து மற்றும் முத்து கலாச்சாரம் மற்றும் கடல் பற்றிய போதுமான அறிவை பெற்றுகொள்கிறார்கள் .	கே 1
அலகு V பாமு:	அறிவியல் தமிழின் வளர்ச்சி, தமிழ்க் கணிப்பொறியின் வளர்ச்சி, இணையத்தில் தமிழ் மென்பொருள் மேம்பாடு, தமிழ் அகராதிகளை சந்தேகம் இன்றி முழுமையாக தெரிந்து கொள்கிறார்கள்.	கே 1

பாடநெறி முடிவுகள் ***மற்றும் நிரல் முடிவுகள் ஒப்பிடுதல்***

பாமு கள்	**மிக உயர்ந்த அறிவாற்றல் நிலை**	**பாடநெறி முடிவுகள்**											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
பாமு **1**	கே 1	**2**	-	-	-	-	-	-	-	-	-	-	-
பாமு **2**	கே 2	**1**	-	-	-	-	-	-	-	-	-	-	-
பாமு **3**	கே 1	**1**	-	-	-	-	-	-	-	-	-	-	-
பாமு **4**	கே 1	**1**	-	-	-	-	-	-	-	-	-	-	-
பாமு **5**	கே 1	**1**	-	-	-	-	-	-	-	-	-	-	-

நிலை 3- அதிக ஒத்துப்போதல், நிலை 2- மிதமாக ஒத்துப்போதல், நிலை 1- குறைவாக ஒத்துப்போதல், நிலை 0- ஒத்துப்போகவில்லை

மதிப்பீட்டுத் திட்டம்:

கூறுகள்	மதிப்பீட்டின் வகை	அதிகபட்ச மதிப்பெண்கள்	குறைக்கப்பட்ட மதிப்பெண்கள்	இறுதி மதிப்பெண்கள்
தொடர்ச்சியான உள் தேர்வு	தொடர்ச்சியான உள் தேர்வு - I	100	40	40
	தொடர்ச்சியான உள் தேர்வு - II	100	40	
இறுதி பருவ தேர்வு	எழுத்து தேர்வு	100	60	60
மொத்தம்				100

இறுதி பருவ தேர்வு: (கேள்வி முறை)

- ஒவ்வொரு யூனிட்டும் இரண்டு 2 மதிப்பெண் வினாக்களையும் ஒரு 16 மதிப்பெண் வினாவையும் (இரண்டில் ஒன்று) கொண்டுள்ளது.
- பதினைந்து கேள்விகளுக்கும் பதிலளிக்க வேண்டும்.

மதிப்பீட்டு முறை

ப்ளூமின் வகை	தொடர்ச்சியான மதிப்பீட்டு சோதனைகள் 1	2	இறுதி தேர்வு
நினைவில் கொள்ளுதல்	60	50	60
புரிந்து கொள்ளுதல்	40	50	40
விண்ணப்பித்தல்	0	0	0
பகுப்பாய்வுதல்	0	0	0
மதிப்பிடுதல்	0	0	0
உருவாக்குதல்	0	0	0

TEXT BOOKS

1. தமிழகவரலாறு - மக்களும்பண்பாடும் - கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்).
2. கணினித்தமிழ் - முனைவர்இல. சுந்தரம். (விகடன்பிரசுரம்).
3. கீழடி - வைகைநதிக்கரையில்சங்ககாலநகரநாகரிகம் (தொல்லியல்துறைவெளியீடு)
4. பொருநை - ஆற்றங்கரைநாகரிகம். (தொல்லியல்துறைவெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).

REFERENCE BOOKS

1. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).

2. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)

3. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

4. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)

5. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)

6. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Course Code:	**24MA201**	**Course Title:**	**Complex Variables and Transforms** (Common to Common to AI&DS,AE,BME,CE,CSE,CSE(AI&ML),EEE, ECE,MECH)
Credits:	**4**	**L – T – P**	**3 – 1 – 0**
Pre-requisite			**24MA101- Matrices and Calculus**

Course objectives:

- To impart analytical ability in solving mathematical problems as applied to the respective branches of Engineering.
- To familiarize the students with complex integration techniques and contour integration techniques which can be used in real integrals.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.

Teaching-Learning Process:

These are sample strategies which teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method does not mean only traditional method, but different type of teaching methods may be adopted to develop the outcomes.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Topics will be introduced in a multiple representation and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT I – Complex Differentiation	[12 hours]
Function of a complex variable – Analytic functions – Necessary conditions and sufficient conditions (excluding proof) – Cauchy – Riemann equations –– Properties of analytic function – Harmonic conjugate – Construction of Analytic functions - Conformal mapping: w = z+a, az, 1/z, and bilinear transformation.	

UNIT II – Complex Integration	[12 hours]
Statement and application of Cauchy's integral theorem and integral formula – Taylor and Laurent expansions – Isolated singularities – Residues - Cauchy's residue theorem. Applications: Contour integration over unit circle and semicircular contours (excluding poles on axis).	

UNIT III – Laplace Transforms	[12 hours]
Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems – Transforms of derivatives and integrals – Initial and Final Value Theorem – Inverse Laplace Transform – Convolution Theorem (Statement only) – Solution of linear second order Ordinary differential equations with constant coefficients using Laplace transforms.	

UNIT IV – Fourier Series and Fourier Transforms	[12 hours]
Dirichlet's conditions – General Fourier series – Odd and even functions – Half range series – Harmonic analysis - Statement of Fourier integral theorem – Fourier transform pair – Parseval's identity.	

UNIT V – Partial Differential Equation	[12 hours]
Formation of partial differential equations - Classification of partial differential equations - Solutions of one dimensional wave equation, One dimensional heat equation (excluding insulated ends) – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges).	

Course outcomes:

On completion of the course, the student will have the ability to:

CO	Course Outcome	Cognitive domain
CO1	Construct analytic functions and use their conformal mapping property in Engineering problems.	K3
CO2	Solve real and complex integrals using the Cauchy's integral formula and residue theorem.	K3
CO3	Apply Laplace transforms techniques in system modelling, digital signal processing, process control, solving boundary value problems	K3
CO4	Apply Fourier series to solve the steady state two-dimensional heat equation in cartesian coordinates.	K3
CO5	Apply the effective mathematical tools for solutions of partial differential equations that model physical phenomena and engineering problems.	K3

COs and POs Mapping:

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	1
CO5	3	2	1	-	-	-	-	-	-	-	-	-
CO6	3	2	1	-	-	-	-	-	-	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	20	20	20
Understand	20	20	20
Apply	60	60	60
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
3. Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012
4. Kandasamy. P., Thilagavathy. K, and Gunavathy. K, Engineering Mathematics Volume I & II, S. Chand & Co, New Delhi, 2005.Reference Books:

Equivalent NPTEL/SWAYAM Courses

S. No.	Course Title	Course Instructor	Host Institute
1	Partial Differential Equations	Prof. Sivaji Ganesh	IIT Bombay
2	Introduction to Fourier Analysis	Prof. Parasar Mohanty	IIT Kanpur
3	Complex Analysis	Prof. Pranav Haridas	IIT Madras

Web Links and Video Lectures (E-Resources):

1. Analytic Functions, C-R Equations: https://www.nptelvideos.com/lecture.php?id=13416
2. Laplace Transform and its Existence: https://www.nptelvideos.com/lecture.php?id=13433
3. Taylor's, Laurent Series of f(z) and Singularities: https://www.nptelvideos.com/lecture.php?id=13431
4. Applications of Fourier Transform to PDEs: https://www.nptelvideos.com/lecture.php?id=13442

Course Code:	**24EC302**	**Course Title:**	**Digital Logic Circuits and Design**
Credits:	**4**	**L – T – P**	**3-0-2**
Pre-requisite			**24MA101- Matrices and Calculus** **24PH101 – Engineering Physics**

Course objectives:

To impart knowledge on the

- To Study the fundamentals of Boolean Algebra and simplification of logic gates.
- To Study the design of various combinational circuits and logic family.
- To study the design procedure of Sequential circuits
- To study the design procedures for State Machines
- To learn the programmable logic and Memory devices

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Project based Learning
3. Experiential Learning
4. NPTEL and Other Videos
5. Smart Class Room

6. Flipped Class 7. Experimental Learning 8. NPTEL and Other Videos 9. Smart Class Room

UNIT I – Boolean Algebra And Logic Gates	[9 hours]
Basic gates and truth table, De-Morgan's theorem, SOP and POS, K Map up to five variables, Two bits and three bits binary addition and Subtraction.	
Practical Topics: 1. To Verify the truth tables of various logic gates. 2. To Implement the Given Boolean Function using Logic Gates. 3. To Verify and Study NAND and NOR gate as Universal Gates.	

UNIT II – Combinational Circuits And Logic Family	[9 hours]
Code converters, Magnitude comparator, Multiplexers and DE multiplexers, Decoders, Encoders, Priority Encoder, Combinational Circuits design-RTL, DTL, TTL & CMOS logic families	
Practical Topics: 1.To study binary to gray and gray to binary converter and verify it for all possible combinations. 2. To implement and verify the truth table of 4x1 Multiplexer and 1x4 De multiplexer. 3. To implement and verify the truth table of Encoders and Decoders.	

UNIT III – Sequential Logic	[9 hours]
74xx series Integrated Circuits, Flip-Flops, Triggering of Flip-Flops, Design of Clocked Sequential Circuits Moore and Melay model- Flip-Flop Excitation Tables , Master Slave Flip-flop , Shift Registers and Counters.	
Practical Topics: 1. Flip-flop: assemble, test and investigate operation of SR, D and JK Flip-flops 2. Shift Register: Design and investigate the operation of all type of shift registers with parallel load. 3. Counters: Design, assemble and test various ripple and synchronous counters-decimal counter, Binary counter with parallel load.	

UNIT IV – State Machine Design	[9 hours]
ASM Chart, State table , State condition and Diagrams, State minimization and hazards – analysis of asynchronous sequential logic circuits	
Practical Topics: 1. Clock-pulse generator: design, implement and test. 2. Develop an Health track monitor App to measure any 3 parameters heart rate , pressure and temperature monitoring system.	

UNIT V – Programmable Logic And Memory Devices	[9 hours]
Introduction PLA and PAL, CPLDs and FPGA - Memory Devices - ROM, RAM- Volatile and Non Volatile RAM, SDRAM,DRAM, PROM,EPROM,EEPROM, FRAM,ASIC	
Practical Topics: Investigate the behavior of RAM unit and its storage capacity -16 X 4 RAM: testing, simulating and memory expansion.	

Laboratory Component **30 hours**

S.No.	Name of the Experiment
1	To Verify the truth tables of various logic gates.
2	To Implement the Given Boolean Function using Logic Gates.
3	To Verify and Study NAND and NOR gate as Universal Gates.
4	To study binary to gray and gray to binary converter and verify it for all possible combinations.
5	To implement and verify the truth table of 4x1 Multiplexer and 1x4 DE multiplexer.
6	To implement and verify the truth table of Encoders and Decoders.
7	Flip-flop: assemble, test and investigate operation of SR, D and JK Flip-flop.
8	Shift Register: Design and investigate the operation of all type of shift registers with parallel load.
9	Counters: Design, assemble and test various ripple and synchronous counters with parallel load.
10	Clock-pulse generator: design, implement and test.
11	Develop an Health track monitor App to measure any 3 parameters heart rate , pressure and temperature monitoring system

12	Investigate the behavior of RAM unit and its storage capacity -16 X 4 RAM: testing, simulating and memory expansion Using HDL/VHDL/ Pspice Simulators

Course outcomes: On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Domain
CO1	Illustrate the concepts of Boolean Algebra and its Simplification procedures relevant to digital logic gates.	K2
CO2	Construct combinational logic circuits to perform various operations on data .	K3
CO3	Apply the concepts of sequential logic circuit to make state Machines .	K3
CO4	Construct an ASM chart to describe the sequential operations of a digital circuit.	K3
CO5	Interpret the concepts of Programmable Logic And Memory Devices to build digital circuits .	K2

COs and POs Mapping:

COs	**POs**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	2	1	-	-	-	-	-	2	-	-	1
CO2	3	2	1	1	-	-	-	-	2	-	-	1
CO3	3	2	1	-	1	-	-	-	2	-	-	1
CO4	3	2	1	1	1	-	-	-	2	-	-	1
CO5	3	2	1	1	1	-	-	-	2	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

Assessment Pattern:

Bloom's Category	Continuous Assessment Tests 1	Continuous Assessment Tests 2	Terminal Examination
Remember	20	20	20
Understand	40	40	40
Apply	40	40	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions.
- One 16 marks question (either or) will be from any one of the five units.
- All the fifteen questions have to be answered.

TEXT BOOKS

1. M. Morris Mano and Michael D. Ciletti, 'Digital Design', Pearson, 6th Edition, 2018.

REFERENCE BOOKS

1. Charles H. Roth, Jr, 'Fundamentals of Logic Design', Jaico Books, 4th Edition, 2002.
2. William I. Fletcher, "An Engineering Approach to Digital Design", Prentice- Hall of India, 1980.
3. Floyd T.L., "Digital Fundamentals", Charles E. Merril publishing company,1982.

4. John. F. Wakerly, "Digital Design Principles and Practices", Pearson Education, 4 th Edition,2007.
5. Donald D. Givone (2002), Digital Principles and Design, Tata McGraw Hill, India

WEB LINKS AND VIDEO LECTURES (E-RESOURCES):

1. Introduction To Digital Circuits : https://nptel.ac.in/courses/117106086/
2. Combinational Circuits https : https://nptel.ac.in/courses/117106086/
3. Code Converters : https://nptel.ac.in/courses/117106086/
4. S,R,JK, D Flip Flops :https://nptel.ac.in/courses/117106086/
5. Design of Synchronous Sequential Circuits : https://nptel.ac.in/courses/117106086
6. Programmable Logic Devices : https://nptel.ac.in/courses/117106086

SKILLED BASED ASSESSMENTS

1. Design a fingerprint attendance system circuit, using a Fingerprint Sensor module to authenticate a true person or employee by taking their finger input in the system Employ 4 push buttons to enrol, Delete, UP/Down. ENROLL and DEL key has triple features.
2. Design a Touchless heart rate, pulse rate monitoring and image recognition app to detect changes in face's reflectivity for automobilist safety, based on cutting-edge research and science conducted at the MIT Media Lab and there by allowing the app to calculate a persons heart rate.
3. Design an Obstacle Avoiding Robot Car Using an Ultrasonic Sensor by interfacing three ultrasonic sensors with arduino uno. Run an algorithm according to which you are going to manipulate your desire distance for obstacle detection then you are going to control your motor rotation direction for movement of your bot. 50cm (Front), 15cm (Each Side).
4. Design and implement a Digital code lock System using Arduino. Employ a LCD display which is used
to interface with the project to output lock status to be used in places where we need more security.
5. Design a Luggage Security System using GSM to inform about the status of the luggage to the owner, by making of an integrated IR Transmitter Receiver circuit and IR diodes which sense any object about certain range. Make the algorithm tailor-made to the specific requirements of the user.

Course Code:	24EE202	Course Title:	Basics of Electrical and Electronics Engineering
Credits:	**4**	**L – T – P**	**3-0-2**
Pre-requisite			**NIL**

Course objectives:

To impart knowledge on the

- Basics of DC electric circuits and its analysis
- Analysis of AC circuits and magnetic circuits
- Working principles and application of DC machines and transformers
- Digital devices and their characteristics
- Functional elements and working of sensors and actuators used for smart systems.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I –DC Circuits	[9 hours]
Introduction to DC Circuits – Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws –Nodal Analysis, Mesh analysis with independent sources only – Appliances.	
Practical Topics: 1. Model an electrical circuit and simulate it to verify Ohms Law. 2. Model an electrical circuit and simulate it to verify Kirchhoff's Voltage Law. 3. Model an electrical circuit and simulate it to verify Kirchhoff's Current Law.	

UNIT II – AC Circuits and Magnetic Circuits	[9 hours]
Introduction to poly-phase circuits - Representation of sinusoidal waveform – peak and rms values, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations – Converters: rectifiers	

and inverters; Basics of magnetic circuits – Flux – Flux density – Magnetic resonance – Self-inductance – mutual-inductance – Coupling.
Practical Topics: 1. Demonstrate the measurement of power in an RLC circuit using wattmeter method. 2. Interpret the DC output of an RLC circuit using half wave rectifier. 3. Interpret the DC output of an RLC circuit using full wave rectifier.

UNIT III – DC Machines and Transformers	**[9 hours]**
Construction, principle of operation, characteristic and application – DC Motor and DC Generator, Types of DC motors and generators – Application: Electric Vehicle – Structure of electric power system – Introduction to single phase transformers –Construction, principle of operation, characteristics and application.	
Practical Topics: 1. Conduct the load test on DC shunt motor to outline its characteristics. 2. Outline the study on the starting methods of DC series motor. 3. Conduct a study on transformer construction for real-time applications.	

UNIT IV – Electronic Devices	**[9 hours]**
Introduction to semiconductor – PN Diode – Zener Diode – BJT and its configurations – CE, CB, CC – SCR – Optoelectronic devices – LED – OLED – Seven segment displays.	
Practical Topics: 1. Experiment with PN junction diode in an AC circuit to verify its characteristics. 2. Experiment with Zener diode in an AC circuit to verify its characteristics. 3. Experiment with SCRin an AC circuit to verify its characteristics.	

UNIT V – Sensors and its Applications	**[9 hours]**
Sensors in IoT – Mobile based sensors, Resistance Temperature sensor, Humidity sensor –Medical sensor – Neural sensor – Motion sensor – PIR sensor, Piezoelectric sensor, Air quality sensor – CO_2 Sensor, RFID sensor, Water leakage detection sensor, Light sensors - Introduction to actuators in automation – Applications: smart homes – smart cities – smart parking system.	
Practical Topics: 1. Utilize Arduino and Bluetooth module for automating home appliances. 2. UtilizeESP8266 processorfor automating home appliances. 3. Construct an Arduino based solar tracker for solar irradiation measurement.	

Laboratory Component: **[30 hours]**

Any 12experiments have to be completed from the following list of experiments.

S.No	Name of the Experiment
1	Model an electrical circuit and simulate it to verify Ohms Law.
2	Model an electrical circuit and simulate it to verify Kirchhoff's Voltage Law.
3	Model an electrical circuit and simulate it to verify Kirchhoff's Current Law.
4	Demonstrate the measurement of power in an RLC circuit using wattmeter method.
5	Interpret the DC output of an RLC circuit using half wave rectifier.
6	Interpret the DC output of an RLC circuit using full wave rectifier.
7	Conduct the load test on DC shunt motor to outline its characteristics.
8	Outline the study on the starting methods of DC series motor.
9	Conduct a study on transformer construction for real-time applications.
10	Experiment with PN junction diode in an AC circuit to verify its characteristics.
11	Experiment with Zener diode in an AC circuit to verify its characteristics
12	Experiment with SCR in an AC circuit to verify its characteristics.
13	Utilize Arduino and Bluetooth module for automating home appliances.
14	UtilizeESP8266 processorfor automating home appliances.
15	Construct an Arduino based solar tracker for solar irradiation measurement.

Course outcomes:

On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Apply the circuit laws and theorems to compute the electrical parameters of domestic and industrial appliances.	**K3**
CO2	Compare the behavior of AC circuits & magnetic circuits for a given input.	**K2**
CO3	Explain the construction, working, and application of electrical machine and transformer to infer its characteristics.	**K2**
CO4	Apply the semiconductor principles using diodes, transistors, thyristors and displays for developing electronic switches and displays.	**K3**
CO5	Identify the sensors for applications in Engineering.	**K3**

COs and POs Mapping:

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	2	1	1	2	-	-	-	2	-	-	1
CO2	2	1	1	-	2	-	-	-	2	-	-	1
CO3	2	1	1	-	2	-	-	-	2	-	-	1
CO4	3	2	1	1	2	-	-	-	2	-	-	1
CO5	3	2	1	1	2	-	-	-	2	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Typeof assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

Assessment Pattern

Bloom's Category	Internal Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	60	40	40
Apply	20	40	40
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. D P Kothari and I.J Nagarath, "Basic Electrical and Electronics Engineering," McGraw Hill Education (India)Private Limited, Second Edition, 2020
2. A.K.Sawhney and PuneetSawhney,"A Course in Electrical & Electronic Measurements & Instrumentation,"DhanpatRai and Co, 2015.

Reference Books:

1. John Bird, "Electrical Circuit theory and technology", Routledge; 2017.
2. Muthusubramanian R and Salivahanan S, "Basic Electrical and Electronics Engineering,"McGraw Hill, NewDelhi,2009.
3. Nagsarkar T K and Sukhija M S, "Basics of Electrical Engineering," Oxford University press, 2012.
4. V K Mehta, Rohitmehta "Principles of Electronics," S.Chand& Company Ltd, 2015.
5. Mahmood Nahvi and Joseph A.Edminister, "Electric Circuits," Schaum' Outline Series, McGraw Hill, 2009.
6. H.S. Kalsi, "Electronic Instrumentation," Tata McGraw-Hill, New Delhi, 2010.
7. Ian Sinclair, "Sensors and Transducers," Elsevier Science, 3rd Edition, 2000.
8. Perry Lea, "Internet of things for architects," Packt, 2018.
9. V N Mittle and Arvind Mittle "Basic Electrical Engineering," McGraw Hill, New Delhi, 2005.
10. R.S. Sedha, "A Textbook of Applied Electronics," S. Chand & Co., 2008.
11. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry and Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017.

Web Links and Video Lectures (E-Resources):

1. A Basic Course on Electric and Magnetic Circuits :
   https://onlinecourses.nptel.ac.in/noc24_ee125/preview
2. Basic Electrical Circuits: https://onlinecourses.nptel.ac.in/noc24_ee112/preview
3. Digital Circuits: https://onlinecourses.nptel.ac.in/noc24_ee147/preview
4. Electrical Machines – I: https://onlinecourses.nptel.ac.in/noc24_ee103/preview
5. Sensor Technologies: Physics, Fabrication and Circuits:
   https://onlinecourses.nptel.ac.in/noc24_ee83/preview
6. Semiconductor Devices and Circuits: https://onlinecourses.nptel.ac.in/noc24_ee143/preview

Suggested Skill Activities:

1. List the different electrical loads available in home, college and prepare their rating chart.
2. Design the residential house wiring using fuse, switch, indicator, lamp, circuit breaker, energy meter and apply Thevenin's theorem to find the current in particular branch.
3. Take a room in your home and replace the fluorescent lamp to LED lamp to calculate the monthly electrical charge and compare with the previous month.
4. Write the parts of the fan and electric mixer in home and draw the wiring diagram for fan and electric mixer.
5. Visit the nearby substation and list out the details of safety measures followed by electrical engineers.
6. List out the rating of electrical machines used in home appliances.
7. Identify the semiconductor devices in electronic appliances.
8. Develop IOT based solutions for engineering applications.
9. Draw the wiring diagram of EV and mentions its parts.
10. Visit nearby power plant and demonstrate the various components, working, power generation and distribution in power plant as a report.

Course Code:	24EE404	Course Title:	IOT - SENSORS AND DEVICES
Credits:	4	L – T – P	3-0-2
Pre-requisite			NIL

Course objectives:

To impart knowledge on the

- Basic electronic components and Sensors.
- Fundamental concepts of Microcontrollers
- Different types of Microcontrollers
- Different protocols for communication
- Interfacing of Arduino microcontrollers with different applications.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Interactive Simulations
4. Lab experiment videos
5. Blended Mode of Learning
6. Project based Learning
7. Experiential Learning
8. NPTEL and Other Videos
9. Smart Class Room
10. Flipped Class

UNIT I - Sensors for IoT	[6 hours]
Active and Passive Sensors, Different Types of Sensors such as Capacitive, Resistive, and Surface Acoustic Wave Sensors for Pressure, Humidity, Toxic Gas; Sensors for Water (pH) quality, Accelerometer, Gyroscope, Moisture, Hall effect and Humidity	

Practical Topics:

1. Building basic circuit diagrams using breadboard and Working of a Multimeter.
2. Simple circuit using IC on breadboard.
3. Simple Relay circuit design for ON-OFF condition.

UNIT II: Microcontroller	[6 hours]
Introduction to microcontrollers and microprocessors, Different microcontrollers, Arduino:Types, UNO Architecture, ADC, DAC, Data acquisition	
Practical Topics: 1. Switch on an LED if a button is pressed. 2. Changing brightness of LED using potentiometer.	

UNIT III: Arduino Programming	[6 hours]
Digital Pins as Input and Output, Reading Analog Quantities, PWM Pin- Arduino's Serial Port and Serial Communication. Interfacing of DC Motor and Relay	
Practical Topics: 1. Change the brightness of LED (Fade in/ Fade out) using PWM 2. DC motor speed control using serial communication.	

UNIT IV – IoT System	[6 hours]
Basics of IoT, IoT Levels, Things and Connections, Building Blocks of IoT connectivity(Client-Server, Web Interface, and API: Qualitative Analysis only), Protocols and Communication (Zigbee, Bluetooth, Wi-Fi, MQTT: Qualitative Analysis only), Bluetooth and Wi-Fi Modules for Arduino	
Practical Topics: 1.Interfacing Wi-Fi module with Arduino 2.Design a simple circuit to measure the pH value of wastewater. 3.Design a simple circuit to apply Hall effect sensor	

UNIT V – IoT Applications	[6 hours]
Application of IoT in the industry, buildings, smart city, logistics, environment, health care, agriculture, and lifestyle product	
Practical Topics: 1. Sending information about the patient in home to the doctor's PC/mobile. 2. Develop an IoT System for smart home applications	

Laboratory Component **30 hours**

SI.No.	Name of the Experiment
1	Building basic circuit diagrams using breadboard and Working of a Multimeter.
2	Simple circuit using IC on breadboard.
3	Simple Relay circuit design for ON-OFF condition.
4	Switch on an LED if a button is pressed.
5	Changing brightness of LED using potentiometer.
6	Change the brightness of LED (Fade in/ Fade out) using PWM.
7	DC motor speed control using serial communication.
8	Interfacing Wi-Fi module with Arduino.
9	Design a simple circuit to measure the pH value of wastewater.
10	Design a simple circuit to apply Hall effect sensor
11	Sending information about the patient in home to the doctor's PC/mobile.
12	Develop an IoT System for real time applications.

Course outcomes:

On completion of the course, the student will have the ability to:

CO	Course Outcome	Cognitive domain
CO1	Illustrate the working principles of different types of sensors.	**K2**
CO2	Describe the basic concepts of the different types of Microcontrollers.	**K2**
CO3	Apply the knowledge of PWM and Serial communication in different circuits.	**K3**
CO4	Explain the working of Wi-Fi module and different protocols for communication for usage in IoT.	**K2**
CO5	Apply the sensor to build an IoT System for Real time applications.	**K3**

COs and POs Mapping:

COs	**POs**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	**2**	**1**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	**2**	**1**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	**3**	**2**	**3**	**3**	**1**	**-**	**-**	**-**	**1**	**-**	**-**	**-**
CO4	**2**	**2**	**1**	**2**	**1**	**-**	**-**	**-**	**1**	**-**	**-**	**-**
CO5	**3**	**2**	**1**	**2**	**1**	**-**	**-**	**-**	**1**	**-**	**-**	**-**

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final marks</th></tr>
<tr><td rowspan="5">Continuous Internal Examination (CIE) - Theory</td><td>CIE – I</td><td>100</td><td rowspan="2">50</td><td rowspan="5">100</td><td rowspan="5">25</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>MCQ</td><td>20</td><td>10</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td rowspan="2">Continuous Internal Examination (CIE) - Laboratory</td><td>Continuous Assessment</td><td>75</td><td>75</td><td rowspan="2">100</td><td rowspan="2">25</td></tr>
<tr><td>Model Lab Exam</td><td>25</td><td>25</td></tr>
<tr><td rowspan="2">End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>35</td><td rowspan="2">50</td><td rowspan="2">50</td></tr>
<tr><td>Lab Exam</td><td>100</td><td>15</td></tr>
<tr><td colspan="5">Total</td><td>100</td></tr>
</table>

Assessment Pattern

<table>
<tr><th rowspan="2">Bloom's Category</th><th colspan="2">Internal Assessment Tests</th><th rowspan="2">Terminal Examination</th></tr>
<tr><th>1</th><th>2</th></tr>
<tr><td>Remember</td><td>20</td><td>20</td><td>20</td></tr>
<tr><td>Understand</td><td>60</td><td>40</td><td>40</td></tr>
<tr><td>Apply</td><td>20</td><td>40</td><td>40</td></tr>
<tr><td>Analyse</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Evaluate</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Create</td><td>0</td><td>0</td><td>0</td></tr>
</table>

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books

1. Peter Dalmaris, "Basic Electronics for Arduino Makers", Packt Publishing, 2017.
2. Tim Pulver, "Hands-On Internet of Things with MQTT: Build Connected IoT Devices with Arduino and MQ Telemetry Transport (MQTT)", Packt Publishing, 2019.
3. Marco Schwartz, "Internet of Things with Arduino Cookbook", Packt Publishing, 2016.

Reference Books:

1. Jody Culkin, Eric Hagan, "Learn Electronics with Arduino: An Illustrated Beginner's Guide to Physical Computing" Make Community, LLC, 2017.
2. Michael Margolis, "Arduino Cookbook" O'Reilly, 2011.
3. Julien Bayle, "C Programming for Arduino", Packt Publishing Ltd., 2013.

Web Links and Video Lectures (E-Resources):

1. Sensors for IoT- https://youtube.com/watch?v=njgixrZOT1E
2. Microcontroller- https://www.youtube.com/watch?v=l9DC9ZpQ5yo
3. Arduino Programming- https://www.youtube.com/watch?v=QO_Jlz1qpDw
4. IoT System- https://www.youtube.com/watch?v=9KlHDeW6bO4
5. IoT Applications- https://www.youtube.com/watch?v=91aXs9E0qAI

Online Courses:

1. http://nptel.ac.in
2. https://swayam.gov.in

Suggested Skill Activities:

1.How to control multiple LEDs / Traffic LEDs using tinker cad software
2.Sending Data to LCD Display using tinker cad software
3.Design a simple circuit to Measure Heart Rate and SpO2
4.Design a simple circuit to maintain the CO2 level inside the room
5.Rainfall Monitoring Using Arduino

Course Code:	24CS301	Course Title:	PROGRAMMING FOR PROBLEM SOLVING USING PYTHON
Credits:	**1.5**	**L – T – P**	**0-0-3**
Pre-requisite			**NIL**

Course objectives:

To impart knowledge on the

- To explain basic concepts in Python
- To implement programs using functions, loops, and conditional statements.
- To demonstrate the concepts of data structures
- To make use of strings and exception handling in Python
- To demonstrate file handling and python modules

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

9. Lab experiment videos
10. Project based Learning

Laboratory Component: **[20 hours]**

SI.No	Name of the Experiment
1	Develop simple python programs using basic data types
2	Develop simple python programs using operators and expressions
3	Develop Python programs using conditional statements
4	Develop Python programs using various Loops
5	Develop python programs using Functions.
6	Develop programs to demonstrate the use of List, and Tuples
7	Develop programs to demonstrate the use of Dictionaries
8	Demonstrate the various string manipulation functions
9	Develop programs to show Exception Handling in tasks
10	Execute programs using Numpy in Jupiter notebook
11	Python program using File I/O, random access file handling methods and Zipping and Unzipping of files
12	Develop Python programs using packages

Course outcomes:

On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Develop basic programs using fundamental data types	K3
CO2	Solve the given problem statement using programming concepts such as operators, conditional and looping statements and functions.	K3
CO3	Make use of data structures such as lists, tuples, and dictionaries to manage and manipulate data in development of simple applications	K3
CO4	Create programs using string handling functions and apply exception handling, and make use of NumPy to solve problems	K3
CO5	Make use of file operations and packages in development of simple applications	K3

COs and POs Mapping

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	3	3	-	1	-	-	-		-	-	1
CO2	3	3	3	-	1	-	-	-		-	-	1
CO3	3	2	2	1	1	-	-	-		-	-	1
CO4	3	2	2	1	1	-	-	-		-	-	1
CO5	3	3	3	1	1	-	-	-		-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

The weightage of Continuous Internal Evaluation (CIE) is 60% and for End Semester Examination (ESE) is 40%.

S.No	Component	Type of Assessment	Max Marks	Reduced Marks	Total	Final Marks
1.	**Continuous Internal Examination(CIE)-Laboratory**	Continuous Assessment	75	75	100	60
2.		Model Lab Exam	25	25		
3.	**End Semester Examination (ESE)**	Lab Exam	100	40	40	40
					Total	100

Course Code:	**24GE231**	**Course Title:**	**WORKSHOP PRACTICE**
Credits:	**1.5**	**L – T – P**	**0-0-3**
Pre-requisite			**NIL**

Course objectives:

To provide hands on training to the students in:

- Applying basic techniques to measure a field, infer masonry work and install plumbing design.
- Fabricating carpentry, foundry, sheet metal and welding works to practice on workshop trades and making end products.
- Utilizing machining processes like turning, drilling, tapping in parts and 3D printing for performing the jobs.
- Designing electrical wiring layout with MCBs and RCCBs, developing staircase wiring and illumination design circuits for buildings.
- Assembling simple electronic components on PCB by soldering and desoldering and testing with IoT based interfaces.
- Developing blogs and website design for the complete access over the network.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Project based learning
2. Industrial Visit

GROUP – A (Civil and Mechanical)

PART I - CIVIL ENGINEERING PRACTICES	**[5 hours]**
1. FIELD MEASUREMENT, MASONRY WORK AND PLUMBING a. Calculate the area of a built-up space and a small parcel of land-use standard measuring tape and digital distance measuring devices. b. Visit a nearby site where construction is at initial stage and observe for following (if necessary, visit two/three times with a gap of a week). If drawings are available relate/match activities with the drawings. i. Digging and filling.	

ii. Foundation preparations.
iii. Brick/stone masonry.
iv. Concrete laying and curing.
v. Laying of sewerage/sanitary lines.
vi. Bar bending and bar laying for columns, beams and ceiling.
vii. Onsite testing for quality.
viii. Onsite preparation for construction work.
ix. Erection and removal of form work, scaffolding, centering/shuttering.

Prepare a brief report on the construction activities, methods, tools, equipments and materials being used.

c. Installation of water lines for wash basin and showers faucet.

PART II MECHANICAL ENGINEERING PRACTICES	**[5 hours]**

2. CARPENTRY, FOUNDRY, WELDING AND SHEET METAL
   a. Carpentry: Prepare T/L/Lap Joint from given wooden work piece and make a Box/Tray out of plywood using modern power tools.
   b. Welding: Make a Butt/Lap of MS plate using Arc welding process.
   c. Casting: Demonstration of Pattern making by sand moulding.
   d. Sheet Metal: Fabrication of Sheet Metal Tray and Funnels.
3. LATHE, DRILLING MACHINE AND 3D PRINTER
   a. Designing a driller component using radial machine.
   b. Perform a job using facing and turning in lathe.
   c. Printing simple 3D geometric shapes using SLA printer.

GROUP – B (Electrical, Electronics and IT)

PART III ELECTRICAL ENGINEERING PRACTICES	**[3 hours]**

4. ELECTRICAL WIRING
   a. Design a wiring circuit integrating energy meter, MCBs and RCCBs.
   b. Develop fluorescent lamp wiring, staircase wiring and electric fan wiring circuits.

PART IV ELECTRONICS ENGINEERING PRACTICES	**[4 hours]**

5. IOT BASED SOLUTIONS AND PCB
   a. Design a single layer PCB layout structure.
   b. Fabricate single layer PCB printing.
   c. Assembling, soldering and desoldering practice on single layer PCB.
   d. GPIO programming in ESP8266, sensor and actuator interfacing with internet enabled microcontroller device.
   e. Integration of microcontroller-based system with Cloud platform.

PART V COMPUTER SCIENCE AND ENGINEERING PRACTICES	[3 hours]
6. INTERACTIVE DYNAMIC WEBSITE a. Design a website for an application using HTML and CSS. b. Convert the designed website into responsive website using Bootstrap. c. Add dynamism to the website by using JavaScript and embed the social media components to the website. d. Incorporate the database interaction with the website. e. Deploy the developed website in the server.	

Course outcomes:

On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Apply basic techniques for field measurements, masonry work and plumbing.	K3
CO2	Make use of workshop trades like carpentry, foundry, sheet metal and welding for practicing on manufacturing of components.	K3
CO3	Develop simple components using Lathe, Drilling Machine and 3D Printer.	K3
CO4	Construct the electrical wiring circuits for buildings based on their requirement.	K3
CO5	Develop IoT based solutions and PCB for real world use cases.	K3
CO6	Build and host an interactive dynamic website.	K3

COs and POs Mapping:

COs	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	1	2	-	-	-	1	1	-	1	3	2	1
CO2	3	2	1	1	2	-	-	-	1	1	-	1			
CO3	3	2	1	1	2	-	-	-	1	1	-	1			
CO4	3	2	1	1	2	-	-	-	1	1	-	1	1	-	-
CO5	3	2	1	1	2	-	-	-	1	1	-	1			
CO6	3	2	1	1	2	-	-	-	1	1	-	1	-	1	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

The weightage of Continuous Internal Evaluation (CIE) is 60% and for End Semester Examination (ESE) is 40%.

S.No	Component	Type of Assessment	Max Marks	Reduced Marks	Total	Final Marks
4.	**Continuous Internal Examination(CIE)-Laboratory**	Continuous Assessment	75	75	100	60
5.		Model Lab Exam	25	25		
6.	**End Semester Examination (ESE)**	Lab Exam	100	40	40	40
					Total	100

Text Books:

1. AICTE's Prescribed Textbook: Workshop / Manufacturing Practices (with Lab Manual) ISBN: 978-93-91505-332
2. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.

Reference Books:

1. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4 th edition, Pearson Education India Edition, 2002.
2. Gowri P. Hariharan and A. Suresh Babu," Manufacturing Technology – I" Pearson Education, 2008.
3. Roy A. Lindberg, "Processes and Materials of Manufacture", 4 th edition, Prentice Hall India, 1998.
4. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House, 2017.

Course Code:	**24EN201**	**Course Title:**	**Presentation and Language Skills Laboratory** (Common to AI&DS,AE,BME,CE,CSE,CSE(AI&ML), EEE, ECE,MECH)
Credits:	**1.5**	**L – T – P**	**0-0-3**
Pre-requisite			**24EN101 English for Engineers**

Course Objectives:

- To apply critical listening skills.
- To make use of critical thinking skills.
- To apply stress as well as tonal variation.
- Make use of language skills to produce error free sentences
- To experiment with presentation skills.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Lab experiment videos
2. Blended Mode of Learning
3. Project based Learning
4. Smart Classroom
5. Flipped Class

	UNIT I	**[12 hours]**
	LIST OF EXERCISES	
	LAB ACTIVITIES	
Sl. No.	**Topics**	**Hours**
1.	Listening to audios (online platforms) and making a critical appreciation of audio content	3
2.	Listening to breaking news	2
3.	Listening to British council / Cambridge English (Selected topics)	2
	CLASSROOM ACTIVITIES	
1	Speaking current issues (selected topics)	2
2	Making conversations at work place, Public Speaking (based on festivals and celebrations)	3

	UNIT II	**[12 hours]**
	LIST OF EXERCISES	
	LAB ACTIVITIES	
Sl. No.	**Topic**	**Hours**

1	English Movie clips and software in the Lab C (Globarena)	3
2	Vocabulary Development through movies/ short films/ Documentaries	3
CLASSROOM ACTIVITIES		
1	Speaking - Just a minute talk and expressions for plans and decisions	3
2	Describing a product	3

UNIT III		**[12 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	**Topic**	**Hours**
1.	Listening to TED talks, scientific lectures.	3
2.	Reading Comprehension strategies	2
3.	Reading- Editorials	2
CLASSROOM ACTIVITIES		
1.	Speaking- Introduction to Phonetics- Speech sounds- Vowels and Consonants- Stress- Rising/ Falling Tone	2
2.	Writing- A day in my life	2
3.	Writing- Situational Dialogues	1

UNIT IV		**[12 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl.No.	**Topic**	**Hours**
1.	Reading Popular Blogs Listening Editorials	3
2.	Creating a Blog	2
CLASSROOM ACTIVITIES		
1.	Errors in Pronunciation. Error detection	3
2.	Writing - Terminology for Engineers. Writing Articles and preparing day to day scripts.	2 2

UNIT V		**[12 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	**Topic**	**Hours**
1.	Prepare PowerPoint presentation (topics selected by	3

	students)	
2.	Reading newspaper articles	2
CLASSROOM ACTIVITIES		
1.	Present the selected topic.	3
2.	Making a short speech / Extempore	2
3.	Writing - Expanding a Proverb Writing Instructions	2

S.No.	Name of the Experiments
1	Making conversation at workplace
2	Writing articles
3	Making expressions for plans and decisions
4	Describing a product
5	Day in my life
6	Writing Terminology for engineers
7	Spotting errors
8	Expansion of proverbs
9	Instructions
10	Reading comprehension

Course Outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Domain
CO1	Build communicative competence through critical listening skills.	K3
CO2	Make use of critical thinking skills to express plans and opinions.	K3
CO3	Apply stress as well as tonal variations for effective communication.	K3
CO4	Make use of language skills to produce error free sentences.	K3
CO5	Experiment with presentation skills to address confidently.	K3

COs and POs Mapping:

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	-	-	-	-	-	-	-	-	-	3	-	3
CO2	-	-	-	-	-	-	-	-	-	3	-	3
CO3	-	-	-	-	-	-	-	-	-	3	-	3
CO4	-	-	-	-	-	-	-	-	-	-	-	3
CO5	-	-	-	-	-	-	-	-	-	3	-	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Assessment Pattern:

Name of the Test	Marks	Total	Reduced to
Continuous Assessment (Experiments 1-10)	50	100	50
Model Examination	50		
End Semester Lab Exam	100	100	50
TOTAL			**100 MARKS**

Textbooks:

1. Raman, Meenakshi and Sangeetha Sharma. Professional Communication. Oxford University Press, Oxford, 2014.
2. Dr. Chellammal. V. Learning to Communicate. Allied Publishers, New Delhi, 2003.
3. Mohan, Krishna. And Meera Bannerjee. Developing Communication Skills. Macmillan India Ltd. 1990.

Reference Books:

Murphy – Raymond. English Grammar in Use BOOK with Answers: A Self-Study. Reference and Practice Book for Intermediate Learners of English. Fourth edition: Cambridge University Press – 2012.

MANUALS/ SOFTWARE: Open Sources / Websites

ROHINI COLLEGE OF ENGINEERING AND TECHNOLOGY

(AUTONOMOUS)

(Anjugramam-Kanyakumari Main Road, Palkulam,Variyoor P.O.-629 401, K.K.Dist.)

Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai

Accredited with A+ Grade by NAAC

B.E. Electronics and Communication Engineering

(B.E ECE)

Curriculum & Syllabus

(*2024-2025 Admitted Students Onwards*)

Vision Statement of RCET

To be an academic institute of continuous excellence towards education and research in rural regime and provide service to nation in terms of nurturing potentially higher social, ethical and engineering companion graduands.

Mission Statement of RCET

To foster and promote technically competent graduands by imparting the state of art Engineering education in rural regime.

To enunciate research assisted scientific learning by dissemination of knowledge towards science, agriculture, industry and national security.

Vision of the Department

To promote ethical and innovative Electronics and Communication Engineers through excellence in teaching, training and research so as to contribute to the advancement of the rural society and mankind.

Mission of the Department

- To focus on quality teaching and learning that will make students to adapt to the needs of the industry and higher learning.
- To infuse a spirit of social responsibility, innovation, creativity and ethical practices through all round development activities of students.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1 Graduates shall be able to lead a successful career by applying the Scientific and Engineering fundamentals to formulate and solve the real life problems.

PEO2 Graduates shall be able to practice the ethics of their profession, consistent with a sense of social responsibility and aptitude for innovations as they work individually and in multi-disciplinary teams.

PEO3 Graduates shall be receptive to recent technologies so as to excel in industry and accomplish professional competence through lifelong learning.

PROGRAMME OUTCOMES (POs)

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6 Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life- long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO1 Ability to perform innovatively in the fields of Electronics and communication Engineering by utilizing the acquired knowledge and to progress in the profession by applying ethical values ultimately benefiting the rural society.

PSO2 Apply advanced engineering hardware and software tools to solve complex Electronics and Communication Engineering problems.

CREDIT INFO		
Sl.No	Category	Credits
1	Humanities and Social Science (HSS)	13
2	Basic Science Courses (BSC)	25
3	Engineering Science Courses (ESC)	25
4	Professional Core Course (PCC)	59
5	Professional Electives Courses (PEC)	18
6	Open Electives Courses (OEC)	12
7	Employability Enhancement Courses (EEC)	17
8	Mandatory Courses (MNC)	-
Total Credits		169

S.No	Course Code	Course Title	Course Type	L	T	P	Credit
Humanities and Social Science (HSS)							
1	24GE101	Heritage of Tamils	HSS	1	0	0	1
2	24EN101	English For Engineers	HSS	2	0	1	2.5
3	24GE201	Tamil and Technology	HSS	1	0	0	1
4	24EN201	Presentation And Language Skills Laboratory	HSS	0	0	3	1.5
5	24MG601	Product Innovation & Entrepreneurship	HSS	2	0	0	2
6	24GE701	Professional Ethics and Human Values	HSS	2	0	0	2
7	24MG701	Economics for Engineers	HSS	3	0	0	3
Basic Science Courses (BSC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24MA101	Matrices and Calculus	BSC	3	1	0	4
2	24PH101	Engineering Physics	BSC	3	0	2	4
3	24CY101	Engineering Chemistry	BSC	3	0	2	4
4	24MA201	Complex Variables and Transforms	BSC	3	1	0	4
5	24PH201	Physics for Electronics Engineering	BSC	3	0	0	3
6	24CY201	Environmental Science and Engineering	BSC	2	0	0	2
7	24MA301	Probability, Statistics and Random Process	BSC	3	1	0	4
Engineering Science Courses (ESC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24ME201	Engineering Graphics & Design	ESC	1	0	4	3
2	24CS201	Programming for Problem Solving using C	ESC	2	0	4	4
3	24EE202	Fundamentals Of Electrical and Electronics Engineering	ESC	3	0	0	3
4	24EE203	Electric Circuit Analysis	ESC	3	0	2	4
5	24GE231	Workshop Practices	ESC	0	0	3	1.5
6	24EE301	Electromagnetic Theory	ESC	3	0	0	3
7	24CS301	Programming for Problem Solving using Python	ESC	0	0	3	1.5

S.No	Course Code	Course Title	Course Type	L	T	P	Credit
8	24EE304	IoT-Sensors and Devices	ESC	3	0	2	4
Professional Core Courses(PCC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24EC302	Digital Logic Circuits and Design	PCC	3	0	2	4
2	24EC303	Signals and Systems	PCC	3	0	2	4
3	24EC301	Electron Devices	PCC	3	0	2	4
4	24EE403	Control Systems	PCC	3	0	0	3
5	24EC401	Analog Electronics	PCC	3	0	2	4
6	24CS401	Computer Networks	PCC	2	0	2	3
7	24EC403	Digital Signal Processing	PCC	3	0	2	4
8	24EC402	Digital Communication	PCC	3	0	2	4
9	24CS402	Data Structures using C++	PCC	2	0	2	3
10	24EC503	Linear Integrated Circuits	PCC	3	0	2	4
11	24EC501	Microprocessors, Microcontrollers and Interfacing Techniques	PCC	3	0	2	4
12	24EC502	Wireless Communication	PCC	3	0	2	4
13	24EC602	Transmission Lines and Waveguides	PCC	3	0	0	3
14	24EC603	Embedded Systems	PCC	3	0	0	3
15	24EC604	VLSI Design	PCC	3	0	2	4
16	24EC701	Antenna and Microwave Engineering	PCC	3	0	2	4
Professional Electives Courses I (PEC)							
NETWORKS							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24EC571	Wireless Systems and Standards	PEC	3	0	0	3
2	24EC572	Wireless Sensor Networks	PEC	3	0	0	3
3	24EC573	Wireless Networking	PEC	3	0	0	3
4	24EC574	Network Security	PEC	3	0	0	3
5	24EC575	Software Defined Networking	PEC	3	0	0	3
6	24EC576	Long Term Evolution Technologies	PEC	3	0	0	3
Professional Electives Courses II (PEC)							
SIGNAL PROCESSING							
1	24EC581	Speech Signal Processing	PEC	3	0	0	3
2	24EC582	Multimedia Compression Techniques	PEC	3	0	0	3
3	24EC583	Wavelets and its Applications	PEC	3	0	0	3

4	24EC584	Advanced Digital Signal Processing	PEC	3	0	0	3
5	24EC585	Pattern Recognition and Machine Learning	PEC	3	0	0	3
6	24EC586	Digital Image Processing	PEC	2	0	2	3
Professional Electives Courses III (PEC)							
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING							
1	24EC671	Soft Computing	PEC	2	0	2	3
2	24EC672	Machine Learning Techniques	PEC	2	0	2	3
3	24EC673	Deep Learning Techniques	PEC	2	0	2	3
4	24EC674	Python Programming for AI And ML	PEC	2	0	2	3
5	24EC675	Introduction to Data Analytics and Visualization	PEC	2	0	2	3
6	24EC676	Architectures for Management of Large Datasets	PEC	2	0	2	3
Professional Electives Courses IV (PEC)							
INTERNET OF THINGS							
1	24EC681	IoT Protocols and Industrial Sensors	PEC	2	0	2	3
2	24EC682	IoT Processors	PEC	2	0	2	3
3	24EC683	IoT System Design	PEC	2	0	2	3
4	24EC684	IoT Communication Models	PEC	2	0	2	3
5	24EC685	Industrial IoT and Industry 4.0	PEC	2	0	2	3
6	24EC686	Python for IoT Data Analytics	PEC	2	0	2	3
Professional Electives Courses V (PEC)							
VLSI SYSTEM DESIGN							
1	24EC771	Analog VLSI Circuits	PEC	3	0	0	3
2	24EC772	Low Power VLSI Design	PEC	3	0	0	3
3	24EC773	Nano Electronics	PEC	3	0	0	3
4	24EC774	Device Modeling	PEC	3	0	0	3
5	24EC775	System-On-Chip Design	PEC	3	0	0	3
6	24EC776	FPGA Based System Design	PEC	3	0	0	3
Professional Electives Courses VI (PEC)							
RADIO FREQUENCY AND ANTENNA SYSTEMS							
1	24EC781	Microwave Circuits and Systems	PEC	3	0	0	3
2	24EC782	Microwave Integrated Circuits	PEC	3	0	0	3
3	24EC783	RF System Design	PEC	3	0	0	3

S.No	Course Code	Course Title	Course Type	L	T	P	Credit
4	24EC784	Electromagnetic Interference and Compatibility	PEC	3	0	0	3
5	24EC785	Antenna Technologies for Wireless Applications	PEC	3	0	0	3
6	24EC786	Optical Communication	PEC	3	0	0	3
Open Electives Courses I (OEC)							
ARTIFICIAL INTELLIGENCE AND COMPUTER SCIENCE AND ENGINEERING							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24AI601	Artificial Intelligence and Machine Learning Fundamentals	OEC	3	0	0	3
2	24AI602	Business Intelligence and Its Applications	OEC	3	0	0	3
3	24AI603	Data Science Fundamentals	OEC	3	0	0	3
4	24CS601	Augmented Reality /Virtual Reality	OEC	3	0	0	3
5	24CS602	Full Stack Development	OEC	3	0	0	3
6	24CS603	Software Testing and Quality Assurance	OEC	3	0	0	3
7	24CS604	Cloud Computing	OEC	3	0	0	3
Open Electives Courses II (OEC)							
CIVIL AND AGRICULTURAL ENGINEERING							
1	24AG601	Principles of Crop Production	OEC	3	0	0	3
2	24AG602	Dairy and Food Engineering	OEC	3	0	0	3
3	24AG603	Post-Harvest Technology	OEC	3	0	0	3
4	24AG604	Agricultural Finance, Banking and Co-operation	OEC	3	0	0	3
5	24CI601	Rural Development	OEC	3	0	0	3
6	24CI602	Geographic Information System	OEC	3	0	0	3
7	24CI603	Water Resources management	OEC	3	0	0	3
8	24CI604	Climate Change and its Impact	OEC	3	0	0	3
Open Electives Courses III (OEC)							
BIO MEDICAL AND ELECTRICAL ENGINEERING							
1	24BM701	Wearable Devices	OEC	3	0	0	3
2	24BM702	Telemedicine and Healthcare Delivery	OEC	3	0	0	3
3	24BM703	Medical Informatics	OEC	3	0	0	3

4	24BM704	Basics of Human Anatomy and Physiology	OEC	3	0	0	3
5	24EE701	Robot Process Automation	OEC	3	0	0	3
6	24EE702	Electric vehicle Technology	OEC	3	0	0	3
7	24EE703	Smart Grid	OEC	3	0	0	3
8	24EE704	Energy Conservation and Management	OEC	3	0	0	3
Open Electives Courses IV (OEC)							
MECHANICAL AND MANAGEMENT							
1	24ME701	Additive Manufacturing	OEC	3	0	0	3
2	24ME702	Rocket Propulsion	OEC	3	0	0	3
3	24ME703	Industrial Safety	OEC	3	0	0	3
4	24ME704	Marine Vehicles	OEC	3	0	0	3
5	24MG701	Digital Marketing	OEC	3	0	0	3
6	24MG702	Industrial Psychology	OEC	3	0	0	3
7	24MG703	Logistics and Supply chain Management	OEC	3	0	0	3
8	24MG704	Corporate Social Responsibility	OEC	3	0	0	3
EMPLOYABILITY ENHANCEMENT COURSES (EEC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24EC351	Mini Project – I (Introduction to Innovative Projects)	EEC	0	0	2	1
2	24EC451	Mini Project – II (Design and development of the product)	EEC	0	0	2	1
3	24EN451	Soft Skills Development	EEC	0	0	2	1
4	24EC551	Mini Project – III (Community based Project)	EEC	0	0	2	1
5	24EN651	Business and Managerial Communications	EEC	0	0	2	1
6	24GE551	Quantitative and Reasoning Skills-I	EEC	0	0	2	1
7	24EC651	Mini Project-IV (Micro Project)	EEC	0	0	2	1
8	24GE651	Quantitative and Reasoning Skills-II	EEC	0	0	2	1
9	24EC751	Project Work Phase I (Design and Analysis)	EEC	0	0	4	2
10	24EC752	Industrial Training / Internship	EEC	0	0	0	2
11	24EC851	Project Work Phase II	EEC	0	0	10	5

MANDATORY COURSES (MNC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24MC101	Induction Programming	MNC	THREE WEEKS			
2	24MC201	Sports And Yoga for Youth Empowerment - II	MNC	0	0	2	0
3	24MC202	NCC Credit Course Level - I	MNC	1	0	2	1#
4	24MC301	Sports And Yoga for Youth Empowerment - II	MNC	0	0	2	0
5	24MC401	NCC Credit Course Level - II	MNC	1	0	0	1#
6	24MC601	Disaster Management	MNC	1	0	0	1#
7	24MC701	Constitution Of India	MNC	1	0	0	1#

SCHEME OF INSTRUCTION FOR FIRST YEAR B.E

1st SEMESTER

S.no	Course code	Course Title	Category	L	T	P	C
THEORY COURSES							
1	24GE101	Heritage of Tamils	HSS	1	0	0	1`
2	24MA101	Matrices and Calculus	BSC	3	1	0	4
THEORY COURSE WITH LABORATORY COMPONENT							
3	24EN101	English for Engineers	HSS	2	0	1	2.5
4	24PH101	Engineering Physics	BSC	3	0	2	4
5	24CY101	Engineering Chemistry	BSC	3	0	2	4
6	24ME201	Engineering graphics & design	ESC	1	0	4	3
7	24CS201	Programming for problem solving using c	ESC	2	0	4	4
MANDATORY COURSES							
8	24MC101	Induction programming	MNC	THREE WEEKS			
TOTAL				14	1	15	22.5

2nd SEMESTER

S.no	Course code	Course Title	Category	L	T	P	C
THEORY COURSES							
1	24GE201	தமிழரும் தொழில்நுட்பமும் / Tamil and Technology	HSS	1	0	0	1
2	24MA201	Complex Variables and Transforms	BSC	4	0	0	4
3	24PH201	Physics for Electronics Engineering	BSC	3	0	0	3
4	24CY401	Environmental Science and Engineering	BSC	2	0	0	2
THEORY COURSE WITH LABORATORY COMPONENT							
5	24EE202	Fundamentals Of Electrical and Electronics Engineering	ESC	3	0	2	4
6	24EE203	Electric Circuit Analysis	ESC	3	0	2	4
LABORATORY COURSES							

7	24GE231	Workshop Practices	ESC	0	0	3	1.5
8	24EN231	Presentation and Language Skills Laboratory	HSS	0	0	3	1.5
9	24CS301	Programming for Problem Solving using Python	ESC	0	0	3	1.5
MANDATORY COURSES							
10	24MC201	Sports and yoga for youth empowerment - II	MNC	0	0	2	0
11	24MC202	NCC CREDIT COURSE LEVEL - I	MNC	1	0	2	1#
TOTAL				13	1	15	21.5

பாடநெறி குறியீடு:	24GE101	பாடத்தின் தலைப்பு:	தமிழர்மரபு (Common to AI&DS, AE, BME, CE, CSE, CSE(AI&ML), EEE, ECE,MECH)
கிரெடிட்	1	L – T – P	1-0-0
Pre-requisite :			**NIL**

பாடத்திட்ட நோக்கங்கள்:
தமிழின் மதச்சார்பற்ற தன்மை, இந்திய மொழிக் குடும்பத்தின் திராவிட மொழி, திருக்குறளின் கருத்துக்கள், சமயங்களின் தாக்கம், நவீன இலக்கிய வளர்ச்சி ஆகியவற்றை நினைவு கூர்தல். தமிழர்களின் சமூக மற்றும் பொருளாதார வாழ்வில் நடுகல், சிற்பங்கள், சிலைகள் மற்றும் அழகிய கைவினைப் பொருட்கள், இசைக்கருவிகள் ஆகியவற்றின் தொடர்புடைய அறிவைக் கோடிட்டுக் காட்டுதல். தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகளை மனதில் பதிய வைத்தல். தமிழ்நாட்டின் தாவரங்கள் மற்றும் விலங்கினங்கள், சங்க நகரங்கள் மற்றும் துறைமுகங்கள், சங்க காலத்தின் ஏற்றுமதி மற்றும் இறக்குமதிகளை நினைவுபடுத்துதல், வெளிநாடுகளில் சோழர் படையெடுப்பைக் கண்டறிதல். இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கைக் கண்டறிதல், இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்குக்கு இணையாக இந்தியாவின் பிற பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கத்தை அடையாளம் காணுதல்.

அலகு I மொழி மற்றும் இலக்கியம்:	**[3hours]**
இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம்- பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில்	

நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.	
அலகு II மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக்கலை:	**[3hours]**
நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.	

அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:	**[3hours]**
தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.	

அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள்:	**[3hours]**
தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறைமுகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி.	

அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு:	**[3hours]**
இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தங்கங்களின் அச்சு வரலாறு.	

பாடநெறி முடிவுகள் (பாமு):

பாடநெறியின் முடிவில், மாணவர் பின்வரும் திறன்களைப் பெறுவர்:

பாமு	**பாடநெறி முடிவுகள்**	**மிக உயர்ந்த அறிவாற்றல் நிலை**
அலகு I பாமு:	தமிழின் மதச்சார்பற்ற தன்மை, திராவிட மொழியின் பங்கு, திருக்குறளின் கருத்துக்கள், சமயங்களின் தாக்கம், நவீன இலக்கிய வளர்ச்சி ஆகியவற்றையும் தெரிந்துகொள்கிறார்கள்.	கே 1
அலகு II பாமு:	தமிழர்களின் சமூக மற்றும் பொருளாதார வாழ்வில் நடுகல், சிற்பங்கள், சிலைகள் மற்றும் அழகிய கைவினைப் பொருட்கள், இசைக்கருவிகள் ஆகியவற்றை விவரிக்கும் ஆற்றலை பெறுகிறார்கள்.	கே 2
அலகு III பாமு:	தமிழர்களின் பாரம்பரிய விளையாட்டுகளை தெரிந்து கொள்ளுவதால் விளையாட வேண்டும் ஏன்ற ஆர்வத்தை பெறுகிறார்கள்.	கே 1
அலகு IV பாமு:	தமிழ்நாட்டின் தாவரங்கள் மற்றும் விலங்கினங்கள் பற்றிய அறிவையும், சங்க கால கட்டிடக்கலை, ஏற்றுமதி மற்றும் இறக்குமதி தொழில் நுட்ப அறிவை பெறுகிறார்கள்..	கே 1
அலகு V பாமு:	இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கையும், இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு இணையாக இருப்பதையும், தெரிந்து கொள்கிறார்கள்.	கே 1

பாடநெறி முடிவுகள் ***மற்றும் நிரல் முடிவுகள் ஒப்பிடுதல்***

பாமுகள்	மிக உயர்ந்த அறிவாற்றல் நிலை	பாடநெறி முடிவுகள்											
		1	2	3	4	5	6	7	8	9	10	11	12
பாமு1	கே 1	2	-	-	-	-	-	-	-	-	-	-	-
பாமு2	கே 2	1	-	-	-	-	-	-	-	-	-	-	-
பாமு3	கே 1	1	-	-	-	-	-	-	-	-	-	-	-
பாமு4	கே 1	1	-	-	-	-	-	-	-	-	-	-	-
பாமு5	கே 1	1	-	-	-	-	-	-	-	-	-	-	-

நிலை 3- அதிக ஒத்துப்போதல், நிலை 2- மிதமாக ஒத்துப்போதல், நிலை 1- குறைவாக ஒத்துப்போதல், நிலை 0- ஒத்துப்போகவில்லை

மதிப்பீட்டுத் திட்டம்:

கூறுகள்	மதிப்பீட்டின் வகை	அதிகபட்ச மதிப்பெண்கள்	குறைக்கப்பட்ட மதிப்பெண்கள்	இறுதி மதிப்பெண்கள்
தொடர்ச்சியான உள் தேர்வு	தொடர்ச்சியான உள் தேர்வு - I	100	40	40
	தொடர்ச்சியான உள் தேர்வு - II	100	40	
இறுதி பருவ தேர்வு	எழுத்து தேர்வு	100	60	60
			மொத்தம்	100

இறுதி பருவ தேர்வு: (கேள்வி முறை)

- ஒவ்வொரு யூனிட்டும் இரண்டு 2 மதிப்பெண் வினாக்களையும் ஒரு 16 மதிப்பெண் வினாவையும் (இரண்டில் ஒன்று) கொண்டுள்ளது.
- பதினைந்து கேள்விகளுக்கும் பதிலளிக்க வேண்டும்.

மதிப்பீட்டு முறை

ப்ளூமின் வகை	தொடர்ச்சியான மதிப்பீட்டு சோதனைகள்		இறுதி தேர்வு
	1	2	
நினைவில் கொள்ளுதல்	60	50	60
புரிந்து கொள்ளுதல்	40	50	40
விண்ணப்பித்தல்	0	0	0
பகுப்பாய்வுதல்	0	0	0
மதிப்பிடுதல்	0	0	0
உருவாக்குதல்	0	0	0

TEXT BOOKS:

1. தமிழகவரலாறு - மக்களும்பண்பாடும் - கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்).
2. கணினித்தமிழ் - முனைவர்இல. சுந்தரம். (விகடன்பிரசுரம்).
3. கீழடி - வைகைநதிக்கரையில்சங்ககாலநகரநாகரிகம் (தொல்லியல்துறைவெளியீடு)
4. பொருநை - ஆற்றங்கரைநாகரிகம். (தொல்லியல்துறைவெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.

REFERENCE BOOKS:

1. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
2. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
3. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department ofArchaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
4. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
5. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)

6. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Course Code:	24MA101	Course Title:	**Matrices and calculus** (Common to AI&DS, AE, BME, CE, CSE, CSE(AI&ML),EEE,ECE, MECH)
Credits:	**4**	**L – T – P**	**3 – 1 – 0**
Pre-requisite			**NIL**

Course objectives:

- To provide the basic tools of calculus mainly for the purpose of modeling the engineering problems mathematically and obtaining solutions.
- To learn the concept of eigenvalues and eigenvectors and to reduce the quadratic form to canonical form.
- To learn the foundation course of Single Variable and multivariable calculus plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

Teaching-Learning Process:

These are sample strategies which teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method does not mean only traditional method, but different type of teaching methods may be adopted to develop the outcomes.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Topics will be introduced in a multiple representation and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT I – Matrices	**[12 hours]**
Eigenvalues and Eigenvectors and their properties – Diagonalization of a matrix (Symmetric matrix) – Cayley - Hamilton theorem (without proof) – Inverse and Power of a matrix by Cayley - Hamilton	

theorem – Quadratic forms and Nature of quadratic forms. Application: Reduction of a quadratic form to canonical form by orthogonal transformation.

UNIT II – Differential Calculus	**[12 hours]**
Functions – Limit – Continuity – Derivatives – Differentiation rule – Product and quotient rules – Chain rules – Implicit differentiation – Logarithmic differentiation. Application: Maxima and Minima of functions of one variable	

UNIT III – Functions of Several Variables	**[12 hours]**
Partial differentiation – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables. Application: Maxima and Minima of functions of two variables using MATLAB - Lagrange's method of undetermined multipliers.	

UNIT IV – Integral Calculus	**[12 hours]**
Definite and Indefinite integrals - Substitution rule - Techniques of Integration: Bernoulli's theorem (without proof) – Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals. Application: Area between simple closed curves.	

UNIT V – Multiple Integrals	**[12 hours]**
Double integrals –Double integrals in cartesian and polar coordinates – Change of order of integration– Area enclosed by plane curves – Triple integrals – Change of variables in double and triple integrals. Application: Volume of solids, Mass of Lamina	

Course outcomes:

On completion of the course, the student will have the ability to:

COs	**Course Outcome**	**Cognitive domain**
CO1	Apply the matrix algebraic techniques for eigen value related applications	K3

CO2	Understand the concepts of limit and continuity of functions	K2
CO3	Compute the derivatives and the extreme points and solve engineering problems	K3
CO4	Use the partial derivatives to find the maxima and minima of multivariable functions	K3
CO5	Use fundamental theorem of calculus to evaluate definite integrals	K3
CO6	Apply the concepts of multiple integrals to find the areas and volumes of geometrical shapes	K3

COs and POs Mapping:

COs	**POs**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	2	1	-	2	-	-	-	-	-	-	2
CO2	2	1	1	-	-	-	-	-	-	-	-	1
CO3	3	2	1	-	2	-	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	-
CO6	3	2	1	-	1	-	-	-	-	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or choice).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	20	20	20
Understand	40	20	20
Apply	40	60	60
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
3. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 2015. [For Units II & IV - Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8]

Reference Books:

1. Muthusubramanian R and Salivahanan S, "Basic Electrical and Electronics Engineering," McGraw Anton. H, Bivens. I and Davis. S, " Calculus ", Wiley, 10th Edition, 2016
2. Bali. N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
3. Jain. R.K. and Iyengar. S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition, 2016.
4. Narayanan. S. and Manicavachagom Pillai. T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.
5. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.Hill, NewDelhi, 2009.

Equivalent NPTEL/SWAYAM Courses

SI.No.	Course Title	Course Instructor	Host Institute
1	Matrix Analysis with Applications	Prof. S. K. Gupta Prof. Sanjeev Kumar	IIT Roorkee
2	Calculus of One Real Variable	Prof. Joydeep Dutta	IIT Kanpur

Web Links and Video Lectures (E-Resources):

1. System of Linear Equations, Eigenvalues and Eigenvectors: https://www.nptelvideos.com/lecture.php?id=13416
2. Concept of Domain, Limit, Continuity and Differentiability: https://www.nptelvideos.com/lecture.php?id=13422
3. Matrix Diagonalization: https://www.nptelvideos.com/lecture.php?id=13481

Course Code:	**24EN101**	**Course Title:**	**ENGLISH FOR ENGINEERS** (Common to AI&DS, AE, BME, CE, CSE, CSE(AI&ML), EEE, ECE, MECH)
Credits:	**2.5**	**L – T – P**	**2-0-1**
Pre-requisite			**NIL**

Course Objectives:

- To develop an understanding of Basic English Grammar.
- To enhance listening skills and select appropriate responses.
- To practice presentation and speaking techniques.
- To develop a quest for reading.
- To practice professional writing.

Teaching-Learning Process:
Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. Language learning softwares / Language Lab 3. Online Resources 4. Smart Class Room 5. Flipped classrooms 6. Project based Collaborative Experiential learning 7. Expert Lecture sessions

UNIT I - BASIC GRAMMAR- VOCABULARY AND EXPRESSIONS	**[8 hours]**
Grammar: Parts of speech - Types of sentences: Assertive - Imperative - Interrogative & Exclamatory - Affirmative - Negative - Gerunds & Infinitives - Tenses - Voices- Impersonal passives- Prepositions -Articles & Determiners- Cause and effect expressions - Vocabulary: Affixes- Synonyms & Antonyms - Homonyms - Homophones- Compound Nouns.	

UNIT II - ACTIVE LISTENING - RESPONDING		**[15 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
SI. No.	**Topic**	**Hours**
1.	Listening to Audio (Podcasts- Audiobooks- Radio Program) and Practice Exercise-Answering Cloze Test Based on Listening	3
2.	Listening to native speaker's Telephone Conversations– Analyzing a Product	3
3.	Listening to Job Interviews - Sports Commentaries /	3

	Animated stories / Anecdotes / Event narration	
4.	Video Comprehension – Brainstorming and Note-Taking	3
	CLASSROOM ACTIVITIES	
1.	Listening to Statistical Information and Follow-up Exercises. - Form Filling Exercises	1
2.	Debate and reviewing the performance of each participant - Panel Discussion	2

UNIT III: SPEAKING AND PRESENTATION SKILLS		**[15 hours]**
	LIST OF EXERCISES	
	LAB ACTIVITIES	
SI. No.	**Topic**	**Hours**
1.	Speaking Development through English software S-net or Globarena and Online Content (Tenses- Voices- SV Agreement- Prepositions- Coherence Markers- Relative Clauses- Modals- Punctuation)	5
	CLASSROOM ACTIVITIES	
1.	Self-Introduction - Sharing Childhood Experiences- Talking about Favorite Personalities	1
2.	Describing Recent Innovation in Technology	1
3.	Interviewing Celebrities and Entrepreneurs	1
4.	Situational Conversations (Meeting a friend in a cafe) - Narrating Personal Experience	1
5.	Group Communication- Discussing Social Issues- Current Affairs and Debate	1
6.	Role-Play- Picture/Movie Description	1
7.	Presentation – I (Book /Movie Review- Story Telling- General	2

	Presentations)	
8.	Presentation – II (Technical Presentations)	2

UNIT IV: READING BETWEEN LINES		**[12 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
SI. No.	**Topic**	**Hours**
1.	Reading Comprehension - skimming - scanning (General / Technical passages	2
2.	Reading Longer Texts with Time Frame	2
3.	Reading Data using different types of Texts- Magazines and Internet Materials	2
4.	Reading Research Papers-- Editing/Proofreading	2
CLASSROOM ACTIVITIES		
1.	Job Advertisements – Manual for Product/Service – Telephone Phrases	1
2.	Reading Cause and Effect Essays-Technical Papers and Case Studies - Sorting out jumbled Sentences in a Paragraph	2
3.	Short Stories - Critical Reading	1

UNIT V- WRITING FOR ENGINEERS	**[7+3 hours]**
Writing - Application Letters - Resume- Product Description - Essay related to Technical / Social / current topics - Interpretation of Charts - Short Articles on everyday life - letters – Enquiry- Quotation- Order- Claim - Adjustment - Response to complaints - Statement of Purpose (SoP) -Emails - Memos -Notices - Circulars - Minutes of Meetings - Internship - Accident Report - Feasibility Report- Recommendations.	

LIST OF EXERCISES		
LAB ACTIVITIES		
SI. No.	**Topic**	**Hours**
1.	Mind Mapping and Brainstorming on any Social Event/Issue	1
2.	Creating a Blog/Vlog/YouTube Channel –Uploading MP3/MP4 – Practice (Movie/Book/ Gadget Review- General/Tech Talks- Interview with Celebrities)	1
3.	Creating a Product Review Blog.	1

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Domain
CO1	Identify various grammatical components- build vocabulary and apply expressions for error-free sentences	K3
CO2	Make use of appropriate words to respond by listening to general and technical online contents	K3
CO3	Experiment with the nuances of presentation and speaking skills	K3
CO4	Apply reading skills in various academic contexts	K3
CO5	Construct legible and flawless sentences proficiently with appropriate choice of words and structures for varied professional contexts	K3

COs and POs Mapping:

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	-	-	-	-	-	-	-	-	-	3	-	3
CO2	-	-	-	-	-	-	-	-	-	3	-	3
CO3	-	-	-	-	-	-	-	-	-	3	-	3
CO4	-	-	-	-	-	-	-	-	-	3	-	3
CO5	-	-	-	-	-	-	-	-	-	3	-	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max. Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - **Theory**	CIE – I	100	60	100	25
	CIE – II	100			
	Skill Assessment I (2 Assignments + 1 seminar)	40	40		
	Skill Assessment II (3 Assignments)	40			
Continuous Internal Examination (CIE) - **Laboratory**	Continuous Assessment (Lab activities & exercises)	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	10	10	10
Understand	30	30	30
Apply	60	60	60
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Gangalakshmi- C- Rathika- B- Saranraj- L. Professional English for Engineers. New Delhi: Cengage- 2022.

2. Murphy- Raymond. English Grammar in Use Book with Answers: A Self-study Reference and Practice Book for Intermediate Learners of English. Fourth Edition: Cambridge University Press- 2012.

Reference Books:

1. Raman- Meenakshi and Sangeetha Sharma. Communication Skills. New Delhi: OUP- 2018
2. R. C. Sharma_ Krishna Mohan - Business Correspondence and Report Writing _ a Practical Approach to Business _ Technical Communication-Mc Graw Hill India (2017)

Web Links and Video Lectures (E-Resources):

MANUALS / SOFTWARE: Open Sources / British Council / Cambridge Websites

Suggested Skill Activities:

1) Listening tests materials [Select podcasts / radio programmes / YouTube videos / audiobooks / materials from British Council] - Cloze tests where students fill in missing words from transcripts – Yes or No Question Answers – one-word answers based on recording – summary of recording
2) Self-introduction / Introduce Colleague
3) Just a Minute talks
4) Extempore
5) Mock GDs
6) Mock Interviews
7) Note Taking of Engineering Lectures
8) Create videos / blogs
9) Present Technical Papers
10) Reading Comprehension Exercises
11) Writing letters – Leave letter – Letter for academic purposes

12) Writing Essays

13) Composing Mails

14) Preparing Statement of Purpose

15) Preparing Covering letter and Resume

Course Code:	**24PH101**	**Course Title:**	**ENGINEERING PHYSICS**
Credits:	**4**	**L – T – P**	**3-0-2**
Pre-requisite			**NIL**

Course Objectives:

- To make the students effectively to achieve an understanding of Mechanics
- To enable the students to gain knowledge of Elasticity.
- To enable the students to gain knowledge of Maxwell's Equation and Electromagnetic waves.
- To introduce the basics of optics and lasers.
- Equipping the students to successfully understand the importance of quantum physics.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I -MECHANICS	[9 hours]
Multiparticle dynamics: Center of mass (CM) – Rotation of rigid bodies: Rotational kinematics – Rotational kinetic energy and moment of inertia - Theorems of M .I –M.I of Uniform rod-M.I of a diatomic molecule - Torque– Rotational energy state of a rigid diatomic molecule - Gyroscope – Torsional stress and deformation-Torsional pendulum- Double pendulum.	
Practical Topics: 1. Torsional pendulum – Determination of rigidity modulus of wire and moment of inertia of disc. 2. Compound pendulum – Determination of rigidity modulus	

UNIT II - ELASTICITY	[9 hours]
Elasticity – Factors affecting Elasticity –Different types of Modulus- Moduli of elasticity and its relation -Stress - strain diagram and its applications - Bending of beams - Bending moment – Cantilever - Young's modulus : Uniform & Non-uniform bending-theory and experiment-I Shaped Girders.	
Practical Topics: 1. Determination of Young's modulus of a given material- Non uniform bending method 2. Uniform bending – Young's modulus determination.	

UNIT III - MAXWELL'S EQUATIONS AND ELECTROMAGNETIC WAVES	[9 hours]
The Maxwell's equations - wave equation- Plane electromagnetic waves in vacuum - properties of electromagnetic waves - Producing electromagnetic waves - Energy and momentum in EM waves - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium vacuum interface for normal incidence..	
Practical Topics: 1. Spectrometer – Determination of wavelength of Hg spectrum using grating. 2. Spectrometer – Angle of the prism 3. Spectrometer – Dispersive power of the prism	

UNIT IV - LASERS &FIBER OPTICS	[9 hours]
Lasers:-Einstein coefficients and their relations –-characteristics of laser - Types of Laser - Nd-YAG laser -semiconductor laser- Applications -Industrial, Medical, laser based military weapons Fiber optics: principle and classification of optical fibers – propagation of light in optical fiber - Numerical aperture and Acceptance angle– Fiber optic communication system - Applications - Displacement and pressure sensors – Endoscopy	
Practical Topics: 1. Determination the acceptance angle and numerical aperture of the given optical fiber. 2. Determination of the particle size of the given powder using laser 3. Determination of wavelength of a given laser source - Grating method	

UNIT V - QUANTUM MECHANICS	[9 hours]
Photons and light waves - Electrons and matter waves- Dual Nature of Light –-De Broglie Waves-Compton effect - The Schrodinger equation (Time dependent and time independent forms) - Physical Significance of wave function - Normalization –Free particle - particle in a infinite potential well: 1D,2D and 3D Boxes- Normalization-quantum computation.	
Practical Topics: 1, Young's Double Slit Experiment to demonstrate the wave nature of particles	

Laboratory component: **30 Hours**

Any ten experiments have to be completed from the following list ofExperiments

SI.No	Name of the experiment
1.	Apply parallel axis theorem to find the resultant of system of concurrent coplanar forces.
2.	Torsional pendulum – Determination of rigidity modulus of wire and moment of inertia of disc
3.	Compound pendulum- Determination of moment of inertia of a rigid rod.

4.	Apply the concept of bending of beams to find the Young's modulus of a given material- by Non uniform bending method
5.	Apply the concept of bending of beams to find the Young's modulus of a given material- by Uniform bending method.
6.	Determination of V-I characteristics of a solar cell.
7.	Using Ohm's law verify the laws of resistances .
8.	Using optical fiber find the acceptance angle and numerical aperture.
9.	Make use of the laser source find the particle size of the given powder.
10.	Determination of wavelength of a given laser source - Grating method.
11.	Spectrometer – Determination of wavelength of Hg spectrum using grating.
12.	Spectrometer – Dispersive power of the prism.
13.	Determination of magnetic Induction due to long current carrying conductor.
14.	Make use of the Young's Double Slit Experiment, demonstrate the wave nature of particles.
15.	Spectrometer – Angle of the prism

Course outcomes: On completion of the course, the student will have the ability to:

CO No	Corse Outcomes	Cognitive Domain
CO1	Apply the concepts of Mechanics in materials.	K3
CO2	Apply the concept of elasticity in beams.	K3
CO3	Apply the concept of electromagnetic waves in communication.	K3
CO4	Illustrate the applications of different lasers &Calculate the acceptance angle and numerical aperture of an optical fiber .	K2
CO5	Explain the quantum concepts and quantum computation.	K2

COs and POs Mapping:

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	2	2	-	-	-	-	-	-	-	-	1
CO2	3	2	2	-	1	-	-	-	-	-	-	1
CO3	3	2	2	-	1	1	-	-	-	-	-	1
CO 4	3	1	1	-	1	1	-	-	-	-	-	1
CO 5	3	1	1	-	-	-	-	-	-	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	60	100	25
	CIE – II	100			
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

Assessment Pattern:

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

TEXT BOOKS:

1. D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw HillEducation (Indian Edition), 2017.
2. E.M.Purcell and D.J.Morin, Electricity and Magnetism, Cambridge Univ.Press,
3. 2013.
4. Bhattacharya, D.K. & Poonam, T. "Engineering Physics". Oxford University Press, 2015

REFERENCES:

1. R.Wolfson. Essential University Physics. Volume 1 & 2. Pearson Education(Indian Edition),2009.

2. Paul A. Tipler, Physic – Volume 1 & 2, CBS, (Indian Edition), 2004.

3. K.Thyagarajan and A.Ghatak. Lasers: Fundamentals and Applications, LaxmiPublications,(Indian Edition), 2019.

4. D.Halliday, R.Resnick and J.Walker. Principles of Physics, Wiley (IndianEdition), 2015.

Equivalent NPTEL/SWAYAM Courses:

SI.No	Course Name	Course Instructor	Course Conducting Agency
1	Quantum Mechanics	Prof .P.Ramadevi	IIT -Bombay

Web links and Video Lectures (e-Resources):

1. ELASTICITY

   https://youtu.be/eICv1p8WjgI?si=88hhiQw_fld7ZrBU

2. MAXWELL'S EQUATIONS AND ELECTROMAGNETIC WAVES

   https://youtu.be/3IPVZYf7C-U?si=PnP1nupcfGfr1C76

3. LASERS &FIBER OPTICS

   https://youtu.be/Ab1nxxkgjH8?si=KR2GS8iBUFayBwdp

4. QUANTUM MECHANICS

   https://youtu.be/AEedn_NiWN0?si=Y27pAqawlwKmthNO

Skill Assessment:

1. Explain the concept behind the balance a water bottle on a edge.
2. The leaning Tower of Pisa is able to stand tilted without toppling, what is the reason behind it.
3. Apply the elasticity concept to find the fatigue change in plastic fiber and natural fiber

4. Radio antennas emit visible light, Why
5. What does an opaque substance do when light rays fall on it.
6. Illustrate the things happen when light falls on a piece of black paper.
7. Explain the dual nature of matter.
8. Optical Fiber is used in hard to reach places in mechanical inspection explain it.
9. Is quantum communication faster than the speed of light
10. Compare electron microscope & tunneling microscope.

Course Code:	**24CY101**	**CourseTitle:**	**Engineering Chemistry** (Common to AI&DS, AE, BME, CE, CSE, CSE(AI&ML), EEE, ECE,MECH)
Credits	**4**	**L – T – P**	**3-0-2**
Pre-requisite			**NIL**

Course objectives:
• To provide a comprehensive understanding of water quality parameters, water treatment techniques and wastewater systems. • To use the fundamental science and engineering principles relevant to materials that includes characterization, properties and processing of engineering materials. • To familiarize with the principles, working and applications of electrochemistry and storage devices for safe, effective and efficient operations. • To study, measure, monitor, control and prevent corrosion processes, economically andsafely. • To classify different types of fuel and fuel analysis techniques that assists to choose mostconvenient fuel for a process involving combustion.

Teaching-Learning Process:
Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. Blended Mode of Learning 3. Experiential Learning 4. NPTEL and Other Videos for theory topics 5. Flipped Class 6. Lab Experiment Videos

UNIT I - WATER TREATMENT	**[9 hours]**
Water Sources- Water Quality parameters - Hardness of water – types-units and calcium carbonate equivalent. -Determination of hardness of water by EDTA method. Scale and sludge, caustic embrittlement, priming and foaming and boiler corrosion. Water softening methods – internal and external conditioning –zeolite process and ion exchange process. Desalination – reverse osmosis and electro dialysis- Municipal water treatment and waste water treatment process.	
Practical Topics: 1. Determination of total hardness by EDTA method. 2. Estimation of alkalinity by Indicator method. 3. Estimation of chlorine content in water sample by Argentometric method. 4. Determination of BOD in water samples.	

UNIT II - CHEMISTRY OF ENGINEERING MATERIALS	[9 hours]
Adhesives: Introduction- requisites of a good adhesive-adhesive action- industrial applications of adhesives. Insulating Materials: Introduction- requirements- Glass and ceramics - preparation, properties andapplications - fabrication of ceramic ware. Lubricants-Classification of lubricants with examples-characteristics of a good lubricants - mechanism of lubrication (thick film, thin film and extreme pressure) - properties of lubricants: viscosity, cloud point, pour point, flash point and fire point. Electronic materials: Introduction-types, properties and applications of semiconducting materials and transistors, materials used in IC's, fibers and cables- properties and applications, organic solar cells - types and applications.	
Practical Topics: 1. Determination of viscosity of oils using Oswald viscometer. 2. Determination of cloud point and pour point of oils.	

UNIT III -ELECTROCHEMISTRY	[9 hours]
Introduction – Electrode potential – Nernst equation and problems - Electrochemical series - Conductometric titrations (acid - base & precipitation titration) Electrodes: Construction, working and applications of Standard and reference electrode (Hydrogen & Calomel) – Ion selective (glass electrode) – determination of pH using glass electrode.Batteries and Fuel Cells – Types of batteries —dry cell -Lead Storage battery–Nickel-Cadmium Battery – Lithium battery – Battery hazards - Biological Batteries. Fuel Cells – Hydrogen-Oxygen FuelCell.	
Practical Topics: 1. Estimation of strength of hydrochloric acid by pHmetry. 2. Determination of strength of acids in a mixture of acids using conductivity meter.	

3. Determination of charging and discharging rate of batteries.	
UNIT IV -CORROSION AND ITS CONTROL	**[9 hours]**
Corrosion – causes, factors, types, Chemical and Electrochemical Corrosion (Galvanic, Differential aeration) –galvanic series-factors influencing rate of corrosion-measurement of corrosion. Determination of corrosion rate by weight loss method. Control Methods-Electrochemical protection – Sacrificial Anodic method – Impressed Current Cathodic Protection – Corrosion Inhibitors – Bio corrosion Protective Coatings – Paints, Constituents, Functions- Surface coating - Surface preparation for metallic coatings, Electroplating and Electro-lessPlating- ceramic coatings, thermal vaporization coating, HVOF coating	
Practical Topics: 1. Estimation of the Ferrous ions in mild steel by Spectrophotometry. 2. Determination of rate of corrosion of by weight loss method	

UNIT V- FUELS AND COMBUSTION	**[9 hours]**
Fuels: Introduction: Classification of fuels; solid fuel -Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Liquid fuels -Manufacture of synthetic petrol –hydrogenation of coal (Bergius process), Knocking – octane number, diesel oil – cetane number; Power alcohol and biodiesel. Combustion of fuels: Introduction: Calorific value – higher and lower calorific values, Theoretical calculation of calorific value by Dulong's formula - Ignition temperature: spontaneous ignition temperature, Explosive range; Flue gas analysis – ORSAT Method.	
Practical Topics: 1. Determination of flash point and fire point of fuels.	

Laboratory component: **30 Hours**

Any ten experiments have to be completed from the following list of experiments

SI.No.	Name of the experiment
1	Determine the total hardness of water sample by EDTA method.
2	Analyze the alkalinity of water sample by Indicator method.
3	Analyze the chlorine content in water sample by Argentometric method.
4	Determine the BOD of water samples.
5	Describe the procedure to determine the viscosity of oil using an Oswald viscometer.
6	Identify the cloud point and pour point of oils.
7	Make use of glass electrode to determine the strength of hydrochloric acid.
8	Make use of conductivity meter to determine the strength of acids in a mixture of acids.
9	Determine quantitatively the amount of Ferrous ions in mild steel by Spectrophotometry.
10	Determine the of rate of corrosion of by weight loss method.
11	Describe the procedure to determine the flash point and fire point of fuels.
12	Conduct a study to find out the charging and discharging rate of batteries.

Course outcomes: On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Analyze the water quality parameters and choose appropriate water treatment methods for use in industries and daily life.	K4
CO2	Make use of the applications of the materials in different engineering disciplines.	K3
CO3	Utilize the principles of electrochemistry and find the materials for energy conversion and storage.	K4
CO4	Determine the corrosion rate to propose suitable protection methods for environmental considerations	K3
CO5	Choose suitable fuels for engineering processes and automobile applications.	K3

COs and POs Mapping

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2	-	-	-	1	-	-	-	-	-	-
CO2	3	2	1	1	-	-	-	-	-	-	-	-
CO3	3	2	1	1	-	-	-	-	-	-	-	-
CO4	2	1	1	-	-	1	2	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	60	100	25
	CIE – II	100			
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	10	10	10
Understand	30	30	30
Apply	40	40	40
Analyze	20	20	20
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Jain P.C. and Jain M, Engineering Chemistry, Dhanpat Rai Publishing Company, New Delhi, 17th Edition,2021.
2. Dara S S and Umare S.S, A Text Book of Engineering Chemistry, S.Chand & Company Limited, 20thEdition, 2018.

Reference Books:

1. Benjamin M. M, Water Chemistry, Waveland Press, 2nd Edition, 2019.
2. Cicek V, Corrosion Engineering, Springer Publishing, 1st Edition, 2021.
3. Shahinpoor. M, Fundamentals of Smart Materials, Publisher: Royal Society of Chemistry, 1st Edition,2020.
4. Berg H, Bernhardsson S, and Johansson P, Electric Vehicle Batteries: Moving from Research towards Innovation, Publisher: Springer, 1st Edition, 2019.
5. B.K.Sharma "Engineering chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2014).

Web links and Video Lectures (e-Resources):

1. Water and wastewater treatment - https://onlinecourses.nptel.ac.in/noc23_ce12/preview
2. SemiconductorDevices and circuits. - https://nptel.ac.in/courses/108108112
3. Corrosion ProtectionMethods - https://onlinecourses.nptel.ac.in/noc23_mm01/preview
4. Elementary Electrochemistry - https://onlinecourses.nptel.ac.in/noc23_cy19/preview
5. Fuel and combustionTechnology -https://archive.nptel.ac.in/courses/103/105/103105110/

Suggested Skill Activities:

1. Measure the TDS, PH & electrical conductivity of a home water.
2. Removal of temporary hardness of any water sample by suitable method.
3. Find the charging and discharging rate of mobile batteries when it is use or not.
4. The need of engineering material is essential in our day today life. - Justify the answer.
5. Measure the corrosion rate of iron bar when it is exposed in the environment.
6. List out the recent engineering materials used in emerging field.
7. Calculate the higher and lower calorific value of a fuel by using Dulong's formula.

8. List out the type of coatings applied on materials which are used in our daily life.
9. Improper disposal of batteries leads to environmental hazard. Suggest the suitable disposable method.
10. Pure Iron material undergo corrosion more fast than other materials. Give reasons.

Course Code:	**24ME201**	**Course Title:**	**Engineering Graphics and Design**
Credits:	**3**	**L – T – P**	**1-0-4**
Pre-requisite			**NIL**

Course objectives:

To impart knowledge on the

- To enable students to understand the standards and conventions of engineering drawing.
- To enhance the visualization skills to understand objects in the respective positions with respect to principal planes.
- To comprehend general projection theory, with emphasis on orthographic projection to represent three-dimensional objects in two-dimensional views.
- To emphasize freehand sketching and pictorial view to aid in the visualization process and to efficiently communicate ideas graphically.
- To Introduce CAD software for the creation of 3D models and 2D engineering drawings.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. NPTEL and Other Videos
3. Smart Class Room
4. Project based learning

UNIT I - DRAWING FUNDAMENTALS, GEOMETRIC CONSTRUCTION, PROJECTION OF POINTS, STRAIGHT LINES AND PLANES	[15 hours]
Drawing BIS standards – Orthographic projections – First angle projection - Drawing instruments – Sheet layout – Conventions – Lines, Lettering, Numbering and Dimensioning Geometric construction – Construction of regular polygons – Conic sections – Ellipse, Parabola and Hyperbola by eccentricity method.Projection of points – Points situated in all four quadrants. Projection of straight lines – Straight lines inclined to both principal planes – Finding true length of the line and true inclinations with respect to principal planes – Rotating line method. Projection of planes – Introduction – Polygonal lamina and Circular lamina - Orientation of planes - Plane parallel to both principal planes, Planes perpendicular to both principal planes and Planes inclined to both principal planes – Rotating object method. Orthographic projection of simple engineering components.	

UNIT II - PROJECTION OF SOLIDS	[15 hours]
Projection of solids – Introduction – Types of solids – Polyhedra and solids of revolution - Projection with axes inclined to one of the principal planes and parallel to other – Change of Position method. 2D drafting - Basic commands – Coordinate systems, Object section methods. Line, Circle, Polyline, Rectangle, Hatch, Fillet, Chamfer, Trim, Extend, Offset, Dim style – Annotation and Layering – Object snaps - 3D modelling – Basic commands – Extraction of multiple views – Part modelling of simple components - Utensils, Hand tools & Furniture etc. - Drawing views using 3D environment.	

UNIT III - DEVELOPMENT OF SURFACES AND PICTORIAL PROJECTION	[15 hours]
Development of lateral surfaces of truncated Prisms, Pyramids, Cylinders and Cones– Parallel line method and Radial line method. Pictorial Projection – Isometric projection – Introduction – Isometric scale – Isometric view of two right regular composite solids – Isometric projection of truncated frustum of solids – Box method. Problems on applications of Isometric projections of simple objects / engineering components.	

UNIT IV- BASIC COMPUTER AIDED DRAWING APPLICATIONS	[15 hours]
Free hand Sketching - Sketching of geometry - multiple view projection from single pictorial view of objects – Illustrative examples - True free hand, Guided Free hand, Roads, Buildings, Utensils, Hand tools & Furniture's etc. Drawing Simple Mechanisms - Bicycles, Tricycles, Gear trains, Ratchets, two- wheeler cart &Four-wheeler carts to dimensions etc.	

UNIT V- MULTIDISCIPLINARY APPLICATIONS AND PRACTICE	[15 hours]
Electric Wiring and lighting diagrams - Like, Automatic fire alarm, Call bell system, UPS system, Basic power distribution system using suitable software. **Basic Building Drawing** - Draw various types of lines, graphical symbols for materials, doors and windows, symbols for sanitary, water supply and electrical installations and write abbreviations as per IS 962. Like, Architectural floor plan, basic foundation drawing, steel structures- Frames, bridges, trusses using Auto CAD or suitable software, **Electronics Engineering Drawings** - Like, Simple Electronics Circuit Drawings, practice on layers concept. **Graphs & Charts** - Like, Column chart, Pie chart, Line charts, Gantt charts, etc. using Microsoft Excel or any suitable software.	

Course outcomes:

On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Apply principles of first angle projection in drafting plan and elevation of points, lines, planes, and solids.	K3
CO2	Apply change of position method in the projection of solids and determine the true shape of the section.	K3
CO3	Apply principles of orthographic projection to extract 2D views from 3D drawing using freehand sketching.	K3
CO4	Apply parallel line and radial line methods to develop lateral surfaces of solids so that students can understand applications in sheet metal design.	K3
CO5	Apply box method to develop the isometric view of simple, truncated, and composite solids.	K3

CO6	Develop simple part model in 3D and plan, elevation, and section of building using a designated CAD software.	K6

COs and POs Mapping:

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	-	-	-	-	-	-	-	2	-	-	1	2	-
CO2	3	1	-	-	-	-	-	-	-	2	-	-	1	2	-
CO3	3	1	-	-	-	-	-	-	-	-	-	-	1	2	-
CO4	3	1	-	-	-	-	-	-	-	2	-	-	1	-	-
CO5	3	1	-	-	-	-	-	-	-	2	-	-	1	2	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Lab Exam	100	50	50	50
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	0	0	0
Understand	20	20	20
Apply	40	40	40
Analyze	0	0	0
Evaluate	0	0	0
Create	40	40	40

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. N.D.Bhatt,"Engineering Graphics", Charotor Publishing House, 53RD Edition 2019
2. Natrajan K.V., "A textbook of Engineering Graphics", Dhanalakshmi Publishers, Chennai (2015)

Reference Books:

1. Venugopal K. and Prabhu Raja V., "Engineering drawing + AutoCAD", New Age International (P) Limited (2022)
2. Lakhwinder pal singh, Harwinder Singh, "Engineering Drawing Principles and Applications", Cambridge University Press, 2021.
3. Cecil Johnson, Jay D Helsel and Dennis R Short, "Engineering Drawing and Design", Seventh Edition, McGraw Hill, 2007.
4. Patil, Rajashekar, "Computer Aided Engineering Graphics", New Age International Ltd,2018.
5. Chris Schroder, "Printed Circuit Board Design using AutoCAD", Newnes,1997.
6. K S Sai Ram, "Design of steel structures", Third Edition by Pearson.
7. A S Pabla, "Electrical power distribution", 6th edition, Tata Mcgrawhill.
8. K. R. Gopalakrishna, & Sudhir Gopalakrishna, "Textbook of Computer Aided Engineering Drawing", 39th Edition, Subash Stores, Bangalore, 2017

Web Links and Video Lectures (E-Resources):

1. http://nptel.ac.in/courses/112103019
2. https://archive.nptel.ac.in/courses/112/105/112105294/

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 and 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 and SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 and SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

LABORATORY REQUIREMENTS

SYSTEM REQUIREMENTS (For a batch of 30 Students)

Hardware:

1. Intel i3 core due processor with 4GB ram with 500GB hard disk – 30 Nos.
2. Laser Printer – 1 No.

Software:

Drafting package – AutoCAD – Adequate license (Open source)

Suggested Skill Activities:

1. 2D drafting of plan and elevation of computer CPU.
2. 2D drafting of plan and elevation of a thermos flask.
3. 2D drafting of a plan and elevation of piston and cylinder.
4. Sketching the projections of a bicycle in freehand.
5. Sketching the projections of a stapler.
6. Cut and develop the lateral surface of a funnel.
7. Cut one edges vertically and develop the lateral surface of CPU cabin.
8. Cut and develop the lateral surfaces of elbow of a pipe.
9. Draw the isometric view of a simple bread toaster.
10. Draw the isometric view of the computer table.
11. Sketch the assembled view of the screw jack using the orthographic projections of its components.
12. Draft the plan, elevation and section of your home using CAD.
13. Draft the plan, elevation and section of 2 storey office building using CAD.
14. Develop the 3D model of the (a) and (b).

Course Code:	24CS201	Course Title:	PROGRAMMING FOR PROBLEM SOLVING USING C
Credits:	4	L – T – P	2-0-4
Pre-requisite			NIL

Course objectives:

To impart knowledge on the

- To gain knowledge on problem solving techniques
- To learn how to write simple and modular C programs
- To develop C programs using arrays and strings
- To learn the usage of pointers in accessing and manipulating memory
- To develop applications in C using structures & files

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Classroom
8. Flipped Class

UNIT I - BASICS OF C PROGRAMMING	[6 hours]
Problem Solving Techniques: Introduction to Algorithm, Pseudo code, Flow Chart, Structure of ‘C’ program. C Tokens: Keywords, Data Types, Constants, Variables - Declaration - Qualifiers – typedef	

Practical Topics:

1. Steps in Problem Solving Drawing flowchart using yEd tool/Raptor Tool programs using simple statements.

2. Programs to illustrate the use of user-defined data types

UNIT II – BASIC CONSTRUCTS IN C	[6 hours]
Managing simple Input and Output operations - Operators and Expressions - Decision Making: Branching statements, looping statements - Function: Declaration, Definition - Passing arguments by value - Recursion - Storage classes	
Practical Topics: 1. Programs using decision making statements 2. Programs using looping statements 3. Programs using user defined functions and recursive functions	

UNIT III – ARRAYS AND STRINGS IN C	[6 hours]
Arrays: Initialization - One dimensional, Two dimensional, and Multi-dimensional arrays - String: Basics, declaring and initializing strings, string handling functions: standard and user defined functions	
Practical Topics: 1. Build programs using arrays and array-based operations. 2. Programs using one dimensional and two dimensional arrays. 3. Implementations involving array usage for string operations.	

UNIT IV – POINTERS IN C	[6 hours]
Pointers - Passing arguments by address - Dynamic Memory Allocation - Pointer arithmetic - Pointers and one dimensional array - Pointers and Multi-Dimensional Array: Array of Pointers, Pointer to Pointer, Pointer to an array - void Pointer - Pointer to function	
Practical Topics: 1. Implementations involving pointers for dynamic memory allocation 2. Implementations involving pointers for string manipulation.	

UNIT V – STRUCTURES, UNIONS AND FILE HANDLING IN C	[6 hours]
Structure: Declaration, Definition-Array of Structures - Pointer to Structure – Nested Structures- Union: Defining union, Accessing union members. Files: File Management functions, Random access in file- Working with Text Files and Binary Files	
Practical Topics: 1. Programs to implement structures 2. Programs to implement union 3. Programs to implement various file operations.	

Laboratory Component: **[45 hours]**

Any 12 experiments have to be completed from the following list of experiments.

S.No.	Name of the Experiment
1	Steps in Problem Solving Drawing flowchart using yEd tool/Raptor Tool programs using simple statements
2	Programs to illustrate the use of user-defined data types
3	Programs using decision making statements
4	Programs using looping statements
5	Programs using user defined functions and recursive functions
6	Build programs using arrays and array-based operations.
7	Programs using one dimensional and two dimensional arrays.
8	Implementations involving array usage for string operations.
9	Implementations involving pointers for dynamic memory allocation
10	Implementations involving pointers for string manipulation.
11	Programs to implement structures
12	Programs to implement union
13	Programs to implement various file operations

Course outcomes:

On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Make use of problem solving techniques to solve real world problems & outline the structure of C program	K3
CO2	Identify the appropriate looping and control statements in C and develop applications using these statements	K3
CO3	Make use of arrays & strings in development of simple applications	K3
CO4	Apply the concepts of pointers and develop C programs using pointer	K3
CO5	Develop programs for storing, retrieving and processing data using structures and files.	K3

COs and POs Mapping

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	3	2	-	1	-	-	-		-	-	1
CO2	3	3	2	-	1	-	-	-		-	-	1
CO3	3	3	2	1	1	-	-	-		-	-	1
CO4	3	3	2	1	1	-	-	-		-	-	1
CO5	3	3	3	1	1	-	-	-		-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			

Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	15	50	50
	Lab Exam	100	35		
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	20	20	20
Understand	20	20	20
Apply	60	60	60
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2015.
2. Pradip Dey, Manas Ghosh, "Programming in C", AICTE Edition, Oxford University Press, 2018

Reference Books:

1. Yashavant P. Kanetkar, "Let Us C : Authentic guide to C programming language", Eighteenth Edition, BPB Publications, 2021
2. Ashok N Kamthane, Programming in C, Pearson, Third Edition, 2020
3. Reema Thareja, "Programming in C", Oxford University Press, Second Edition, 2016.

4. Paul Deitel and Harvey Deitel, "C How to Program with an Introduction to C++", Eighth edition, Pearson Education, 2018.
5. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", 1st Edition, Pearson Education, 2013.
6. E.Balagurusamy, "Programming in ANSI C", seventh edition, Mc Graw Hill Education,2017

Suggested Skill Activities:

1. Steps in Problem Solving Drawing flowchart using yEd tool/Raptor Tool
2. Write a Program to calculate and display the volume of a CUBE having its height (h=10cm), width (w=12cm) and depth (8cm).
3. Ramya has bought 50 kg of onion for Rs 40 per kg and 60 kg of potato for Rs 20 per kg. Then she sold out all the stock with the selling price of Rs 60 per kg and Rs 30 per kg for onion and potato respectively. Write a C program which computes the profit gained by her.
4. A Food delivery boy needs to walk down every street in his area in order to deliver the food. Assume that the distances between the streets along the roads are given. The food delivery boy starts at the hotel and returns back to the hotel after delivering all the foods. Implement an algorithm to help the food delivery boy to walk minimum distance for the purpose.
5. Write a program to input name, marks of 5 subjects of a student and display the name of the student, the total marks scored, percentage scored and the class of result.
6. A location in a map is represented by a pair of points as x co-ordinate and y co-ordinate. Person X wants to move towards person Y which is residing in the location L1 and L2 respectively. Write C Program to find the distance between these two person .
7. If a four-digit number is input through the keyboard, write a program to obtain the sum of the first and last digit of this number.
8. Write a program to find GCD (greatest common divisor or HCF) and LCM (least common multiple) of two numbers

9. Write a Program to multiply two 3 X 3 Matrices.
10. Write a program to create a structure named company which has name, address, phone and no Of Employee as member variables. Read name of company, its address, phone and no Of Employee. Finally display these members‟ value.
11. Write a program to create array of books. Collect various details of books such as topic, author, department. Collect details for N books and display the details of books based on department name or author
12. A class has strength of N students. The class has two mentors, one person for the odd roll numbers and the other for the rest. Write a C program which reads the roll numbers of all the students and gives two lists of roll numbers corresponding to each advisor
13. Write a C program to maintain the inventory details of items sold in a super market such as item id, name, no of items available, price per item. Perform efficient data storage based on user‟s demand at runtime
14. Write a C program to use binary files for maintaining a telephone directory which includes telephone no, Owner name and address. Here address includes details such as door no, street name, locality, city and pincode. Update the door no of all people belonging to a particular street as follows: Increment the old door no by 10 to get the new door no. (Eg: If the old door no is 13, update it as 23)

பாடநெறி குறியீடு:	24GE201	பாடத்தின் தலைப்பு:	தமிழரும்தொழில்நுட்பமும்
கிரெடிட்	1	L – T – P	1-0-0

பாடத்திட்டநோக்கங்கள்:

1. சங்ககாலத்து நெசவுத்தொழிலை விவரிப்பதற்கும் மட்பாண்டத்தொழில் நுட்பத்தைக் கண்டறிவதற்கும்.
2. சங்ககால கட்டுமானம், மேடை அமைப்பு, சிற்பங்கள், கோவில்கள், அம்மன்கோவில், திருமலைநாயக்கர் மஹால், செட்டிநாட்டு வீடுகள், இந்தோ - சாரோசெனிக் கட்டிடக்கலை ஆகியவற்றைக் கண்டறிந்து மேற்கோள் காட்ட.
3. கப்பல் கட்டுதல் மற்றும் இரும்புத் தொழிலைக் கண்டறிதல், சிலப்பதிகாரத்தில் நாணயங்கள், மணி தயாரிக்கும் தொழிற்சாலைகள், மணிகளின் வகைகள் ஆகியவற்றைப் படிக்க.
4. நீர்நிலைகளின் முக்கியத்துவத்தைகாட்ட, கால்நடை வளர்ப்பு மற்றும் கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகளை கண்காணிக்க, விவசாயம், மீன்பிடி, முத்து மற்றும் முத்துகலாச்சாரம் மற்றும் கடல் பற்றிய பண்டைய அறிவை அங்கீகரிக்க.
5. அறிவியல் தமிழின் வளர்ச்சி மற்றும் தமிழ்க்கணிப்பொறியின் வளர்ச்சியைக் கவனிக்க, இணையத்தில் தமிழ்மென்பொருள் மேம்பாடு, தமிழ் அகராதிகளை மேற்கோள் காட்ட.

அலகு I நெசவு மற்றும் பானைத்தொழில்நுட்பம்:	[3 hours]
சங்ககாலத்தில் நெசவுத்தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்புபாண்டங்கள் - பண்டங்களில் கீறல் குறியீடுகள்.	

அலகு II வடிவமைப்பு மற்றும் கட்டிடத்தொழில்நுட்பம்:	[3 hours]
சங்ககாலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்ககாலத்தில் வீட்டுப்பொருட்களில் வடிவமைப்பு - சங்ககாலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடைஅமைப்பு பற்றியவிவரங்கள் - மாமல்லபுரச்சிற்பங்களும், கோவில்களும் - சோழர்காலத்துப் பெருங்கோவில்கள் மற்றும் வழிபாட்டுத்தலங்கள் - நாயக்கர்காலக்கோயில்கள் மாதிரி கட்டமைப்பு பற்றி அறிதல்,மதுரைமீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலைநாயக்கர்மஹால் - செட்டி நாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ - சாரோசெனிக் கட்டிடக்கலை.	

அலகு III உற்பத்தித் தொழில்நுட்பம்	[3 hours]
கப்பல் கட்டும் கலை - உலோகவியல் - இரும்பு தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு வரலாற்றுச்சான்றுகளாக செம்பு மற்றும் தங்கநாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சங்கு மணிகள் - எலும்புத்துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.	

அலகு IV வேளாண்மை மற்றும் நீர்பாசனத்தொழில்நுட்பம்	[3 hours]
அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக்கு குமுழித்தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மைச்சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன் வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்.	

அலகு V அறிவியல் தமிழ் மற்றும் கணிதத்தமிழ்:	[3 hours]
அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி -தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ்மென்பொருள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.	

பாடநெறி முடிவுகள் (பாமு):

பாடநெறியின் முடிவில், மாணவர் பின்வரும் திறன்களைப் பெறுவார்:

பாமு	பாடநெறி முடிவுகள்	மிக உயர்ந்த அறிவாற்றல் நிலை
அலகு I பாமு:	சங்க கால ஜவுளி தொழில் மற்றும் மட்பாண்ட தொழில்நுட்பம் பற்றி அறிவார்கள்.	கே 1
அலகு II பாமு:	சங்க கால கட்டுமானம், மேடை அமைப்பு, சிற்பங்கள், கோவில்கள், அம்மன் கோவில், திருமலை நாயக்கர் மஹால், செட்டிநாட்டு வீடுகள், இந்தோ-சராசனிக் கட்டிடக்கலை ஆகியவற்றை விவரிக்க இயலும்.	கே 2

அலகு III பாமு:	கப்பல் கட்டுதல், இரும்புத் தொழில், நாணயம் தயாரித்தல் மற்றும் மணி தயாரிக்கும் தொழில்கள் பற்றி அறிந்து கொள்கிறார்கள்.	கே 1
அலகு IV பாமு:	நீர்நிலைகளின் முக்கியத்துவம், கால்நடை வளர்ப்பு, கிணறு, விவசாயம், மீன்பிடி, முத்து மற்றும் முத்து கலாச்சாரம் மற்றும் கடல் பற்றிய போதுமான அறிவை பெற்றுகொள்கிறார்கள் .	கே 1
அலகு V பாமு:	அறிவியல் தமிழின் வளர்ச்சி, தமிழ்க் கணிப்பொறியின் வளர்ச்சி, இணையத்தில் தமிழ் மென்பொருள் மேம்பாடு, தமிழ் அகராதிகளை சந்தேகம் இன்றி முழுமையாக தெரிந்து கொள்கிறார்கள்.	கே 1

பாடநெறி முடிவுகள் *மற்றும் நிரல் முடிவுகள் ஒப்பிடுதல்*

பாமுகள்	மிக உயர்ந்த அறிவாற்றல் நிலை	பாடநெறி முடிவுகள்											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
பாமு **1**	கே 1	**2**	-	-	-	-	-	-	-	-	-	-	-
பாமு **2**	கே 2	**1**	-	-	-	-	-	-	-	-	-	-	-
பாமு **3**	கே 1	**1**	-	-	-	-	-	-	-	-	-	-	-
பாமு **4**	கே 1	**1**	-	-	-	-	-	-	-	-	-	-	-
பாமு **5**	கே 1	**1**	-	-	-	-	-	-	-	-	-	-	-

நிலை 3- *அதிக ஒத்துப்போதல், நிலை* 2- *மிதமாக ஒத்துப்போதல், நிலை* 1- *குறைவாக ஒத்துப்போதல், நிலை* 0- *ஒத்துப்போகவில்லை*

மதிப்பீட்டுத் திட்டம்:

கூறுகள்	மதிப்பீட்டின் வகை	அதிகபட்ச மதிப்பெண்கள்	குறைக்கப்பட்ட மதிப்பெண்கள்	இறுதி மதிப்பெண்கள்
தொடர்ச்சியான உள் தேர்வு	தொடர்ச்சியான உள் தேர்வு - I	100	40	40
	தொடர்ச்சியான உள் தேர்வு - II	100	40	
இறுதி பருவ தேர்வு	எழுத்து தேர்வு	100	60	60
மொத்தம்				100

இறுதி பருவ தேர்வு: (கேள்வி முறை)

- ஒவ்வொரு யூனிட்டும் இரண்டு 2 மதிப்பெண் வினாக்களையும் ஒரு 16 மதிப்பெண் வினாவையும் (இரண்டில் ஒன்று) கொண்டுள்ளது.
- பதினைந்து கேள்விகளுக்கும் பதிலளிக்க வேண்டும்.

மதிப்பீட்டு முறை

ப்ளூமின் வகை	தொடர்ச்சியான மதிப்பீட்டு சோதனைகள்		இறுதி தேர்வு
	1	2	
நினைவில் கொள்ளுதல்	60	50	60
புரிந்து கொள்ளுதல்	40	50	40
விண்ணப்பித்தல்	0	0	0
பகுப்பாய்வுதல்	0	0	0
மதிப்பிடுதல்	0	0	0
உருவாக்குதல்	0	0	0

TEXT BOOKS

1. தமிழகவரலாறு - மக்களும்பண்பாடும் - கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்).

2. கணினித்தமிழ் - முனைவர்இல. சுந்தரம். (விகடன்பிரசுரம்).

3. கீழடி - வைகைநதிக்கரையில்சங்ககாலநகரநாகரிகம் (தொல்லியல்துறைவெளியீடு)

4. பொருநை - ஆற்றங்கரைநாகரிகம். (தொல்லியல்துறைவெளியீடு)

5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)

6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).

REFERENCE BOOKS

1. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
2. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
3. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
4. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
5. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
6. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Course Code:	**24MA201**	**Course Title:**	**Complex Variables and Transforms** (Common to Common to AI&DS, AE, BME, CE, CSE, CSE(AI&ML), EEE, ECE, MECH)
Credits:	**4**	**L – T – P**	**3 – 1 – 0**
Pre-requisite			**24MA101- Matrices and Calculus**

Course objectives:

- To impart analytical ability in solving mathematical problems as applied to the respective branches of Engineering.
- To familiarize the students with complex integration techniques and contour integration techniques which can be used in real integrals.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.

Teaching-Learning Process:

These are sample strategies which teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method does not mean only traditional method, but different type of teaching methods may be adopted to develop the outcomes.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Topics will be introduced in a multiple representation and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT I – Complex Differentiation	**[12 hours]**
Function of a complex variable – Analytic functions – Necessary conditions and sufficient conditions (excluding proof) – Cauchy – Riemann equations –– Properties of analytic function – Harmonic conjugate – Construction of Analytic functions - Conformal mapping: w = z+a, az, 1/z, and bilinear transformation.	
UNIT II – Complex Integration	**[12 hours]**
Statement and application of Cauchy's integral theorem and integral formula – Taylor and Laurent expansions – Isolated singularities – Residues - Cauchy's residue theorem. Applications: Contour integration over unit circle and semicircular contours (excluding poles on axis).	

UNIT III – Laplace Transforms	**[12 hours]**
Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems – Transforms of derivatives and integrals – Initial and Final Value Theorem – Inverse Laplace Transform – Convolution Theorem (Statement only) – Solution of linear second order Ordinary differential equations with constant coefficients using Laplace transforms.	

UNIT IV – Fourier Series and Fourier Transforms	**[12 hours]**
Dirichlet's conditions – General Fourier series – Odd and even functions – Half range series – Harmonic analysis - Statement of Fourier integral theorem – Fourier transform pair – Parseval's identity.	

UNIT V – Partial Differential Equation	[12 hours]
Formation of partial differential equations - Classification of partial differential equations - Solutions of one dimensional wave equation, One dimensional heat equation (excluding insulated ends) – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges).	

Course outcomes:

On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Construct analytic functions and use their conformal mapping property in Engineering problems.	K3
CO2	Solve real and complex integrals using the Cauchy's integral formula and residue theorem.	K3
CO3	Apply Laplace transforms techniques in system modelling, digital signal processing, process control, solving boundary value problems	K3
CO4	Apply Fourier series to solve the steady state two-dimensional heat equation in cartesian coordinates.	K3
CO5	Apply the effective mathematical tools for solutions of partial differential equations that model physical phenomena and engineering problems.	K3

COs and POs Mapping:

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	1
CO5	3	2	1	-	-	-	-	-	-	-	-	-
CO6	3	2	1	-	-	-	-	-	-	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	20	20	20
Understand	20	20	20
Apply	60	60	60
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
3. Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012
4. Kandasamy. P., Thilagavathy. K, and Gunavathy. K, Engineering Mathematics Volume I & II, S. Chand & Co, New Delhi, 2005.Reference Books:

Equivalent NPTEL/SWAYAM Courses

S. No.	Course Title	Course Instructor	Host Institute
1	Partial Differential Equations	Prof. Sivaji Ganesh	IIT Bombay
2	Introduction to Fourier Analysis	Prof. Parasar Mohanty	IIT Kanpur
3	Complex Analysis	Prof. Pranav Haridas	IIT Madras

Web Links and Video Lectures (E-Resources):

1. Analytic Functions, C-R Equations: https://www.nptelvideos.com/lecture.php?id=13416
2. Laplace Transform and its Existence: https://www.nptelvideos.com/lecture.php?id=13433
3. Taylor's, Laurent Series of f(z) and Singularities: https://www.nptelvideos.com/lecture.php?id=13431
4. Applications of Fourier Transform to PDEs: https://www.nptelvideos.com/lecture.php?id=13442

Course Code	**24PH201**	**CourseTitle:**	**PHYSICS FOR ELECTRONICS ENGINEERING(ECE&EEE)**
Credits:	**3**	**L – T – P**	**3-0-0**
Pre-requisite:			**NIL**

Course objectives:

- To study the electrical properties of materials including electron theory of metals.
- To familiarize with the properties of semiconductors, determination of charge carriers and device applications.
- Equipping the students to understand the applications of magnetic materials and dielectric materials.
- To establish a sound, grasp of knowledge on different optical properties of materials, optical displays and applications.
- To inculcate an idea of significance of Nano structures, quantum confinement and the preparation of Nano materials.

Teaching-Learning Process:
Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. Lab experiment videos 3. Blended Mode of Learning 4. Project based Learning 5. Experiential Learning 6. NPTEL and Other Videos 7. Smart Class Room 8. Flipped Class

UNIT I CONDUCTING MATERIALS	**[9 hours]**
Classical free electron theory - Expression for electrical conductivity - Thermal conductivity, Wiede Mann Franz law, Merits & Demerits of classical free Electron Theory - Quantum free electron theory - Electron in a metal – degenerate and non-degenerate states – Fermi- Dirac statistics– Density of energy states – Energy bands in solids – Electron effective mass.	

UNIT II SEMICONDUCTING MATERIALS	**[9 hours]**
Direct and indirect band gap semiconductors – Intrinsic Semiconductors - Carrier concentration in intrinsic semiconductors - Variation of Fermi level with temperature – extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors – Variation of Fermi level with temperature – Hall effect and devices- Ohmic contacts– Schottky diode.	

UNIT III MAGNETIC AND DIELECTRIC MATERIALS	**[9 hours]**
Magnetic materials – Classification (Dia , Para & Ferro) – Hysteresis – Ferrites - BaTiO3 – Application of Nd-FeB magnets. Electric polarization – Different types of polarization – Temperature and frequency dependence –Dielectric loss and dielectric breakdown – dielectric materials applications - capacitors and transformers.	

UNIT IV MATERIALS FOR ELECTRONICS	[9 hours]
Classification of optical materials –Optical process in Semiconductors-Optical absorption and emission-carrier generation and recombination processes - Absorption emission and scattering of light in metals, insulators and semiconductors (concepts only) - LCD-Photo Transistor- photo current in a P-N diode – Laser diodes -solar cell - LED – Organic LED.	

UNIT-V NANO MATERIALS	[9 hours]
Nanomaterials-Quantum Confinement-Quantum Structures-Density of states for quantum well-Wire-Dots-Preparation of Nano Materials- Ball Milling - Pulsed Laser Deposition-Sol -Gel Method-Electro Deposition Method- Plasma arc method.	

Course outcomes: On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Explain the electrical properties of materials.	K2
CO2	Apply semiconducting properties of materials in electronics.	K3
CO3	Infer the properties of magnetic and dielectric materials for relevant electrical and electronics engineering applications	K2
CO4	Apply the optical properties of materials in opto electronic devices.	K3
CO5	Apply the concept of Nano materials for Nano devices.	K3

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	40	40	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

COs and POs Mapping

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	2	1	2	-	-	-	-	-	-	-	-	1
CO2	2	1	2	-	-	-	-	-	-	-	-	1
CO3	2	1	1	-	-	-	-	-	-	-	-	1
CO4	3	1	1	-	-	-	-	-	-	-	-	1
CO5	3	2	1	-	-	-	-	-	-	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- NotMapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

1. Each unit consists of two 2 marks questions and one 16 marks question (either or).
2. All the fifteen questions have to be answered.

TEXT BOOKS:

1.S.O. Kasap. Principles of Electronic Materials and Devices, McGraw Hill Education (Indian Edition), 2020.

2.R.F. Pierret. Semiconductor Device Fundamentals. Pearson (Indian Edition), 2006.

3. G.W. Hanson. Fundamentals of Nano electronics. Pearson Education (Indian Edition), 2009.

REFERENCE BOOKS:

1. Jasprit Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Education (Indian Edition), 2019.

2. Charles Kittel, Introduction to Solid State Physics, Wiley India Edition, 2019.

3. Mark Fox, Optical Properties of Solids, Oxford Univ.Press, 2001.

NPTEL COURSE:

Sl.No	Course Name	Course Instructor	Course Conducting Agency
1	Solid state Physics	Prof. Amal Kumar Das	IIT Kharagpur

WEB LINKS AND VIDEO LECTURES (E-RESOURCES):

1. Electrical Conductivity: https://www.youtube.com/watch?v=QvPSVwzU-8A
2. Band Theory of solids: https://www.youtube.com/watch?v=qcE2Wcpm05k&ab_channel=nptelhrd
3. Intrinsic semiconductor: https://www.youtube.com/watch?v=JZN3DAaeOB8

Suggested Skill Activities:

1.As you look at materials and objects around your house Which do you think are conductors and insulators?

2. Identify the change when you connect a light bulb to battery using conductive materials?

3. What will happen if you connect a light bulb to battery using insulating materials?

4. List the usage of alphanumerical displays in day to life.

5.Compute the size variation and efficiency of the nano materials.

6.Illustrate the role of semiconductors in renewable energy technologies.

7.Explain the reason for using smart materials like SMA in retractable roofs.

8.List out 10 uses of magnetic materials in house.

9.Explain the role of nanomaterials in Electronics

10.Discuss about the role of semiconductor in temperature sensors which is air conditioner.

Course Code:	24CY401	Course Title:	Environmental Science and Engineering
Credits:	**2**	**L – T – P**	**2-0-0**
Pre-requisite:			**NIL**

Course objectives:

To impart knowledge on the

- To gain in-depth knowledge on natural processes and resources that sustain life and govern economy.
- To know the importance of water resources which are important socially, economically viable and environmentally sustainable.
- To impart the Knowledge of pollution and its control methods.
- To mitigate the environmental and health risks associated with indiscriminate waste andfind the suitable methodologies for waste management.
- To balance ecological, economic and social goals, such as reducing carbon emissions, promoting renewable energy and ensuring equitable resource access.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. NPTEL and Other Videos
3. Smart Class Room
4. Field visit
5. Project based learning
6. Industrial Visit

UNIT I - Ecology and Biodiversity	[6 hours]
Definition, scope and importance of environment – need for public awareness – conceptof an ecosystem - Biodiversity and its values- Biodiversity at global, national and local level- India as a mega-diversity nation – hotspots of biodiversity – threats to biodiversity – endangered and endemic speciesof India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.	
UNIT II - Water resources and Environment microbiology	**[6 hours]**
Water resources: Use and over- utilization of surface and groundwater – dams benefits andproblems, conflicts over water –Water availability at global level, surface level, ground level-Sources-Hydro phonics -Classification of microorganism –Role of microorganism in waste water treatment-Bacterial nutrition and growth.	

UNIT III -Air and Noise pollution	[6 hours]
Sources and classification of air pollutants and their effect on human health-Ambient airquality and emission standards-Air pollutants-Particulate matters-Control equipments- Gravity separator-Centrifugal separator-fabric filter-Electrostatic separator, Catalytic convertors– Noise pollution-causes – Consequences-Control measures- modern tools used in pollution mitigation measures-sustainable activity of pollution control- recent case studies - Environmental Protection Act.	

UNIT IV- Solid waste and Hazardous waste management	[6 hours]
Soil contaminants–sources and management methods of -Solid Waste Hazardous waste – Plastic waste- -Biomedical waste- Hazardous waste& E-waste management -Case studies on Occupational Health and Safety Management system (OHASMS).	

UNIT V-Environmental management and Sustainable development	[6 hours]
Renewable and non-renewable energy Sources- Energy Polices- Development, GDP, Sustainability-concept, needs and challenges-economic, social and aspects of sustainability-Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment-Sustainable goals -Sustainable habitat- Green buildings, Green materials, Energy efficiency, Sustainable transports. Carbon emission-Carbon footprint-Carbon Sequestration.	

Course outcomes:

On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Illustrate the important features of environment and its conservation.	K2
CO2	Explain the need of water resources and its application to meet the modern requirements and the necessity of its conservation.	K2
CO3	Identify the causes, effects of environmental pollution and explain the control techniques for particulate, gaseous emissions and contribute to the preventive measures in the society.	K3
CO4	Identify the different management methods of solid and hazardous waste.	K3
CO5	Explain the sustainability practices and identify green materials for sustainable development.	K2

COs and POs Mapping:

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	1	-	-	-	-	1	1	-	-	-	-	-
CO2	2	1	-	-	-	1	1	-	-	-	-	-
CO3	2	-	-	-	-	1	2	1	-	-	-	-
CO4	1	-	-	-	-	2	2	1	-	-	-	-
CO5	1	-	-	-	-	1	2	1	-	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	60	100	40
	CIE – II	100			
	Skill Assessment – I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	20	20	20
Understand	60	40	40
Apply	20	40	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Benny Joseph, Environmental Science and Engineering ‘, Tata McGraw-Hill, NewDelhi, (2014).
2. Miguel Fischer,“Environmental Management: Ecosystems, Competitiveness and Waste Management” Nova Science Publishers, (2021)

Reference Books:

1. Dharmendra S.Sengar, ‘Environmental law ‘, Prentice hall of India Pvt Ltd, NewDelhi, (2007).
2. Erach Bharucha, “Textbook of Environmental Studies”, Universities Press (I) Pvt, Ltd, Hydrabad, (2015).
3. G.Tyler Miller,Scott E.Spoolman,“Environmental Science”,Cengag Learning India Pvt.Ltd,Delhi, (2014).
4. Mahuabasu, Xavier saverimuthu, “Fundamentals of Environmental Studies”,Cambridge university press,(2017)
5. Anubha Kaushik , C.P. Kaushik, “Perspectives in Environmental Studies”, New Age International Pvt. Ltd, New Delhi, (2004). 6. Frank R. Spellman, “Handbook of EnvironmentalEngineering”, CRC Press, (2015).

Web Links and Video Lectures (E-Resources):

1. Ecology andSociety: https://onlinecourses.nptel.ac.in/noc24_hs149/preview
2. SustainablePower GenerationSystems: https://onlinecourses.nptel.ac.in/noc24_ge54/preview
3. Environmentand Development: https://onlinecourses.nptel.ac.in/noc24_hs150/preview

Suggested Skill Activities:

1. Why is it beneficial to follow a student centered and participatory process for environmental education?
2. Identify the endemic species of flora and fauna found nearest to your locality.
3. List the major arguments cited against the construction of dams.
4. Discuss how the symbiotic relationship between algae and bacteria is useful in the treatment of sewage in an oxidation pond.
5. List the various ways in which an individual can contribute towards pollution prevention in the society.
6. Mention any four hazardous wastes originating from households and explain their management strategies.

7. Conduct a survey and find out how chemicals and various material are distributed /cycled in your campus.
8. List the common organic materials that are suitable and unsuitable for composting.
9. List the advantages of recycling of MSW with examples.
10. What are the major obstacles in the implementation of incineration technology in developing countries.

Course Code:	**24EE202**	**Course Title:**	**Fundamentals of Electrical and Electronics Engineering**
Credits:	**4**	**L – T – P**	**3-0-2**
Pre-requisite			**NIL**

Course objectives:

To impart knowledge on the

- Basics of DC electric circuits and its analysis
- Analysis of AC circuits and magnetic circuits
- Working principles and application of DC machines and transformers
- Digital devices and their characteristics
- Functional elements and working of sensors and actuators used for smart systems.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I –DC Circuits	**[9 hours]**
Introduction to DC Circuits – Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws –Nodal Analysis, Mesh analysis with independent sources only – Appliances.	

Practical Topics:

1. Model an electrical circuit and simulate it to verify Ohms Law.
2. Model an electrical circuit and simulate it to verify Kirchhoff's Voltage Law.
3. Model an electrical circuit and simulate it to verify Kirchhoff's Current Law.

UNIT II – AC Circuits and Magnetic Circuits	**[9 hours]**

Introduction to poly-phase circuits - Representation of sinusoidal waveform – peak and rms values, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations – Converters: rectifiers and inverters; Basics of magnetic circuits – Flux – Flux density – Magnetic resonance – Self-inductance – mutual-inductance – Coupling.

Practical Topics:

1. Demonstrate the measurement of power in an RLC circuit using wattmeter method.
2. Interpret the DC output of an RLC circuit using half wave rectifier.
3. Interpret the DC output of an RLC circuit using full wave rectifier.

UNIT III – DC Machines and Transformers	**[9 hours]**

Construction, principle of operation, characteristic and application – DC Motor and DC Generator, Types of DC motors and generators – Application: Electric Vehicle – Structure of electric power system – Introduction to single phase transformers –Construction, principle of operation, characteristics and application.

Practical Topics:

1. Conduct the load test on DC shunt motor to outline its characteristics.
2. Outline the study on the starting methods of DC series motor.
3. Conduct a study on transformer construction for real-time applications.

UNIT IV – Digital Electronics	**[9 hours]**

Introduction to digital systems – Number system – Boolean Algebra – POS and SOP – Logic gates – K-map simplification – Flip Flops – Combinational logic circuits: adders – subtractors.

Practical Topics:

1. Experiment with the logic gates to verify its truth table.
2. Make use of the logic gates to verify the functioning of half and full adders.
3. Make use of the logic gates to verify the functioning of half and full subtractors.

UNIT V – Sensors and its Applications	[9 hours]
Sensors in IoT – Mobile based sensors, Resistance Temperature sensor, Humidity sensor –Medical sensor – Neural sensor – Motion sensor – PIR sensor, Piezoelectric sensor, Air quality sensor – CO_2 Sensor, RFID sensor, Water leakage detection sensor, Light sensors - Introduction to actuators in automation – Applications: smart homes – smart cities – smart parking system.	
Practical Topics: 1. Utilize Arduino and Bluetooth module for automating home appliances. 2. Utilize ESP8266 processor for automating home appliances. 3. Construct an Arduino based solar tracker for solar irradiation measurement.	

Laboratory Component: **[30 hours]**

Any 12experiments have to be completed from the following list of experiments.

S.No	Name of the Experiment
1	Model an electrical circuit and simulate it to verify Ohms Law.
2	Model an electrical circuit and simulate it to verify Kirchhoff's Voltage Law.
3	Model an electrical circuit and simulate it to verify Kirchhoff's Current Law.
4	Demonstrate the measurement of power in an RLC circuit using wattmeter method.
5	Interpret the DC output of an RLC circuit using half wave rectifier.
6	Interpret the DC output of an RLC circuit using full wave rectifier.
7	Conduct the load test on DC shunt motor to outline its characteristics.
8	Outline the study on the starting methods of DC series motor.
9	Conduct a study on transformer construction for real-time applications.
10	Experiment with the logic gates to verify its truth table.
11	Make use of the logic gates to verify the functioning of half and full adders.
12	Make use of the logic gates to verify the functioning of half and full subtractors.
13	Utilize Arduino and Bluetooth module for automating home appliances.
14	UtilizeESP8266 processor for automating home appliances.
15	Construct an Arduino based solar tracker for solar irradiation measurement.

Course outcomes:

On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Apply the circuit laws and theorems to compute the electrical parameters of domestic and industrial appliances.	**K3**
CO2	Compare the behavior of AC circuits & magnetic circuits for a given input.	**K2**
CO3	Explain the construction, working, and application of electrical machine and transformer to infer its characteristics.	**K2**
CO4	Apply the semiconductor principles using diodes, transistors, thyristors and displays for developing electronic switches and displays.	**K3**
CO5	Identify the sensors for applications in Engineering.	**K3**

COs and POs Mapping:

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	2	1	1	2	-	-	-	2	-	-	1
CO2	2	1	1	-	2	-	-	-	2	-	-	1
CO3	2	1	1	-	2	-	-	-	2	-	-	1
CO4	3	2	1	1	2	-	-	-	2	-	-	1
CO5	3	2	1	1	2	-	-	-	2	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max Marks</th><th>Reduce d Marks</th><th>Tota l</th><th>Final mark s</th></tr>
<tr><td rowspan="5">Continuous Internal Examination (CIE) - Theory</td><td>CIE – I</td><td>100</td><td rowspan="2">50</td><td rowspan="5">10 0</td><td rowspan="5">25</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>MCQ</td><td>20</td><td>10</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
</table>

Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

Assessment Pattern

Bloom's Category	Internal Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	60	40	40
Apply	20	40	40
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. D P Kothari and I.J Nagarath, "Basic Electrical and Electronics Engineering," McGraw Hill Education (India)Private Limited, Second Edition, 2020
2. A.K.Sawhney and PuneetSawhney,"A Course in Electrical & Electronic Measurements & Instrumentation,"DhanpatRai and Co, 2015.

Reference Books:

1. John Bird, "Electrical Circuit theory and technology", Routledge; 2017.
2. Muthusubramanian R and Salivahanan S, "Basic Electrical and Electronics Engineering,"McGraw Hill, NewDelhi,2009.
3. Nagsarkar T K and Sukhija M S, "Basics of Electrical Engineering," Oxford University press, 2012.
4. V K Mehta, Rohitmehta "Principles of Electronics," S.Chand& Company Ltd, 2015.
5. Mahmood Nahvi and Joseph A.Edminister, "Electric Circuits," Schaum' Outline Series, McGraw Hill, 2009.
6. H.S. Kalsi, "Electronic Instrumentation," Tata McGraw-Hill, New Delhi, 2010.

7. Ian Sinclair, “Sensors and Transducers,” Elsevier Science, 3rd Edition, 2000.
8. Perry Lea, “Internet of things for architects,” Packt, 2018.
9. V N Mittle and Arvind Mittle “Basic Electrical Engineering,” McGraw Hill, New Delhi, 2005.
10. R.S. Sedha, “A Textbook of Applied Electronics,” S. Chand & Co., 2008.
11. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry and Gonzalo Salgueiro, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, CISCO Press, 2017.

Web Links and Video Lectures (E-Resources):

1. A Basic Course on Electric and Magnetic Circuits : https://onlinecourses.nptel.ac.in/noc24_ee125/preview
2. Basic Electrical Circuits: https://onlinecourses.nptel.ac.in/noc24_ee112/preview
3. Digital Circuits: https://onlinecourses.nptel.ac.in/noc24_ee147/preview
4. Electrical Machines – I: https://onlinecourses.nptel.ac.in/noc24_ee103/preview
5. Sensor Technologies: Physics, Fabrication and Circuits: https://onlinecourses.nptel.ac.in/noc24_ee83/preview
6. Semiconductor Devices and Circuits: https://onlinecourses.nptel.ac.in/noc24_ee143/preview

Suggested Skill Activities:

1. List the different electrical loads available in home, college and prepare their rating chart.
2. Design the residential house wiring using fuse, switch, indicator, lamp, circuit breaker, energy meter and apply Thevenin’s theorem to find the current in particular branch.
3. Take a room in your home and replace the fluorescent lamp to LED lamp to calculate the monthly electrical charge and compare with the previous month.
4. Write the parts of the fan and electric mixer in home and draw the wiring diagram for fan and electric mixer.
5. Visit the nearby substation and list out the details of safety measures followed by electrical engineers.
6. List out the rating of electrical machines used in home appliances.
7. Identify the semiconductor devices in electronic appliances.
8. Develop IOT based solutions for engineering applications.
9. Draw the wiring diagram of EV and mentions its parts.
10. Visit nearby power plant and demonstrate the various components, working, power generation and distribution in power plant as a report.

Course Code:	24EE203	Course Title:	**Electric Circuit Analysis** (Common to ECE and Bio)
Credits:	**4**	**L – T – P**	**3-0-2**
Pre-requisite			**NIL**

Course objectives:

To impart knowledge on the

- To apply the basic concepts and behavior of DC and AC circuits.
- To identify the knowledge on solving circuit equations using network theorems
- To interpret the transient and steady state response of the circuits subjected to DC excitations and AC with sinusoidal excitations.
- To learn the concept of coupling in circuits and topologies

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Blended Mode of Learning
3. Experiential Learning
4. NPTEL and Other Videos for theory topics
5. Flipped Class
6. Lab Experiment Videos

UNIT I Basic Circuits Analysis	**[9 hours]**

Fundamentals concepts of R, L and C elements - Energy Sources - Ohm's Law -Kirchhoff 's Laws - DC Circuits - Resistors in series and parallel circuits - Mesh current and node voltage methods of analysis D.C and A.C Circuits.

Practical Topics:

1. Simulation and experimental verification of KCL in series and parallel electrical circuit using fundamental laws.
2. Simulation and experimental verification of KVL in series and parallel electrical circuit using fundamental laws.

UNIT II – Network Theorems	**[9 hours]**

Network reduction: voltage and current division, source transformation - star delta conversion. Theorems - Superposition, Thevenin's and Norton's Theorem - Maximum power transfer theorem - Reciprocity Theorem - Statement, application to DC and AC Circuits.

Practical Topics:

1. Simulation and experimental verification of electrical circuit problems using Thevenin's, theorem.
2. Simulation and experimental verification of electrical circuit problems using Norton's theorem.
3. Simulation and experimental verification of electrical circuit problems using Superposition theorem.

UNIT III – Sinusoidal Steady State Analysis	[9 hours]
Sinusoidal Steady - State analysis, The Complex Forcing Function, The Phasor, Phasor relationship for R, L, and C, impedance and Admittance - Nodal and Mesh Analysis, Phasor Diagrams, AC Circuit Power Analysis, Instantaneous Power, Average Power, apparent Power and Power Factor, Complex Power.	

Practical Topics:

1. Simulation of three phase balanced star,delta networks circuit (Power and Power factor calculations).
2. Simulation of three phase unbalanced star,delta networks circuit (Power and Power factor calculations).

UNIT IV – Transient and Resonance In RLC Circuits	[9 hours]
Basic RL and RC Circuits, The Source - Free RL Circuit, The Source - Free RC Circuit, The Unit Step Function, Driven RL Circuits, Driven RC Circuits, RLC Circuits, Frequency Response, Parallel Resonance, Series Resonance, Quality Factor.	

Practical Topics:

1. Simulation and Experimental validation of R-L electric circuit transients
2. Simulation and Experimental validation of R-C electric circuit transients

UNIT V – Coupled Circuits and Topology	[9 hours]
Magnetically Coupled Circuits, mutual Inductance - the Ideal Transformer - An introduction to Network Topology, Trees and General Nodal analysis, Links and Loop analysis.	

Practical Topics:

1. Design and implementation of series resonance circuit.
2. Design and implementation parallel resonance circuit.

Laboratory Component: **[30 hours]**

Any ten experiments have to be completed from the following list of experiments.

S.No.	Name of the Experiment
1	Simulation and experimental verification of KCL in series and parallel electrical circuit using fundamental laws.
2	Simulation and experimental verification of KVL in series and parallel electrical circuit using fundamental laws.
3	Simulation and experimental verification of electrical circuit problems using Thevenin's, theorem.
4	Simulation and experimental verification of electrical circuit problems using Norton's theorem.
5	Simulation and experimental verification of electrical circuit problems using Superposition theorem.
6	Simulation and Experimental validation of R-L electric circuit transients
7	Simulation and Experimental validation of R-C electric circuit transients
8	Design and implementation of series resonance circuit.
9	Design and implementation parallel resonance circuit.
10	Simulation of three phase balanced star,delta networks circuit (Power and Power factor calculations).
11	Simulation of three phase unbalanced star,delta networks circuit (Power and Power factor calculations).

Course outcomes:

On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Apply the concept of Kirchhoff's laws for measuring current and voltage in electrical circuits.	K3
CO2	Identify the different types of network theorems for solving AC and DC circuits	K2
CO3	Interpret the steady state response of R, L and C circuits .	K2
CO4	Identify the transient response for RC, RL and RLC circuits and frequency response of parallel and series resonance circuits.	K2
CO5	Illustrate the coupled circuits for inferring the functioning of transformers.	K3

COs and POs Mapping:

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	2	1	-	2	-	-	-	-	-	-	-
CO2	3	2	1	-	2	-	-	-	-	-	-	-
CO3	2	1	-	-	2	-	-	-	-	-	-	-
CO4	3	2	-	-	2	-	-	-	-	-	-	-
CO5	2	1	-	-	2	-	-	-	-	-	-	-

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	10	10	10
Understand	50	50	50
Apply	40	40	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. William H. HaytJr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis",McGraw Hill publishers, 9thedition, New Delhi, 2020.
2. Chakrabarti A, "Circuits Theory (Analysis and synthesis), DhanpatRai& Sons, New Delhi, 2020.
3. Allan H. Robbins, Wilhelm C. Miller, "Circuit Analysis Theory and Practice", Cengage Learning India, 2013.

Reference Books:

1. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, 2019.
2. Sudhakar A and Shyam Mohan SP, "Circuits and Networks Analysis and Synthesis",McGraHill, 2015.
3. Joseph A. Edminister, MahmoodNahvi, "Electric circuits", Schaum's series, McGraw-Hill, First Edition, 2019.
4. Richard C. Dorf and James A. Svoboda, "Introduction to Electric Circuits", 7th Edition, John Wiley Sons, Inc. 2018.

Web Links and Video Lectures (E-Resources):

5. Basic Electrical Circuits : https://onlinecourses.nptel.ac.in/noc24_ee112/preview
6. Semiconductor Devices and Circuits: https://onlinecourses.nptel.ac.in/noc24_ee143/preview
7. Basic Course on Electric and Magnetic circuits : https://onlinecourses.nptel.ac.in/noc24_ee125/preview
8. Electrical Equipment and Machines : https://onlinecourses.nptel.ac.in/noc24_ee91/preview

Suggested Skill Activities:

1. List of different loads available in home & college and prepare the power rating chart.
2. Measurement of Energy consumption in home.
3. Find the current through particular element using Thevenin's theorem in a practical circuit.
4. Find the voltage across particular element using Norton's theorem in a practical circuit.
5. Analyze the transient response of R & RL load in a practical circuit.
6. Analyze the transient response of RLC circuit using PSPICE.
7. Experiment verification of series RLC circuit in Induction Heating.
8. Experiment verification of parallel RLC circuit.
9. Experimental verification of balanced three phase circuit.
10. Experimental verification of unbalanced three phase circuits.

Course Code:	24GE231	Course Title:	WORKSHOP PRACTICE
Credits:	**1.5**	**L – T – P**	**0-0-3**
Pre-requisite			**NIL**

Course objectives:

To provide hands on training to the students in:

- Applying basic techniques to measure a field, infer masonry work and install plumbing design.
- Fabricating carpentry, foundry, sheet metal and welding works to practice on workshop trades and making end products.
- Utilizing machining processes like turning, drilling, tapping in parts and 3D printing for performing the jobs.
- Designing electrical wiring layout with MCBs and RCCBs, developing staircase wiring and illumination design circuits for buildings.
- Assembling simple electronic components on PCB by soldering and desoldering and testing with IoT based interfaces.
- Developing blogs and website design for the complete access over the network.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Project based learning
2. Industrial Visit

GROUP – A (Civil and Mechanical)

PART I - CIVIL ENGINEERING PRACTICES	[5 hours]

1. FIELD MEASUREMENT, MASONRY WORK AND PLUMBING

a. Calculate the area of a built-up space and a small parcel of land-use standard measuring tape and digital distance measuring devices.

b. Visit a nearby site where construction is at initial stage and observe for following (if necessary, visit two/three times with a gap of a week). If drawings are available relate/match activities with the drawings.

i. Digging and filling.

ii. Foundation preparations.

iii.	Brick/stone masonry.
iv.	Concrete laying and curing.
v.	Laying of sewerage/sanitary lines.
vi.	Bar bending and bar laying for columns, beams and ceiling.
vii.	Onsite testing for quality.
viii.	Onsite preparation for construction work.
ix.	Erection and removal of form work, scaffolding, centering/shuttering.
	Prepare a brief report on the construction activities, methods, tools, equipments and materials being used.
c.	Installation of water lines for wash basin and showers faucet.

PART II MECHANICAL ENGINEERING PRACTICES	**[5 hours]**
2. CARPENTRY, FOUNDRY, WELDING AND SHEET METAL a. Carpentry: Prepare T/L/Lap Joint from given wooden work piece and make a Box/Tray out of plywood using modern power tools. b. Welding: Make a Butt/Lap of MS plate using Arc welding process. c. Casting: Demonstration of Pattern making by sand moulding. d. Sheet Metal: Fabrication of Sheet Metal Tray and Funnels. 3. LATHE, DRILLING MACHINE AND 3D PRINTER a. Designing a driller component using radial machine. b. Perform a job using facing and turning in lathe. c. Printing simple 3D geometric shapes using SLA printer.	

GROUP – B (Electrical, Electronics and IT)

PART III ELECTRICAL ENGINEERING PRACTICES	**[3 hours]**
4. ELECTRICAL WIRING a. Design a wiring circuit integrating energy meter, MCBs and RCCBs. b. Develop fluorescent lamp wiring, staircase wiring and electric fan wiring circuits.	

PART IV ELECTRONICS ENGINEERING PRACTICES	**[4 hours]**
5. IOT BASED SOLUTIONS AND PCB a. Design a single layer PCB layout structure. b. Fabricate single layer PCB printing. c. Assembling, soldering and desoldering practice on single layer PCB. d. GPIO programming in ESP8266, sensor and actuator interfacing with internet enabled microcontroller device. e. Integration of microcontroller-based system with Cloud platform.	

PART V COMPUTER SCIENCE AND ENGINEERING PRACTICES	[3 hours]
6. INTERACTIVE DYNAMIC WEBSITE a. Design a website for an application using HTML and CSS. b. Convert the designed website into responsive website using Bootstrap. c. Add dynamism to the website by using JavaScript and embed the social media components to the website. d. Incorporate the database interaction with the website. e. Deploy the developed website in the server.	

Course outcomes:

On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Apply basic techniques for field measurements, masonry work and plumbing.	K3
CO2	Make use of workshop trades like carpentry, foundry, sheet metal and welding for practicing on manufacturing of components.	K3
CO3	Develop simple components using Lathe, Drilling Machine and 3D Printer.	K3
CO4	Construct the electrical wiring circuits for buildings based on their requirement.	K3
CO5	Develop IoT based solutions and PCB for real world use cases.	K3
CO6	Build and host an interactive dynamic website.	K3

COs and POs Mapping:

COs	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	1	2	-	-	-	1	1	-	1	3	2	1
CO2	3	2	1	1	2	-	-	-	1	1	-	1	-	-	-
CO3	3	2	1	1	2	-	-	-	1	1	-	1	-	-	-
CO4	3	2	1	1	2	-	-	-	1	1	-	1	1	-	-
CO5	3	2	1	1	2	-	-	-	1	1	-	1	-	-	-
CO6	3	2	1	1	2	-	-	-	1	1	-	1	-	1	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

The weightage of Continuous Internal Evaluation (CIE) is 60% and for End Semester Examination (ESE) is 40%.

<table>
<tr><th>S.No</th><th>Component</th><th>Type of Assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final Marks</th></tr>
<tr><td>1.</td><td rowspan="2">Continuous Internal Examination(CIE)-Laboratory</td><td>Continuous Assessment</td><td>75</td><td>75</td><td rowspan="2">100</td><td rowspan="2">60</td></tr>
<tr><td>2.</td><td>Model Lab Exam</td><td>25</td><td>25</td></tr>
<tr><td>3.</td><td>End Semester Examination (ESE)</td><td>Lab Exam</td><td>100</td><td>40</td><td>40</td><td>40</td></tr>
<tr><td colspan="6" align="right">Total</td><td>100</td></tr>
</table>

Text Books:

1. AICTE's Prescribed Textbook: Workshop / Manufacturing Practices (with Lab Manual) ISBN: 978-93-91505-332
2. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.

Reference Books:

1. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
2. Gowri P. Hariharan and A. Suresh Babu," Manufacturing Technology – I" Pearson Education, 2008.
3. Roy A. Lindberg, "Processes and Materials of Manufacture", 4 th edition, Prentice Hall India, 1998.
4. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House, 2017.

Course Code:	**24EN201**	**Course Title:**	**Presentation and Language Skills Laboratory** (Common to AI&DS, AE, BME, CE, CSE, CSE(AI&ML),EEE, ECE,MECH)
Credits:	**1.5**	**L – T – P**	**0-0-3**
Pre-requisite			**24EN101 English for Engineers**

Course Objectives:

- To apply critical listening skills.
- To make use of critical thinking skills.
- To apply stress as well as tonal variation.
- Make use of language skills to produce error free sentences
- To experiment with presentation skills.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Lab experiment videos
2. Blended Mode of Learning
3. Project based Learning
4. Smart Classroom
5. Flipped Class

	UNIT I	**[12 hours]**
	LIST OF EXERCISES	
	LAB ACTIVITIES	
Sl. No.	**Topics**	**Hours**
1.	Listening to audios (online platforms) and making a critical appreciation of audio content	3
2.	Listening to breaking news	2
3.	Listening to British council / Cambridge English (Selected topics)	2
	CLASSROOM ACTIVITIES	
1	Speaking current issues (selected topics)	2
2	Making conversations at work place, Public Speaking (based on festivals and celebrations)	3

	UNIT II	**[12 hours]**
	LIST OF EXERCISES	
	LAB ACTIVITIES	
Sl. No.	**Topic**	**Hours**
1	English Movie clips and software in the Lab C (Globarena)	3

2	Vocabulary Development through movies/ short films/ Documentaries	3
CLASSROOM ACTIVITIES		
1	Speaking - Just a minute talk and expressions for plans and decisions	3
2	Describing a product	3

UNIT III		**[12 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	**Topic**	**Hours**
1.	Listening to TED talks, scientific lectures.	3
2.	Reading Comprehension strategies	2
3.	Reading- Editorials	2
CLASSROOM ACTIVITIES		
1.	Speaking- Introduction to Phonetics- Speech sounds- Vowels and Consonants- Stress- Rising/ Falling Tone	2
2.	Writing- A day in my life	2
3.	Writing- Situational Dialogues	1

UNIT IV		**[12 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl.No.	**Topic**	**Hours**
1.	Reading Popular Blogs Listening Editorials	3
2.	Creating a Blog	2
CLASSROOM ACTIVITIES		
1.	Errors in Pronunciation. Error detection	3
2.	Writing - Terminology for Engineers. Writing Articles and preparing day to day scripts.	2 2

UNIT V		**[12 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	**Topic**	**Hours**
1.	Prepare PowerPoint presentation (topics selected by students)	3
2.	Reading newspaper articles	2

CLASSROOM ACTIVITIES		
1.	Present the selected topic.	3
2.	Making a short speech / Extempore	2
3.	Writing - Expanding a Proverb Writing Instructions	2

Course Outcomes:

S.No.	Name of the Experiments
1	Making conversation at workplace
2	Writing articles
3	Making expressions for plans and decisions
4	Describing a product
5	Day in my life
6	Writing Terminology for engineers
7	Spotting errors
8	Expansion of proverbs
9	Instructions
10	Reading comprehension

On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Build communicative competence through critical listening skills.	K3
CO2	Make use of critical thinking skills to express plans and opinions.	K3
CO3	Apply stress as well as tonal variations for effective communication.	K3
CO4	Make use of language skills to produce error free sentences.	K3
CO5	Experiment with presentation skills to address confidently.	K3

COs and POs Mapping:

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	-	-	-	-	-	-	-	-	-	3	-	3
CO2	-	-	-	-	-	-	-	-	-	3	-	3
CO3	-	-	-	-	-	-	-	-	-	3	-	3
CO4	-	-	-	-	-	-	-	-	-	-	-	3
CO5	-	-	-	-	-	-	-	-	-	3	-	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Assessment Pattern:

Name of the Test	Marks	Total	Reduced to
Continuous Assessment (Experiments 1-10)	50	100	50
Model Examination	50		
End Semester Lab Exam	100	100	50
		TOTAL	**100 MARKS**

Textbooks:

1. Raman, Meenakshi and Sangeetha Sharma. Professional Communication. Oxford University Press, Oxford, 2014.
2. Dr. Chellammal. V. Learning to Communicate. Allied Publishers, New Delhi, 2003.
3. Mohan, Krishna. And Meera Bannerjee. Developing Communication Skills. Macmillan India Ltd. 1990.

Reference Books:

Murphy – Raymond. English Grammar in Use BOOK with Answers: A Self-Study. Reference and Practice Book for Intermediate Learners of English. Fourth edition: Cambridge University Press – 2012.

MANUALS/ SOFTWARE: Open Sources / Websites

Course Code:	24CS301	Course Title:	PROGRAMMING FOR PROBLEM SOLVING USING PYTHON
Credits:	**1.5**	**L – T – P**	**0-0-3**
Pre-requisite			**24CS201 PROGRAMMING FOR PROBLEM SOLVING USING C**

Course objectives:

To impart knowledge on the

- To explain basic concepts in Python
- To implement programs using functions, loops, and conditional statements.
- To demonstrate the concepts of data structures
- To make use of strings and exception handling in Python
- To demonstrate file handling and python modules

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Lab experiment videos
2. Project based Learning

Laboratory Component: **[20 hours]**

SI.No	Name of the Experiment
1	Develop simple python programs using basic data types
2	Develop simple python programs using operators and expressions
3	Develop Python programs using conditional statements
4	Develop Python programs using various Loops
5	Develop python programs using Functions.
6	Develop programs to demonstrate the use of List, and Tuples
7	Develop programs to demonstrate the use of Dictionaries
8	Demonstrate the various string manipulation functions
9	Develop programs to show Exception Handling in tasks
10	Execute programs using Numpy in Jupiter notebook
11	Python program using File I/O, random access file handling methods and Zipping and Unzipping of files
12	Develop Python programs using packages

Course outcomes:

On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Develop basic programs using fundamental data types	K3
CO2	Solve the given problem statement using programming concepts such as operators, conditional and looping statements and functions.	K3
CO3	Make use of data structures such as lists, tuples, and dictionaries to manage and manipulate data in development of simple applications	K3
CO4	Create programs using string handling functions and apply exception handling, and make use of NumPy to solve problems	K3
CO5	Make use of file operations and packages in development of simple applications	K3

COs and POs Mapping

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	3	3	-	1	-	-	-		-	-	1
CO2	3	3	3	-	1	-	-	-		-	-	1
CO3	3	2	2	1	1	-	-	-		-	-	1
CO4	3	2	2	1	1	-	-	-		-	-	1
CO5	3	3	3	1	1	-	-	-		-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

The weightage of Continuous Internal Evaluation (CIE) is 60% and for End Semester Examination (ESE) is 40%.

<table>
<tr><th>S.No</th><th>Component</th><th>Type of Assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final Marks</th></tr>
<tr><td>1.</td><td rowspan="2">Continuous Internal Examination (CIE)- Laboratory</td><td>Continuous Assessment</td><td>75</td><td>75</td><td rowspan="2">100</td><td rowspan="2">60</td></tr>
<tr><td>2.</td><td>Model Lab Exam</td><td>25</td><td>25</td></tr>
<tr><td>3.</td><td>End Semester Examination (ESE)</td><td>Lab Exam</td><td>100</td><td>40</td><td>40</td><td>40</td></tr>
<tr><td colspan="6" align="right">Total</td><td>100</td></tr>
</table>

ROHINI COLLEGE OF ENGINEERING AND TECHNOLOGY

(AUTONOMOUS)

(Anjugramam-Kanyakumari Main Road, Palkulam,Variyoor P.O.-629 401, K.K.Dist.)

Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai

Accredited with A+ Grade by NAAC

B.E. Electrical and Electronics Engineering

(B.E. EEE)

Curriculum & Syllabus

(*2024-2025 Admitted Students Onwards*)

Vision Statement of RCET

To be an academic institute of continuous excellence towards education and research in rural regime and provide service to nation in terms of nurturing potentially higher social, ethical and engineering companion graduands.

Mission Statement of RCET

- To foster and promote technically competent graduands by imparting the state of art Engineering education in rural regime.
- To enunciate research assisted scientific learning by dissemination of knowledge towards science, agriculture, industry and national security.

Vision of the Department

To create technically competent technocrats to meet the demand of Electrical and Electronics industry and societal need for the wellbeing of human kinds.

Mission of the Department

- To provide knowledge and skills necessary for professional development in Electrical and Electronics Engineering.
- To promote research and creativity in the area of Electrical and Electronics Engineering.
- To promote team work and professional conduct in societal activities.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1 Graduates of the programme will possess career in electrical and allied fields

PEO2 Graduates will have the ability to adapt to the growing technological requirement of the society through lifelong learning and team work

PEO3 Graduates of the programme will possess knowledge to pursue higher studies

PROGRAM OUTCOMES (POs)

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6 Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life- long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSO)

PSO1 Ability to design and analyze various issues in power system, control and Instrumentation systems and power electronic and drive system.

PSO2 Ability to design and simulate real time problems in electrical system using modern software tools.

PSO3 Ability to apply the knowledge for the development of renewable energy to meet the demand of society.

CREDIT INFO		
Sl.No	Category	Credits
1	Humanities and Social Science (HSS)	13
2	Basic Science Courses (BSC)	25
3	Engineering Science Courses (ESC)	25
4	Professional Core Course(PCC)	59
5	Professional Electives Courses (PEC)	18
6	Open Electives Courses (OEC)	12
7	Employability Enhancement Courses (EEC)	17
8	Mandatory Courses (MNC)	-
Total Credits		169

Humanities and Social Science (HSS)							
Sl.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24GE101	Heritage of Tamils	HSS	1	0	0	1
2	24EN101	English for Engineers	HSS	2	0	1	2.5
3	24GE201	Tamil and Technology	HSS	1	0	0	1
4	24EN231	Presentation and Language Skills Laboratory	HSS	0	0	3	1.5
5	24MG701	Economics for Engineers	HSS	3	0	0	3
6	24MG601	Product Innovation & Entrepreneurship	HSS	2	0	0	2
7	24GE701	Professional Ethics and Human Values	HSS	2	0	0	2
Basic Science Courses (BSC)							
Sl.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24MA101	Matrix and Calculus	BSC	3	1	0	4
2	24PH101	Engineering Physics	BSC	3	0	2	4
3	24CY101	Engineering Chemistry	BSC	3	0	2	4
4	24MA201	Complex Variables and Transforms	BSC	4	0	0	4
5	24PH201	Physics for Electronics Engineering	BSC	3	0	0	3
6	24CY201	Environmental Science and Engineering	BSC	2	0	0	2
7	24MA302	Probability, Statistics and Numerical Methods	BSC	3	1	0	4

Engineering Science Courses (ESC)							
Sl.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24ME201	Engineering Graphics	ESC	1	0	4	3
2	24CS201	Programming for Problem Solving in C	ESC	2	0	4	4
3	24GE202	Basics of Civil and Mechanical Engineering	ESC	4	0	0	4
4	24EE201	Electric Circuits	ESC	3	0	0	3
5	24EE231	Electric Circuits Laboratory	ESC	0	0	2	1
6	24GE231	Workshop Practices	ESC	0	0	3	1.5
7	24EE301	Electromagnetic Theory	ESC	3	0	0	3
8	24EE404	IoT-Sensors and Devices	ESC	3	0	2	4
9	24CS331	Programming for Problem Solving in Python	ESC	0	0	3	1.5
Professional Core Courses (PCC)							
Sl.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24EC301	Electron Devices and Circuits	PCC	3	0	2	4
2	24EE302	Power System Generation, Transmission and Distribution	PCC	3	0	0	3
3	24EC302	Digital Logic Circuits and Design	PCC	3	0	2	4
4	24EE303	Electrical Machines - I	PCC	3	0	2	4
5	24EE401	Electrical Machines II	PCC	3	0	0	3
6	24EE402	Control Systems	PCC	3	0	0	3
7	24CS402	Data Structures using C++	PCC	2	0	2	3
8	24EC403	Digital Signal Processing	PCC	3	0	2	4
9	24EC503	Linear Integrated Circuits	PCC	3	0	2	4
10	24EE431	Electrical Machines II	PCC	0	0	3	1.5
11	24EE432	Control System Lab	PCC	0	0	3	1.5
12	24EE501	Power System Protection and Switchgear	PCC	3	0	0	3
13	24EC501	Microprocessors, Microcontrollers and Interfacing Techniques	PCC	3	0	2	4
14	24EE502	Power Electronics and Applications	PCC	3	0	2	4
15	24EE503	Measurements and Instrumentation	PCC	2	0	2	3
16	24EE601	High Voltage Engineering	PCC	3	0	0	3
17	24EC603	Embedded Systems	PCC	3	0	0	3
18	24EE701	Power System Analysis	PCC	3	0	2	4

Sl.No	Course Code	Course Title	Course Type	L	T	P	Credit
Professional Electives Courses I (PEC)							
POWER SYSTEM STREAM							
1	24EE571	Power Quality	PEC	3	0	0	3
2	24EE572	Power System Operation and Control	PEC	3	0	0	3
3	24EE573	High Voltage DC Transmission	PEC	3	0	0	3
4	24EE574	Smart Grid Technologies	PEC	3	0	0	3
5	24EE575	Utilization and Conservation of Electrical Energy	PEC	3	0	0	3
6	24EE576	Demand Side Management	PEC	3	0	0	3
Professional Electives Courses II (PEC)							
ELECTRIC VEHICLE TECHNOLOGY STREAM							
1	24EE581	Electric Vehicle Architecture	PEC	3	0	0	3
2	24EE582	Design of Motor and Power Converters for Electric Vehicles	PEC	3	0	0	3
3	24EE583	Electric Vehicle Design, Mechanics and Control	PEC	3	0	0	3
4	24EE584	Design of Electric Vehicle charging system	PEC	3	0	0	3
5	24EE585	Grid Integration of Electric Vehicles	PEC	3	0	0	3
6	24EE586	Intelligent Control of Electric Vehicles	PEC	3	0	0	3
Professional Electives Courses III (PEC)							
GREEN ENERGY TECHNOLOGY STREAM							
1	24EE671	Solar Energy Conversion Systems	PEC	2	0	2	3
2	24EE672	Wind Power Technology	PEC	2	0	2	3
3	24EE673	Fuel Cell Systems	PEC	2	0	2	3
4	24EE674	Renewable Energy Systems	PEC	2	0	2	3
5	24EE675	Energy Storage Systems	PEC	2	0	2	3
6	24EE676	Grid Integration of Renewable Energy Sources	PEC	2	0	2	3
Professional Electives Courses IV (PEC)							
ELECTRICAL TECHNOLOGY STREAM							
1	24EE681	Electric Drives and Control	PEC	2	0	2	3
2	24EE682	Special Machines and Controllers	PEC	2	0	2	3
3	24EE683	Electrical Machine Design	PEC	2	0	2	3
4	24EE684	Industrial Automation	PEC	2	0	2	3
5	24EE685	Energy Auditing	PEC	2	0	2	3
6	24EE686	Big Data Analytics for Smart Grid	PEC	2	0	2	3

Professional Electives Courses V (PEC)							
ELECTRONICS STREAM							
1	24EC771	Analog VLSI Circuits	PEC	3	0	0	3
2	24EE772	Communication Systems	PEC	3	0	0	3
3	24EC773	Nano Electronics	PEC	3	0	0	3
4	24EE774	Virtual Instrumentation	PEC	3	0	0	3
5	24EE775	Automotive Electrical and Electronics Systems	PEC	3	0	0	3
6	24EE776	Power Electronic Interfaces for Renewable Energy Sources	PEC	3	0	0	3
Professional Electives Courses VI (PEC)							
COMPUTER STREAM							
1	24CS781	Computer Networks	PEC	3	0	0	3
2	24CS782	Software Project Management and Quality Assurance	PEC	3	0	0	3
3	24CS783	Internetworking and Applications	PEC	3	0	0	3
4	24CS784	Database Management Systems	PEC	3	0	0	3
5	24CS785	Object Oriented Analysis and Design	PEC	3	0	0	3
6	24CS786	Cyber Security	PEC	3	0	0	3
Open Electives Courses I (OEC)							
Artificial Intelligence and Computer science and Engineering							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24AI601	Artificial Intelligence and Machine Learning Fundamentals	OEC	3	0	0	3
2	24AI602	Business Intelligence and Its Applications	OEC	3	0	0	3
3	24AI603	Data Science Fundamentals	OEC	3	0	0	3
4	24CS601	Augmented Reality /Virtual Reality	OEC	3	0	0	3
5	24CS602	Full Stack Development	OEC	3	0	0	3
6	24CS603	Software Testing and Quality Assurance	OEC	3	0	0	3
7	24CS604	Cloud Computing	OEC	3	0	0	3
Open Electives Courses II (OEC)							
Civil and Agricultural Engineering							
1.	24AG601	Principles of Crop Production	OEC	3	0	0	3
2.	24AG602	Dairy and Food Engineering	OEC	3	0	0	3
3	24AG603	Post-Harvest Technology	OEC	3	0	0	3
4	24AG604	Agricultural Finance, Banking and Co-operation	OEC	3	0	0	3
5	24CI601	Rural Development	OEC	3	0	0	3
6	24CI602	Geographic Information System	OEC	3	0	0	3
7	24CI603	Water Resources management	OEC	3	0	0	3
8	24CI604	Climate Change and its Impact	OEC	3	0	0	3

Open Electives Courses III (OEC)							
Bio Medical and Electronics and Communication Engineering							
1	24BM701	Wearable Devices	OEC	3	0	0	3
2	24BM702	Telemedicine and Healthcare Delivery	OEC	3	0	0	3
3	24BM703	Medical Informatics	OEC	3	0	0	3
4	24BM704	Basics of Human Anatomy and Physiology	OEC	3	0	0	3
5	24EC504	Fuzzy Logic Systems and ANN	OEC	3	0	0	3
6	24EC505	Consumer Electronics	OEC	3	0	0	3
Open Electives Courses IV (OEC)							
Mechanical and Management							
1	24ME701	Additive Manufacturing	OEC	3	0	0	3
2	24ME702	Rocket Propulsion	OEC	3	0	0	3
3	24ME703	Industrial Safety	OEC	3	0	0	3
4	24ME704	Marine Vehicles	OEC	3	0	0	3
5	24MG701	Digital Marketing	OEC	3	0	0	3
6	24MG702	Industrial Psychology	OEC	3	0	0	3
7	24MG703	Logistics and Supply chain Management	OEC	3	0	0	3
8	24MG704	Corporate Social Responsibility	OEC	3	0	0	3
Employability Enhancement Courses (EEC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24EE351	Mini Project – I (Introduction to Innovative Projects)	EEC	0	0	2	1
2	24EE451	Mini Project – II (Design and development of the product)	EEC	0	0	2	1
3	24EN451	Soft Skills Development	EEC	0	0	2	1
4	24EE551	Mini Project – III (Community based Project)	EEC	0	0	2	1
5	24GE551	Quantitative and Reasoning Skills - I	EEC	0	0	2	1
6	24EE651	Mini Project-IV (Micro Project)	EEC	0	0	2	1
7	24GE651	Quantitative and Reasoning Skills – II	EEC	0	0	2	1
8	24EN651	Business and Managerial Communication	EEC	0	0	2	1
9	24EE751	Project Work Phase I (Design and Analysis)	EEC	0	0	4	2
10	24EE752	Industrial Training/Internship	EEC	0	0	0	2
11	24EE851	Project Work Phase II	EEC	0	0	10	5

Mandatory Courses (MNC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24MC101	Induction Programming	MNC	Three Weeks			
2	24MC201	Sports and Yoga for Youth Empowerment - I	MNC	0	0	2	0
3	24MC202	NCC Credit Course Level- I	MNC	1	0	2	1#
4	24MC301	Sports and Yoga for Youth Empowerment - II	MNC	0	0	2	0
5	24MC401	NCC Credit Course Level - II	MNC	1	0	2	1#
6	24MC601	Disaster Management	MNC	1	0	0	1#
7	24MC701	Constitutions of India	MNC	1	0	0	1#

Recommended Courses for SEMESTER-I

S.No	Course code	Course Title	Category	L	T	P	C
THEORY COURSES							
1	24GE101	Heritage of Tamils	HSS	1	0	0	1
2	24MA101	Matrices and Calculus	BSC	3	1	0	4
THEORY COURSE WITH LABORATORY COMPONENT							
3	24EN101	English for Engineers	HSS	2	0	1	2.5
4	24PH101	Engineering Physics	BSC	3	0	2	4
5	24CY101	Engineering Chemistry	BSC	3	0	2	4
6	24ME201	Engineering Graphics & Design	ESC	1	0	4	3
7	24CS201	Programming for Problem Solving using C	ESC	2	0	4	4
MANDATORY COURSES							
8	24MC101	Induction Programming	MNC	THREE WEEKS			
TOTAL				15	1	13	22.5

Recommended Courses for SEMESTER-II

S.No	Course Code	Course Title	Category	L	T	P	C
THEORY COURSES							
1	24GE201	Tamil and Technology	HSS	1	0	0	1
2	24MA201	Complex Variables and Transforms	BSC	4	0	0	4
3	24PH201	Physics for Electronics Engineering	BSC	3	0	0	3
4	24CY201	Environmental Science and Engineering	BSC	2	0	0	2
5	24GE202	Basics of Civil and Mechanical Engineering	ESC	4	0	0	4
6	24EE201	Electric Circuits	ESC	3	0	0	3
THEORY COURSE WITH LABORATORY COMPONENT							
7	24EC301	Electron Devices and Circuits	PCC	3	0	2	4
LABORATORY COURSES							
8	24EE231	Electric Circuits Laboratory	ESC	0	0	2	1
9	24GE231	Workshop Practices	ESC	0	0	3	1.5
10	24EN231	Presentation and Language Skills Laboratory	HSS	0	0	3	1.5
MANDATORY COURSES							
11	24MC201	Sports and Yoga for Youth Empowerment - I	MNC	0	0	2	0
12	24MC202	NCC Credit Course Level- I	MNC	1	0	2	1#
		TOTAL		20	0	10	25

பாடநெறி குறியீடு:	**24GE101**	***பாடத்தின் தலைப்பு:***	***தமிழர்மரபு*** (Common to AI&DS, AE, BME, CE, CSE, CSE(AI&ML), EEE, ECE, MECH)
கிரெடிட்	**1**	**L – T – P**	**1-0-0**

பாடத்திட்ட நோக்கங்கள்:

தமிழின் மதச்சார்பற்ற தன்மை, இந்திய மொழிக் குடும்பத்தின் திராவிட மொழி, திருக்குறளின் கருத்துக்கள், சமயங்களின் தாக்கம், நவீன இலக்கிய வளர்ச்சி ஆகியவற்றை நினைவு கூர்தல்.

தமிழர்களின் சமூக மற்றும் பொருளாதார வாழ்வில் நடுகல், சிற்பங்கள், சிலைகள் மற்றும் அழகிய கைவினைப் பொருட்கள், இசைக்கருவிகள் ஆகியவற்றின் தொடர்புடைய அறிவைக் கோடிட்டுக் காட்டுதல்.

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகளை மனதில் பதிய வைத்தல்.

தமிழ்நாட்டின் தாவரங்கள் மற்றும் விலங்கினங்கள், சங்க நகரங்கள் மற்றும் துறைமுகங்கள், சங்க காலத்தின் ஏற்றுமதி மற்றும் இறக்குமதிகளை நினைவுபடுத்துதல், வெளிநாடுகளில் சோழர் படையெடுப்பைக் கண்டறிதல்.

இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கைக் கண்டறிதல், இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்குக்கு இணையாக இந்தியாவின் பிற பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கத்தை அடையாளம் காணுதல்.

அலகு I மொழி மற்றும் இலக்கியம்:	**[3hours]**
இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம்- பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும்	

பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு II மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக்கலை:	**[3hours]**
நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.	

அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:	**[3hours]**
தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.	

அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள்:	**[3hours]**
தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறைமுகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி.	

அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு:	**[3hours]**
இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தங்கங்களின் அச்சு வரலாறு.	

பாடநெறி முடிவுகள் (பாமு):

பாடநெறியின் முடிவில், மாணவர் பின்வரும் திறன்களைப் பெறுவர்:

பாமு	**பாடநெறி முடிவுகள்**	**மிக உயர்ந்த அறிவாற்றல் நிலை**
அலகு I பாமு:	தமிழின் மதச்சார்பற்ற தன்மை, திராவிட மொழியின் பங்கு, திருக்குறளின் கருத்துக்கள், சமயங்களின் தாக்கம், நவீன இலக்கிய வளர்ச்சி ஆகியவற்றையும் தெரிந்துகொள்கிறார்கள்.	கே 1
அலகு II பாமு:	தமிழர்களின் சமூக மற்றும் பொருளாதார வாழ்வில் நடுகல், சிற்பங்கள், சிலைகள் மற்றும் அழகிய கைவினைப் பொருட்கள், இசைக்கருவிகள் ஆகியவற்றை விவரிக்கும் ஆற்றலை பெறுகிறார்கள்.	கே 2
அலகு III பாமு:	தமிழர்களின் பாரம்பரிய விளையாட்டுகளை தெரிந்து கொள்ளுவதால் விளையாட வேண்டும் ஏன்ற ஆர்வத்தை பெறுகிறார்கள்.	கே 1
அலகு IV பாமு:	தமிழ்நாட்டின் தாவரங்கள் மற்றும் விலங்கினங்கள் பற்றிய அறிவையும், சங்க கால கட்டிடக்கலை, ஏற்றுமதி மற்றும் இறக்குமதி தொழில் நுட்ப அறிவை பெறுகிறார்கள்..	கே 1
அலகு V பாமு:	இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கையும், இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு இணையாக இருப்பதையும், தெரிந்து கொள்கிறார்கள்.	கே 1

பாடநெறி முடிவுகள் ***மற்றும் நிரல் முடிவுகள் ஒப்பிடுதல்***

பாமுகள்	மிக உயர்ந்த அறிவாற்றல் நிலை	பாடநெறி முடிவுகள்											
		1	2	3	4	5	6	7	8	9	10	11	12
பாமு1	கே 1	2	-	-	-	-	-	-	-	-	-	-	-
பாமு2	கே 2	1	-	-	-	-	-	-	-	-	-	-	-
பாமு3	கே 1	1	-	-	-	-	-	-	-	-	-	-	-
பாமு4	கே 1	1	-	-	-	-	-	-	-	-	-	-	-
பாமு5	கே 1	1	-	-	-	-	-	-	-	-	-	-	-

நிலை 3- அதிக ஒத்துப்போதல், நிலை 2- மிதமாக ஒத்துப்போதல், நிலை 1- குறைவாக ஒத்துப்போதல், நிலை 0- ஒத்துப்போகவில்லை

மதிப்பீட்டுத் திட்டம்:

கூறுகள்	மதிப்பீட்டின் வகை	அதிகபட்ச மதிப்பெண்கள்	குறைக்கப்பட்ட மதிப்பெண்கள்	இறுதி மதிப்பெண்கள்
தொடர்ச்சியான உள் தேர்வு	தொடர்ச்சியான உள் தேர்வு - I	100	40	40
	தொடர்ச்சியான உள் தேர்வு - II	100	40	
இறுதி பருவ தேர்வு	எழுத்து தேர்வு	100	60	60
			மொத்தம்	100

இறுதி பருவ தேர்வு: (கேள்வி முறை)

- ஒவ்வொரு யூனிட்டும் இரண்டு 2 மதிப்பெண் வினாக்களையும் ஒரு 16 மதிப்பெண் வினாவையும் (இரண்டில் ஒன்று) கொண்டுள்ளது.
- பதினைந்து கேள்விகளுக்கும் பதிலளிக்க வேண்டும்.

மதிப்பீட்டு முறை

ப்ளூமின் வகை	தொடர்ச்சியான மதிப்பீட்டு சோதனைகள்		இறுதி தேர்வு
	1	**2**	
நினைவில் கொள்ளுதல்	60	50	60
புரிந்து கொள்ளுதல்	40	50	40
விண்ணபப்பித்தல்	0	0	0
பகுப்பாய்வுதல்	0	0	0
மதிப்பிடுதல்	0	0	0
உருவாக்குதல்	0	0	0

TEXT BOOKS:

1. தமிழகவரலாறு - மக்களும்பண்பாடும் - கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்).
2. கணினித்தமிழ் - முனைவர்இல. சுந்தரம். (விகடன்பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (தொல்லியல்துறைவெளியீடு)
4. பொருநை - ஆற்றங்கரைநாகரிகம். (தொல்லியல்துறைவெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.

REFERENCE BOOKS:

1. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
2. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
3. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department ofArchaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
4. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
5. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
6. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Course Code:	24MA101	Course Title:	**Matrices and calculus** (Common to AI&DS, AE, BME, CE, CSE, CSE(AI&ML), EEE, ECE, MECH)
Credits:	**4**	**L – T – P**	**3 – 1 – 0**
Pre-requisite			**NIL**

Course objectives:

- To provide the basic tools of calculus mainly for the purpose of modeling the engineering problems mathematically and obtaining solutions.
- To learn the concept of eigenvalues and eigenvectors and to reduce the quadratic form to canonical form.
- To learn the foundation course of Single Variable and multivariable calculus plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

Teaching-Learning Process:

These are sample strategies which teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method does not mean only traditional method, but different type of teaching methods may be adopted to develop the outcomes.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Topics will be introduced in a multiple representation and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT I – Matrices	**[12 hours]**
Eigenvalues and Eigenvectors and their properties – Diagonalization of a matrix (Symmetric matrix) – Cayley - Hamilton theorem (without proof) – Inverse and Power of a matrix by Cayley - Hamilton theorem – Quadratic forms and Nature of quadratic forms. Application: Reduction of a quadratic form to canonical form by orthogonal	

transformation.

UNIT II – Differential Calculus	[12 hours]
Functions – Limit – Continuity – Derivatives – Differentiation rule – Product and quotient rules – Chain rules – Implicit differentiation – Logarithmic differentiation. Application: Maxima and Minima of functions of one variable	

UNIT III – Functions of Several Variables	[12 hours]
Partial differentiation – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables. Application: Maxima and Minima of functions of two variables using MATLAB - Lagrange's method of undetermined multipliers.	

UNIT IV – Integral Calculus	[12 hours]
Definite and Indefinite integrals - Substitution rule - Techniques of Integration: Bernoulli's theorem (without proof) – Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals. Application: Area between simple closed curves.	

UNIT V – Multiple Integrals	[12 hours]
Double integrals –Double integrals in cartesian and polar coordinates – Change of order of integration– Area enclosed by plane curves – Triple integrals – Change of variables in double and triple integrals. Application: Volume of solids, Mass of Lamina	

Course outcomes:

On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Apply the matrix algebraic techniques for eigen value related applications	K3
CO2	Understand the concepts of limit and continuity of functions	K2
CO3	Compute the derivatives and the extreme points and solve engineering problems	K3
CO4	Use the partial derivatives to find the maxima and minima of multivariable functions	K3
CO5	Use fundamental theorem of calculus to evaluate definite integrals	K3
CO6	Apply the concepts of multiple integrals to find the areas and volumes of geometrical shapes	K3

COs and POs Mapping:

COs	Pos											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	2	1	-	2	-	-	-	-	-	-	2
CO2	2	1	1	-	-	-	-	-	-	-	-	1
CO3	3	2	1	-	2	-	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	-
CO6	3	2	1	-	1	-	-	-	-	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped,

Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final marks</th></tr>
<tr><td rowspan="5">Continuous Internal Examination (CIE)</td><td>CIE – I</td><td>100</td><td rowspan="2">50</td><td rowspan="5">100</td><td rowspan="5">40</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>MCQ</td><td>20</td><td>10</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td>End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>60</td><td>60</td><td>60</td></tr>
<tr><td colspan="5">Total</td><td>100</td></tr>
</table>

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or choice).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	20	20	20
Understand	40	20	20
Apply	40	60	60
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
3. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 2015. [For Units II & IV - Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8]

Reference Books:

1. Muthusubramanian R and Salivahanan S, "Basic Electrical and Electronics Engineering," McGraw Anton. H, Bivens. I and Davis. S, " Calculus ", Wiley, 10th Edition, 2016
2. Bali. N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
3. Jain. R.K. and Iyengar. S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition, 2016.
4. Narayanan. S. and Manicavachagom Pillai. T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.

5. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.Hill, NewDelhi, 2009.

Equivalent NPTEL/SWAYAM Courses

SI.No.	Course Title	Course Instructor	Host Institute
1	Matrix Analysis with Applications	Prof. S. K. Gupta Prof. Sanjeev Kumar	IIT Roorkee
2	Calculus of One Real Variable	Prof. Joydeep Dutta	IIT Kanpur

Web Links and Video Lectures (E-Resources):

1. System of Linear Equations, Eigenvalues and Eigenvectors: https://www.nptelvideos.com/lecture.php?id=13416
2. Concept of Domain, Limit, Continuity and Differentiability: https://www.nptelvideos.com/lecture.php?id=13422
3. Matrix Diagonalization: https://www.nptelvideos.com/lecture.php?id=13481

Course Code:	**24EN101**	**Course Title:**	**ENGLISH FOR ENGINEERS** (Common to AI&DS, AE,BME,CE,CSE,CSE(AI&ML),EEE, ECE,MECH)
Credits:	**2.5**	**L – T – P**	**1-0-3**
Pre-requisite			**NIL**

Course Objectives:

- To develop an understanding of Basic English Grammar.
- To enhance listening skills and select appropriate responses.
- To practice presentation and speaking techniques.
- To develop a quest for reading.
- To practice professional writing.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Language learning softwares / Language Lab
3. Online Resources
4. Smart Class Room
5. Flipped classrooms
6. Project based Collaborative Experiential learning
7. Expert Lecture sessions

UNIT I - BASIC GRAMMAR- VOCABULARY AND EXPRESSIONS	**[8 hours]**
Grammar: Parts of speech - Types of sentences: Assertive - Imperative - Interrogative & Exclamatory - Affirmative - Negative - Gerunds & Infinitives - Tenses - Voices- Impersonal passives- Prepositions -Articles & Determiners- Cause and effect expressions - Vocabulary: Affixes- Synonyms & Antonyms - Homonyms - Homophones- Compound Nouns.	

UNIT II - ACTIVE LISTENING - RESPONDING		**[15 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
SI. No.	**Topic**	**Hours**
1.	Listening to Audio (Podcasts- Audiobooks- Radio Program) and Practice Exercise-Answering Cloze Test Based on Listening	3
2.	Listening to native speaker's Telephone Conversations–Analyzing a Product	3
3.	Listening to Job Interviews - Sports Commentaries / Animated stories / Anecdotes / Event narration	3
4.	Video Comprehension – Brainstorming and Note-Taking	3
CLASSROOM ACTIVITIES		
1.	Listening to Statistical Information and Follow-up Exercises. - Form Filling Exercises	1
2.	Debate and reviewing the performance of each participant - Panel Discussion	2

UNIT III: SPEAKING AND PRESENTATION SKILLS		[15 hours]
LIST OF EXERCISES		
LAB ACTIVITIES		
SI. No.	**Topic**	**Hours**
1.	Speaking Development through English software S-net or Globarena and Online Content (Tenses- Voices- SV Agreement- Prepositions- Coherence Markers- Relative Clauses- Modals- Punctuation)	5
CLASSROOM ACTIVITIES		
1.	Self-Introduction - Sharing Childhood Experiences- Talking about Favorite Personalities	1
2.	Describing Recent Innovation in Technology	1
3.	Interviewing Celebrities and Entrepreneurs	1
4.	Situational Conversations (Meeting a friend in a cafe) - Narrating Personal Experience	1
5.	Group Communication- Discussing Social Issues- Current Affairs and Debate	1
6.	Role-Play- Picture/Movie Description	1
7.	Presentation – I (Book /Movie Review- Story Telling- General Presentations)	2
8.	Presentation – II (Technical Presentations)	2

UNIT IV: READING BETWEEN LINES		[12 hours]
LIST OF EXERCISES		
LAB ACTIVITIES		
SI. No.	**Topic**	**Hours**
1.	Reading Comprehension - skimming - scanning (General / Technical passages	2
2.	Reading Longer Texts with Time Frame	2
3.	Reading Data using different types of Texts- Magazines and Internet Materials	2
4.	Reading Research Papers-- Editing/Proofreading	2
CLASSROOM ACTIVITIES		
1.	Job Advertisements – Manual for Product/Service – Telephone Phrases	1
2.	Reading Cause and Effect Essays-Technical Papers and Case Studies - Sorting out jumbled Sentences in a Paragraph	2

3.	Short Stories - Critical Reading	1

UNIT V- WRITING FOR ENGINEERS	**[7+3 hours]**
Writing - Application Letters - Resume- Product Description - Essay related to Technical / Social / current topics - Interpretation of Charts - Short Articles on everyday life - letters – Enquiry- Quotation- Order- Claim - Adjustment - Response to complaints - Statement of Purpose (SoP) -Emails - Memos -Notices - Circulars - Minutes of Meetings - Internship - Accident Report - Feasibility Report- Recommendations.	

LIST OF EXERCISES		
LAB ACTIVITIES		
SI. No.	**Topic**	**Hours**
1.	Mind Mapping and Brainstorming on any Social Event/Issue	1
2.	Creating a Blog/Vlog/YouTube Channel –Uploading MP3/MP4 – Practice (Movie/Book/ Gadget Review-General/Tech Talks- Interview with Celebrities)	1
3.	Creating a Product Review Blog.	1

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Domain
CO1	Identify various grammatical components- build vocabulary and apply expressions for error-free sentences	K3
CO2	Make use of appropriate words to respond by listening to general and technical online contents	K3
CO3	Experiment with the nuances of presentation and speaking skills	K3
CO4	Apply reading skills in various academic contexts	K3
CO5	Construct legible and flawless sentences proficiently with appropriate choice of words and structures for varied professional contexts	K3

COs and POs Mapping:

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	-	-	-	-	-	-	-	-	-	3	-	3
CO2	-	-	-	-	-	-	-	-	-	3	-	3
CO3	-	-	-	-	-	-	-	-	-	3	-	3
CO4	-	-	-	-	-	-	-	-	-	3	-	3
CO5	-	-	-	-	-	-	-	-	-	3	-	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped,
Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max. Marks</th><th>Reduced Marks</th><th>Total</th><th>Final marks</th></tr>
<tr><td rowspan="4">Continuous Internal Examination (CIE) - Theory</td><td>CIE – I</td><td>100</td><td rowspan="2">60</td><td rowspan="4">100</td><td rowspan="4">25</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>Skill Assessment I
(2 Assignments + 1 seminar)</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment II
(3 Assignments)</td><td>40</td></tr>
<tr><td rowspan="2">Continuous Internal Examination (CIE) - Laboratory</td><td>Continuous Assessment
(Lab activities & exercises)</td><td>75</td><td>75</td><td rowspan="2">100</td><td rowspan="2">25</td></tr>
<tr><td>Model Lab Exam</td><td>25</td><td>25</td></tr>
<tr><td rowspan="2">End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>35</td><td rowspan="2">50</td><td rowspan="2">50</td></tr>
<tr><td>Lab Exam</td><td>100</td><td>15</td></tr>
<tr><td colspan="5" align="right">Total</td><td>100</td></tr>
</table>

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	10	10	10
Understand	30	30	30
Apply	60	60	60
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Gangalakshmi- C- Rathika- B- Saranraj- L. Professional English for Engineers. New Delhi: Cengage- 2022.
2. Murphy- Raymond. English Grammar in Use Book with Answers: A Self-study Reference and Practice Book for Intermediate Learners of English. Fourth Edition: Cambridge University Press- 2012.

Reference Books:

1. Raman- Meenakshi and Sangeetha Sharma. Communication Skills. New Delhi: OUP- 2018
2. R. C. Sharma_ Krishna Mohan - Business Correspondence and Report Writing _ a Practical Approach to Business _ Technical Communication-Mc Graw Hill India (2017)

Web Links and Video Lectures (E-Resources):

MANUALS / SOFTWARE: Open Sources / British Council / Cambridge Websites

Suggested Skill Activities:

1) Listening tests materials [Select podcasts / radio programmes / YouTube videos / audiobooks / materials from British Council] - Cloze tests where students fill in missing words from transcripts – Yes or No Question Answers – one-word answers based on recording – summary of recording
2) Self-introduction / Introduce Colleague
3) Just a Minute talks
4) Extempore
5) Mock GDs
6) Mock Interviews
7) Note Taking of Engineering Lectures
8) Create videos / blogs
9) Present Technical Papers
10) Reading Comprehension Exercises
11) Writing letters – Leave letter – Letter for academic purposes
12) Writing Essays
13) Composing Mails
14) Preparing Statement of Purpose
15) Preparing Covering letter and Resume

Course Code:	24PH101	Course Title:	ENGINEERING PHYSICS
Credits:	4	L – T – P	3-0-2
Pre-requisite			NIL

Course Objectives:

- To make the students effectively to achieve an understanding of Mechanics
- To enable the students to gain knowledge of Elasticity.
- To enable the students to gain knowledge of Maxwell's Equation and Electromagnetic waves.
- To introduce the basics of optics and lasers.
- Equipping the students to successfully understand the importance of quantum physics.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I -MECHANICS	[9 hours]
Multiparticle dynamics: Center of mass (CM) – Rotation of rigid bodies: Rotational kinematics – Rotational kinetic energy and moment of inertia - Theorems of M .I –M.I of Uniform rod-M.I of a diatomic molecule - Torque– Rotational energy state of a rigid diatomic molecule - Gyroscope – Torsional stress and deformation-Torsional pendulum- Double	

pendulum.
Practical Topics: 1. Torsional pendulum – Determination of rigidity modulus of wire and moment of inertia of disc. 2. Compound pendulum – Determination of rigidity modulus

UNIT II - ELASTICITY	[9 hours]
Elasticity – Factors affecting Elasticity –Different types of Modulus- Moduli of elasticity and its relation -Stress - strain diagram and its applications - Bending of beams - Bending moment – Cantilever - Young's modulus : Uniform & Non-uniform bending-theory and experiment-I Shaped Girders.	
Practical Topics: 1. Determination of Young's modulus of a given material- Non uniform bending method 2. Uniform bending – Young's modulus determination.	

UNIT III - MAXWELL'S EQUATIONS AND ELECTROMAGNETIC WAVES	[9 hours]
The Maxwell's equations - wave equation- Plane electromagnetic waves in vacuum - properties of electromagnetic waves - Producing electromagnetic waves - Energy and momentum in EM waves - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium vacuum interface for normal incidence..	
Practical Topics: 1. Spectrometer – Determination of wavelength of Hg spectrum using grating. 2. Spectrometer – Angle of the prism 3. Spectrometer – Dispersive power of the prism	

UNIT IV - LASERS &FIBER OPTICS	[9 hours]

Lasers:-Einstein coefficients and their relations –-characteristics of laser - Types of Laser - Nd-YAG laser -semiconductor laser- Applications -Industrial, Medical, laser based military weapons

Fiber optics: principle and classification of optical fibers – propagation of light in optical fiber - Numerical aperture and Acceptance angle– Fiber optic communication system - Applications - Displacement and pressure sensors – Endoscopy

Practical Topics:

1. Determination the acceptance angle and numerical aperture of the given optical fiber.
2. Determination of the particle size of the given powder using laser
3. Determination of wavelength of a given laser source - Grating method

UNIT V - QUANTUM MECHANICS	[9 hours]

Photons and light waves - Electrons and matter waves- Dual Nature of Light –-De Broglie Waves-Compton effect - The Schrodinger equation (Time dependent and time independent forms) - Physical Significance of wave function - Normalization –Free particle - particle in a infinite potential well: 1D,2D and 3D Boxes- Normalization-quantum computation.

Practical Topics:

1, Young's Double Slit Experiment to demonstrate the wave nature of particles

Laboratory component: **30 Hours**

Any ten experiments have to be completed from the following list ofExperiments

S. No	Name of the experiment
1.	Apply parallel axis theorem to find the resultant of system of concurrent coplanar forces.
2.	Torsional pendulum – Determination of rigidity modulus of wire and moment of inertia of disc
3.	Compound pendulum- Determination of moment of inertia of a rigid rod.
4.	Apply the concept of bending of beams to find the Young's modulus of a given material-by Non uniform bending method
5.	Apply the concept of bending of beams to find the Young's modulus of a given material-by Uniform bending method.
6.	Determination of V-I characteristics of a solar cell.
7.	Using Ohm's law verify the laws of resistances .
8.	Using optical fiber find the acceptance angle and numerical aperture.

9.	Make use of the laser source find the particle size of the given powder.
10.	Determination of wavelength of a given laser source - Grating method.
11.	Spectrometer – Determination of wavelength of Hg spectrum using grating.
12.	Spectrometer – Dispersive power of the prism.
13.	Determination of magnetic Induction due to long current carrying conductor.
14.	Make use of the Young's Double Slit Experiment, demonstrate the wave nature of particles.
15.	Spectrometer – Angle of the prism

Course outcomes:

On completion of the course, the student will have the ability to:

CO No	Course Outcomes	Cognitive Domain
CO1	Apply the concepts of Mechanics in materials.	K3
CO2	Apply the concept of elasticity in beams.	K3
CO3	Apply the concept of electromagnetic waves in communication.	K3
CO4	Illustrate the applications of different lasers &Calculate the acceptance angle and numerical aperture of an optical fiber .	K2
CO5	Explain the quantum concepts and quantum computation.	K2

COs and POs Mapping:

COs	**POs**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	2	2	-	-	-	-	-	-	-	-	1
CO2	3	2	2	-	1	-	-	-	-	-	-	1
CO3	3	2	2	-	1	1	-	-	-	-	-	1
CO 4	3	1	1	-	1	1	-	-	-	-	-	1
CO 5	3	1	1	-	-	-	-	-	-	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped

Level 0-Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	60	100	25
	CIE – II	100			
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

Assessment Pattern:

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

TEXT BOOKS:

1. D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw Hill Education (Indian Edition), 2017.
2. E.M.Purcell and D.J.Morin, Electricity and Magnetism, Cambridge Univ.Press,
3. 2013.
4. Bhattacharya, D.K. & Poonam, T. "Engineering Physics". Oxford University Press, 2015

REFERENCES:

1. R.Wolfson. Essential University Physics. Volume 1 & 2. Pearson Education(Indian Edition),2009.
2. Paul A. Tipler, Physic – Volume 1 & 2, CBS, (Indian Edition), 2004.
3. K.Thyagarajan and A.Ghatak. Lasers: Fundamentals and Applications, LaxmiPublications,(Indian Edition), 2019.
4. D.Halliday, R.Resnick and J.Walker. Principles of Physics, Wiley (IndianEdition), 2015.

Equivalent NPTEL/SWAYAM Courses:

SI.No	Course Name	Course Instructor	Course Conducting Agency
1	Quantum Mechanics	Prof .P.Ramadevi	IIT -Bombay

Web links and Video Lectures (e-Resources):

1. ELASTICITY
   https://youtu.be/eICv1p8WjgI?si=88hhiQw_fld7ZrBU

2. MAXWELL'S EQUATIONS AND ELECTROMAGNETIC WAVES
   https://youtu.be/3IPVZYf7C-U?si=PnP1nupcfGfr1C76
3. LASERS &FIBER OPTICS
   https://youtu.be/Ab1nxxkgjH8?si=KR2GS8iBUFayBwdp
4. QUANTUM MECHANICS
   https://youtu.be/AEedn_NiWN0?si=Y27pAqawlwKmthNO

Skill Assessment:

1. Explain the concept behind the balance a water bottle on a edge.
2. The leaning Tower of Pisa is able to stand tilted without toppling, what is the reason behind it.
3. Apply the elasticity concept to find the fatigue change in plastic fiber and natural fiber
4. Radio antennas emit visible light, Why
5. What does an opaque substance do when light rays fall on it.
6. Illustrate the things happen when light falls on a piece of black paper.
7. Explain the dual nature of matter.
8. Optical Fiber is used in hard to reach places in mechanical inspection explain it.
9. Is quantum communication faster than the speed of light

10. Compare electron microscope & tunneling microscope.

Course Code:	**24CY101**	**Course Title:**	**ENGINEERING CHEMISTRY** (Common to AI&DS, AE, BME, CE, CSE, CSE(AI&ML), EEE, ECE, MECH)
Credits	**4**	**L – T – P**	**3-0-2**
Pre-requisite			**NIL**

Course objectives:

- To provide a comprehensive understanding of water quality parameters, water treatmenttechniques and wastewater systems.
- To use the fundamental science and engineering principles relevant to materials that includescharacterization, properties and processing of engineering materials.
- To familiarize with the principles, working and applications of electrochemistry and storagedevices for safe, effective and efficient operations.
- To study, measure, monitor, control and prevent corrosion processes, economically andsafely.
- To classify different types of fuel and fuel analysis techniques that assists to choose mostconvenient fuel for a process involving combustion.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Blended Mode of Learning
3. Experiential Learning
4. NPTEL and Other Videos for theory topics
5. Flipped Class
6. Lab Experiment Videos

UNIT I - WATER TREATMENT	[9 hours]
Water Sources- Water Quality parameters - Hardness of water – types-units and calcium carbonate equivalent. -Determination of hardness of water by EDTA method. Scale and sludge, caustic embrittlement, priming and foaming and boiler corrosion. Water softening methods – internal and external conditioning –zeolite process and ion exchange process. Desalination – reverse osmosis andelectro dialysis- Municipal water treatment and waste water treatment process.	
Practical Topics: 1. Determination of total hardness by EDTA method. 2. Estimation of alkalinity by Indicator method. 3. Estimation of chlorine content in water sample by Argentometric method. 4. Determination of BOD in water samples.	

UNIT II - CHEMISTRY OF ENGINEERING MATERIALS	[9 hours]
Adhesives: Introduction- requisites of a good adhesive-adhesive action-industrial applications of adhesives. Insulating Materials: Introduction- requirements- Glass and ceramics - preparation, properties andapplications - fabrication of ceramic ware. Lubricants-Classification of lubricants with examples-characteristics of a good lubricants - mechanism of lubrication (thick film, thin film and extreme pressure) - properties of lubricants: viscosity, cloud point, pour point, flash point and fire point. Electronic materials: Introduction-types, properties and applications of semiconducting materials and transistors, materials used in IC's, fibers and cables- properties and applications, organic solar cells - types and applications.	
Practical Topics: 1. Determination of viscosity of oils using Oswald viscometer. 2. Determination of cloud point and pour point of oils.	

UNIT III -ELECTROCHEMISTRY	[9 hours]
Introduction – Electrode potential – Nernst equation and problems - Electrochemical series - Conductometric titrations (acid - base & precipitation titration) Electrodes: Construction, working and applications of Standard and reference electrode (Hydrogen & Calomel) – Ion selective (glass electrode) – determination of pH using glass electrode. Batteries and Fuel Cells – Types of batteries —dry cell -Lead Storage battery–Nickel-Cadmium Battery – Lithium battery – Battery hazards - Biological Batteries. Fuel Cells – Hydrogen-Oxygen FuelCell.	
Practical Topics: 1. Estimation of strength of hydrochloric acid by pHmetry. 2. Determination of strength of acids in a mixture of acids using conductivity meter. 3. Determination of charging and discharging rate of batteries.	

UNIT IV -CORROSION AND ITS CONTROL	[9 hours]
Corrosion – causes, factors, types, Chemical and Electrochemical Corrosion (Galvanic, Differential aeration) –galvanic series-factors influencing rate of corrosion-measurement of corrosion. Determination of corrosion rate by weight loss method. Control Methods-Electrochemical protection – Sacrificial Anodic method – Impressed Current Cathodic Protection – Corrosion Inhibitors – Bio corrosion Protective Coatings – Paints, Constituents, Functions- Surface coating - Surface preparation for metallic coatings, Electroplating and Electro-lessPlating- ceramic coatings, thermal vaporization coating, HVOF coating	
Practical Topics: 1. Estimation of the Ferrous ions in mild steel by Spectrophotometry. 2. Determination of rate of corrosion of by weight loss method	

UNIT V- FUELS AND COMBUSTION	[9 hours]
Fuels: Introduction: Classification of fuels; solid fuel -Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Liquid fuels -Manufacture of synthetic petrol –hydrogenation of coal (Bergius process), Knocking – octane number, diesel oil – cetane number; Power alcohol and biodiesel. Combustion of fuels: Introduction: Calorific value – higher and lower calorific values, Theoretical calculation of calorific value by Dulong's formula - Ignition temperature: spontaneous ignition temperature, Explosive range; Flue gas analysis – ORSAT Method.	
Practical Topics: 1. Determination of flash point and fire point of fuels.	

Laboratory component: **30 Hours**

Any ten experiments have to be completed from the following list of experiments

SI.No.	Name of the experiment
1	Determine the total hardness of water sample by EDTA method.
2	Analyze the alkalinity of water sample by Indicator method.
3	Analyze the chlorine content in water sample by Argentometric method.
4	Determine the BOD of water samples.
5	Describe the procedure to determine the viscosity of oil using an Oswald viscometer.
6	Identify the cloud point and pour point of oils.
7	Make use of glass electrode to determine the strength of hydrochloric acid.
8	Make use of conductivity meter to determine the strength of acids in a mixture of acids.
9	Determine quantitatively the amount of Ferrous ions in mild steel by Spectrophotometry.
10	Determine the of rate of corrosion of by weight loss method.
11	Describe the procedure to determine the flash point and fire point of fuels.
12	Conduct a study to find out the charging and discharging rate of batteries.

Course outcomes: On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Level
CO1	Analyze the water quality parameters and choose appropriate water treatment methods for use in industries and daily life.	K4
CO2	Make use of the applications of the materials in different engineering disciplines.	K3
CO3	Utilize the principles of electrochemistry and find the materials for energy conversion and storage.	K4
CO4	Determine the corrosion rate to propose suitable protection methods for environmental considerations	K3
CO5	Choose suitable fuels for engineering processes and automobile applications.	K3

COs and POs Mapping

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2	-	-	-	1	-	-	-	-	-	-
CO2	3	2	1	1	-	-	-	-	-	-	-	-
CO3	3	2	1	1	-	-	-	-	-	-	-	-
CO4	2	1	1	-	-	1	2	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final marks</th></tr>
<tr><td rowspan="4">Continuous Internal Examination (CIE) - Theory</td><td>CIE – I</td><td>100</td><td rowspan="2">60</td><td rowspan="4">100</td><td rowspan="4">25</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td rowspan="2">Continuous Internal Examination (CIE) - Laboratory</td><td>Continuous Assessment</td><td>75</td><td>75</td><td rowspan="2">100</td><td rowspan="2">25</td></tr>
<tr><td>Model Lab Exam</td><td>25</td><td>25</td></tr>
<tr><td rowspan="2">End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>35</td><td rowspan="2">50</td><td rowspan="2">50</td></tr>
<tr><td>Lab Exam</td><td>100</td><td>15</td></tr>
<tr><td colspan="5" align="right">Total</td><td>100</td></tr>
</table>

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	10	10	10
Understand	30	30	30
Apply	40	40	40
Analyze	20	20	20
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Jain P.C. and Jain M, Engineering Chemistry, Dhanpat Rai Publishing Company, New Delhi, 17th Edition,2021.
2. Dara S S and Umare S.S, A Text Book of Engineering Chemistry, S.Chand & Company Limited, 20thEdition, 2018.

Reference Books:

1. Benjamin M. M, Water Chemistry, Waveland Press, 2nd Edition, 2019.
2. Cicek V, Corrosion Engineering, Springer Publishing, 1st Edition, 2021.
3. Shahinpoor. M, Fundamentals of Smart Materials, Publisher: Royal Society of Chemistry, 1st Edition,2020.
4. Berg H, Bernhardsson S, and Johansson P, Electric Vehicle Batteries: Moving from Research towardsInnovation, Publisher: Springer, 1st Edition, 2019.
5. B.K.Sharma "Engineering chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2014).

Web links and Video Lectures (e-Resources):

1. Water and wastewater treatment - https://onlinecourses.nptel.ac.in/noc23_ce12/preview
2. SemiconductorDevices and circuits. - https://nptel.ac.in/courses/108108112
3. Corrosion ProtectionMethods - https://onlinecourses.nptel.ac.in/noc23_mm01/preview
4. Elementary Electrochemistry - https://onlinecourses.nptel.ac.in/noc23_cy19/preview
5. Fuel and combustionTechnology -https://archive.nptel.ac.in/courses/103/105/103105110/

Suggested Skill Activities:

1. Measure the TDS, PH & electrical conductivity of a home water.
2. Removal of temporary hardness of any water sample by suitable method.
3. Find the charging and discharging rate of mobile batteries when it is use or not.
4. The need of engineering material is essential in our day today life. - Justify the answer.
5. Measure the corrosion rate of iron bar when it is exposed in the environment.
6. List out the recent engineering materials used in emerging field.
7. Calculate the higher and lower calorific value of a fuel by using Dulong's formula.
8. List out the type of coatings applied on materials which are used in our daily life.
9. Improper disposal of batteries leads to environmental hazard. Suggest the suitable disposable method.
10. Pure Iron material undergo corrosion more fast than other materials. Give reasons.

Course Code:	**24ME201**	**Course Title:**	**Engineering Graphics and Design**
Credits:	**3**	**L – T – P**	**1-0-4**
Pre-requisite			**NIL**

Course objectives:

To impart knowledge on the

- To enable students to understand the standards and conventions of engineering drawing.
- To enhance the visualization skills to understand objects in the respective positions with respect to principal planes.
- To comprehend general projection theory, with emphasis on orthographic projection to represent three-dimensional objects in two-dimensional views.
- To emphasize freehand sketching and pictorial view to aid in the visualization process and to efficiently communicate ideas graphically.

- To Introduce CAD software for the creation of 3D models and 2D engineering drawings.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. NPTEL and Other Videos
3. Smart Class Room
4. Project based learning

UNIT I - DRAWING FUNDAMENTALS, GEOMETRIC CONSTRUCTION, PROJECTION OF POINTS, STRAIGHT LINES AND PLANES	[15 hours]
Drawing BIS standards – Orthographic projections – First angle projection - Drawing instruments – Sheet layout – Conventions – Lines, Lettering, Numbering and Dimensioning Geometric construction – Construction of regular polygons – Conic sections – Ellipse, Parabola and Hyperbola by eccentricity method.Projection of points – Points situated in all four quadrants. Projection of straight lines – Straight lines inclined to both principal planes – Finding true length of the line and true inclinations with respect to principal planes – Rotating line method. Projection of planes – Introduction – Polygonal lamina and Circular lamina - Orientation of planes - Plane parallel to both principal planes, Planes perpendicular to both principal planes and Planes inclined to both principal planes – Rotating object method.Orthographic projection of simple engineering components.	

UNIT II - PROJECTION OF SOLIDS	[15 hours]
Projection of solids – Introduction – Types of solids – Polyhedra and solids of revolution - Projection with axes inclined to one of the principal planes and parallel to other – Change of Position method. 2D drafting - Basic commands – Coordinate systems, Object section methods. Line, Circle,	

Polyline, Rectangle, Hatch, Fillet, Chamfer, Trim, Extend, Offset, Dim style – Annotation and Layering – Object snaps - 3D modelling – Basic commands – Extraction of multiple views – Part modelling of simple components - Utensils, Hand tools & Furniture etc. - Drawing views using 3D environment.

UNIT III - DEVELOPMENT OF SURFACES AND PICTORIAL PROJECTION	**[15 hours]**
Development of lateral surfaces of truncated Prisms, Pyramids, Cylinders and Cones– Parallel line method and Radial line method. Pictorial Projection – Isometric projection – Introduction – Isometric scale – Isometric view of two right regular composite solids – Isometric projection of truncated frustum of solids – Box method. Problems on applications of Isometric projections of simple objects / engineering components.	

UNIT IV- BASIC COMPUTER AIDED DRAWING APPLICATIONS	**[15 hours]**
Free hand Sketching - Sketching of geometry - multiple view projection from single pictorial view of objects – Illustrative examples - True free hand, Guided Free hand, Roads, Buildings, Utensils, Hand tools & Furniture's etc.Drawing Simple Mechanisms - Bicycles, Tricycles, Gear trains, Ratchets, two-wheeler cart &Four-wheeler carts to dimensions etc.	

UNIT V- MULTIDISCIPLINARY APPLICATIONS AND PRACTICE	**[15 hours]**
Electric Wiring and lighting diagrams - Like, Automatic fire alarm, Call bell system, UPS system, Basic power distribution system using suitable software. Basic Building Drawing - Draw various types of lines, graphical symbols for materials, doors and windows, symbols for sanitary, water supply and electrical installations and write abbreviations as per IS 962. Like, Architectural floor plan, basic foundation drawing, steel structures- Frames, bridges, trusses using Auto CAD or suitable software, Electronics Engineering Drawings - Like, Simple Electronics Circuit Drawings, practice on layers concept. Graphs & Charts - Like, Column chart, Pie chart, Line charts, Gantt charts, etc. using Microsoft Excel or any suitable software.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Level
CO1	Apply principles of first angle projection in drafting plan and elevation of points, lines, planes, and solids.	K3
CO2	Apply change of position method in the projection of solids and determine the true shape of the section.	K3
CO3	Apply principles of orthographic projection to extract 2D views from 3D drawing using freehand sketching.	K3
CO4	Apply parallel line and radial line methods to develop lateral surfaces of solids so that students can understand applications in sheet metal design.	K3
CO5	Apply box method to develop the isometric view of simple, truncated, and composite solids.	K3
CO6	Develop simple part model in 3D and plan, elevation, and section of building using a designated CAD software.	K6

COs and POs Mapping:

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	-	-	-	-	-	-	-	2	-	-	1	2	-
CO2	3	1	-	-	-	-	-	-	-	2	-	-	1	2	-
CO3	3	1	-	-	-	-	-	-	-	-	-	-	1	2	-
CO4	3	1	-	-	-	-	-	-	-	2	-	-	1	-	-
CO5	3	1	-	-	-	-	-	-	-	2	-	-	1	2	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		

- Theory	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	0	0	0
Understand	20	20	20
Apply	40	40	40
Analyze	0	0	0
Evaluate	0	0	0
Create	40	40	40

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. N.D.Bhatt,"Engineering Graphics", Charotor Publishing House, 53RD Edition 2019
2. Natrajan K.V., "A textbook of Engineering Graphics", Dhanalakshmi Publishers, Chennai (2015)

Reference Books:

1. Venugopal K. and Prabhu Raja V., “Engineering drawing + AutoCAD”, New Age International (P) Limited (2022)
2. Lakhwinder pal singh, Harwinder Singh, “Engineering Drawing Principles and Applications”, Cambridge University Press, 2021.
3. Cecil Johnson, Jay D Helsel and Dennis R Short, “Engineering Drawing and Design”, Seventh Edition, McGraw Hill, 2007.
4. Patil, Rajashekar, “Computer Aided Engineering Graphics”, New Age International Ltd,2018.
5. Chris Schroder, “Printed Circuit Board Design using AutoCAD”, Newnes,1997.
6. K S Sai Ram, “Design of steel structures”, Third Edition by Pearson.
7. A S Pabla, “Electrical power distribution”, 6th edition, Tata Mcgrawhill.
8. K. R. Gopalakrishna, & Sudhir Gopalakrishna, “Textbook of Computer Aided Engineering Drawing”, 39th Edition, Subash Stores, Bangalore, 2017

Web Links and Video Lectures (E-Resources):

1. **http://nptel.ac.in/courses/112103019**
2. https://archive.nptel.ac.in/courses/112/105/112105294/

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 and 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 and SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 and SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

LABORATORY REQUIREMENTS

SYSTEM REQUIREMENTS (For a batch of 30 Students)

Hardware:

1. Intel i3 core due processor with 4GB ram with 500GB hard disk – 30 Nos.
2. Laser Printer – 1 No.

Software:

Drafting package – AutoCAD – Adequate license (Open source)

Suggested Skill Activities:

1. 2D drafting of plan and elevation of computer CPU.
2. 2D drafting of plan and elevation of a thermos flask.
3. 2D drafting of a plan and elevation of piston and cylinder.
4. Sketching the projections of a bicycle in freehand.
5. Sketching the projections of a stapler.
6. Cut and develop the lateral surface of a funnel.
7. Cut one edges vertically and develop the lateral surface of CPU cabin.
8. Cut and develop the lateral surfaces of elbow of a pipe.
9. Draw the isometric view of a simple bread toaster.
10. Draw the isometric view of the computer table.
11. Sketch the assembled view of the screw jack using the orthographic projections of its components.
12. Draft the plan, elevation and section of your home using CAD.
13. Draft the plan, elevation and section of 2 storey office building using CAD.
14. Develop the 3D model of the (a) and (b).

Course Code:	**24CS201**	**Course Title:**	**PROGRAMMING FOR PROBLEM SOLVING USING C**
Credits:	**4**	**L – T – P**	**2-0-4**
Pre-requisite			**NIL**

Course objectives:

To impart knowledge on the

- To gain knowledge on problem solving techniques
- To learn how to write simple and modular C programs
- To develop C programs using arrays and strings
- To learn the usage of pointers in accessing and manipulating memory
- To develop applications in C using structures & files

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Classroom
8. Flipped Class

UNIT I - BASICS OF C PROGRAMMING	[6 hours]
Problem Solving Techniques: Introduction to Algorithm, Pseudo code, Flow Chart, Structure of 'C' program. C Tokens: Keywords, Data Types, Constants, Variables - Declaration - Qualifiers – typedef	

Practical Topics:

1. Steps in Problem Solving Drawing flowchart using yEd tool/Raptor Tool programs using simple statements.
2. Programs to illustrate the use of user-defined data types

UNIT II – BASIC CONSTRUCTS IN C	[6 hours]
Managing simple Input and Output operations - Operators and Expressions - Decision Making: Branching statements, looping statements - Function: Declaration, Definition - Passing arguments by value - Recursion - Storage classes	

Practical Topics:

1. Programs using decision making statements
2. Programs using looping statements
3. Programs using user defined functions and recursive functions

UNIT III – ARRAYS AND STRINGS IN C	**[6 hours]**
Arrays: Initialization - One dimensional, Two dimensional, and Multi-dimensional arrays - String: Basics, declaring and initializing strings, string handling functions: standard and user defined functions	
Practical Topics: 1. Build programs using arrays and array-based operations. 2. Programs using one dimensional and two dimensional arrays. 3. Implementations involving array usage for string operations.	

UNIT IV – POINTERS IN C	**[6 hours]**
Pointers - Passing arguments by address - Dynamic Memory Allocation - Pointer arithmetic - Pointers and one dimensional array - Pointers and Multi-Dimensional Array: Array of Pointers, Pointer to Pointer, Pointer to an array - void Pointer - Pointer to function	
Practical Topics: 1. Implementations involving pointers for dynamic memory allocation 2. Implementations involving pointers for string manipulation.	

UNIT V – STRUCTURES, UNIONS AND FILE HANDLING IN C	**[6 hours]**
Structure: Declaration, Definition-Array of Structures - Pointer to Structure – Nested Structures- Union: Defining union, Accessing union members. Files: File Management functions, Random access in file- Working with Text Files and Binary Files	
Practical Topics: 1. Programs to implement structures 2. Programs to implement union 3. Programs to implement various file operations.	

Laboratory Component: **[45 hours]**

Any 12 experiments have to be completed from the following list of experiments.

S.No.	Name of the Experiment
1	Steps in Problem Solving Drawing flowchart using yEd tool/Raptor Tool programs using simple statements
2	Programs to illustrate the use of user-defined data types
3	Programs using decision making statements
4	Programs using looping statements
5	Programs using user defined functions and recursive functions
6	Build programs using arrays and array-based operations.
7	Programs using one dimensional and two dimensional arrays.
8	Implementations involving array usage for string operations.
9	Implementations involving pointers for dynamic memory allocation
10	Implementations involving pointers for string manipulation.
11	Programs to implement structures
12	Programs to implement union
13	Programs to implement various file operations

Course outcomes:

On completion of the course, the student will have the ability to:

CO No	Corse Outcomes	Cognitive Domain
CO1	Make use of problem solving techniques to solve real world problems & outline the structure of C program	K3
CO2	Identify the appropriate looping and control statements in C and develop applications using these statements	K3
CO3	Make use of arrays & strings in development of simple applications	K3
CO4	Apply the concepts of pointers and develop C programs using pointer	K3
CO5	Develop programs for storing, retrieving and processing data using structures and files.	K3

COs and POs Mapping

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	**3**	**3**	2	-	1	**-**	-	-		-	-	1
CO2	**3**	**3**	2	-	1	-	-	-		-	-	1
CO3	**3**	**3**	2	1	1	-	-	-		-	-	1
CO4	**3**	**3**	2	1	1	-	-	-		-	-	1
CO5	**3**	**3**	3	1	1	-	-	-		-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not

Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	15	50	50
	Lab Exam	100	35		
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	20	20	20
Understand	20	20	20
Apply	60	60	60
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2015.
2. Pradip Dey, Manas Ghosh, "Programming in C", AICTE Edition, Oxford University Press, 2018

Reference Books:

1. Yashavant P. Kanetkar, "Let Us C : Authentic guide to C programming language", Eighteenth Edition, BPB Publications, 2021
2. Ashok N Kamthane, Programming in C, Pearson, Third Edition, 2020
3. Reema Thareja, "Programming in C", Oxford University Press, Second Edition, 2016.
4. Paul Deitel and Harvey Deitel, "C How to Program with an Introduction to C++", Eighth edition, Pearson Education, 2018.
5. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", 1st Edition, Pearson Education, 2013.
6. E.Balagurusamy, "Programming in ANSI C", seventh edition, Mc Graw Hill Education,2017

Suggested Skill Activities:

1. Steps in Problem Solving Drawing flowchart using yEd tool/Raptor Tool
2. Write a Program to calculate and display the volume of a CUBE having its height (h=10cm), width (w=12cm) and depth (8cm).
3. Ramya has bought 50 kg of onion for Rs 40 per kg and 60 kg of potato for Rs 20 per kg. Then she sold out all the stock with the selling price of Rs 60 per kg and Rs 30

per kg for onion and potato respectively. Write a C program which computes the profit gained by her.

4. A Food delivery boy needs to walk down every street in his area in order to deliver the food. Assume that the distances between the streets along the roads are given. The food delivery boy starts at the hotel and returns back to the hotel after delivering all the foods. Implement an algorithm to help the food delivery boy to walk minimum distance for the purpose.
5. Write a program to input name, marks of 5 subjects of a student and display the name of the student, the total marks scored, percentage scored and the class of result.
6. A location in a map is represented by a pair of points as x co-ordinate and y co-ordinate. Person X wants to move towards person Y which is residing in the location L1 and L2 respectively. Write C Program to find the distance between these two person .
7. If a four-digit number is input through the keyboard, write a program to obtain the sum of the first and last digit of this number.
8. Write a program to find GCD (greatest common divisor or HCF) and LCM (least common multiple) of two numbers
9. Write a Program to multiply two 3 X 3 Matrices.
10. Write a program to create a structure named company which has name, address, phone and no Of Employee as member variables. Read name of company, its address, phone and no Of Employee. Finally display these members‟ value.
11. Write a program to create array of books. Collect various details of books such as topic, author, department. Collect details for N books and display the details of books based on department name or author
12. A class has strength of N students. The class has two mentors, one person for the odd roll numbers and the other for the rest. Write a C program which reads the roll numbers of all the students and gives two lists of roll numbers corresponding to each advisor
13. Write a C program to maintain the inventory details of items sold in a super market such as item id, name, no of items available, price per item. Perform efficient data storage based on user‟s demand at runtime
14. Write a C program to use binary files for maintaining a telephone directory which includes telephone no, Owner name and address. Here address includes details such as door no, street name, locality, city and pincode. Update the door no of all people belonging to a particular street as follows: Increment the old door no by 10 to get the new door no. (Eg: If the old door no is 13, update it as 23).

பாடநெறி குறியீடு:	24GE201	பாடத்தின் தலைப்பு:	தமிழரும் தொழில்நுட்பமும்
கிரெடிட்	1	L – T – P	1-0-0

பாடத்திட்டநோக்கங்கள்:

1. சங்ககாலத்து நெசவுத்தொழிலை விவரிப்பதற்கும் மட்பாண்டத்தொழில் நுட்பத்தைக் கண்டறிவதற்கும்.
2. சங்ககால கட்டுமானம், மேடை அமைப்பு, சிற்பங்கள், கோவில்கள், அம்மன்கோவில், திருமலைநாயக்கர் மஹால், செட்டிநாட்டு வீடுகள், இந்தோ - சாரோசெனிக் கட்டிடக்கலை ஆகியவற்றைக் கண்டறிந்து மேற்கோள் காட்ட.
3. கப்பல் கட்டுதல் மற்றும் இரும்புத் தொழிலைக் கண்டறிதல், சிலப்பதிகாரத்தில் நாணயங்கள், மணி தயாரிக்கும் தொழிற்சாலைகள், மணிகளின் வகைகள் ஆகியவற்றைப் படிக்க.
4. நீர்நிலைகளின் முக்கியத்துவத்தைகாட்ட, கால்நடை வளர்ப்பு மற்றும் கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகளை கண்காணிக்க, விவசாயம், மீன்பிடி, முத்து மற்றும் முத்துகலாச்சாரம் மற்றும் கடல் பற்றிய பண்டைய அறிவை அங்கீகரிக்க.
5. அறிவியல் தமிழின் வளர்ச்சி மற்றும் தமிழ்க்கணிப்பொறியின் வளர்ச்சியைக் கவனிக்க, இணையத்தில் தமிழ்மென்பொருள் மேம்பாடு, தமிழ் அகராதிகளை மேற்கோள் காட்ட.

அலகு I நெசவு மற்றும் பானைத்தொழில்நுட்பம்:	[3 hours]
சங்ககாலத்தில் நெசவுத்தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பண்டங்களில் கீறல் குறியீடுகள்.	

அலகு II வடிவமைப்பு மற்றும் கட்டிடத்தொழில்நுட்பம்:	[3 hours]
சங்ககாலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்ககாலத்தில் வீட்டுப்பொருட்களில் வடிவமைப்பு - சங்ககாலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடைஅமைப்பு பற்றியவிவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் - சோழர்காலத்துப் பெருங்கோவில்கள் மற்றும் வழிபாட்டுத்தலங்கள் - நாயக்கர்காலக்கோயில்கள் மாதிரி கட்டமைப்பு பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டி நாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ - சாரோசெனிக் கட்டிடக்கலை.	

அலகு III உற்பத்தித் தொழில்நுட்பம்	[3 hours]
கப்பல் கட்டும் கலை - உலோகவியல் - இரும்பு தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு வரலாற்றுச்சான்றுகளாக செம்பு மற்றும் தங்கநாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சங்கு மணிகள் - எலும்புத்துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.	

அலகு IV வேளாண்மை மற்றும் நீர்பாசனத்தொழில்நுட்பம்	[3 hours]
அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக்கு குமுழித்தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன் வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்.	

அலகு V அறிவியல் தமிழ் மற்றும் கணிதத்தமிழ்:	[3 hours]
அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.	

பாடநெறி முடிவுகள் (பாமு):

பாடநெறியின் முடிவில், மாணவர் பின்வரும் திறன்களைப் பெறுவார்:

பாமு	**பாடநெறி முடிவுகள்**	**மிக உயர்ந்த அறிவாற்றல் நிலை**
அலகு I பாமு:	சங்க கால ஐவுளி தொழில் மற்றும் மட்பாண்ட தொழில்நுட்பம் பற்றி அறிவார்கள்.	கே 1
அலகு II பாமு:	சங்க கால கட்டுமானம், மேடை அமைப்பு, சிற்பங்கள், கோவில்கள், அம்மன் கோவில், திருமலை நாயக்கர் மஹால், செட்டிநாட்டு வீடுகள், இந்தோ-சராசனிக் கட்டிடக்கலை ஆகியவற்றை விவரிக்க இயலும்.	கே 2
அலகு III பாமு:	கப்பல் கட்டுதல், இரும்புத் தொழில், நாணயம் தயாரித்தல் மற்றும் மணி தயாரிக்கும் தொழில்கள் பற்றி அறிந்து கொள்கிறார்கள்.	கே 1
அலகு IV பாமு:	நீர்நிலைகளின் முக்கியத்துவம், கால்நடை வளர்ப்பு, கிணறு, விவசாயம், மீன்பிடி, முத்து மற்றும் முத்து கலாச்சாரம் மற்றும் கடல் பற்றிய போதுமான அறிவை பெற்றுகொள்கிறார்கள் .	கே 1

அலகு V பாமு:	அறிவியல் தமிழின் வளர்ச்சி, தமிழ்க் கணிப்பொறியின் வளர்ச்சி, இணையத்தில் தமிழ் மென்பொருள் மேம்பாடு, தமிழ் அகராதிகளை சந்தேகம் இன்றி முழுமையாக தெரிந்து கொள்கிறார்கள்.	கே 1

மதிப்பீட்டு முறை

ப்ளூமின் வகை	தொடர்ச்சியான மதிப்பீட்டு சோதனைகள்		இறுதி தேர்வு
	1	2	
நினைவில் கொள்ளுதல்	60	50	60
புரிந்து கொள்ளுதல்	40	50	40
விண்ணப்பித்தல்	0	0	0
பகுப்பாய்வுதல்	0	0	0
மதிப்பிடுதல்	0	0	0
உருவாக்குதல்	0	0	0

பாடநெறி முடிவுகள் *மற்றும் நிரல் முடிவுகள் ஒப்பிடுதல்*

பாமு**கள்**	மிக உயர்ந்த அறிவாற்றல் நிலை	**பாடநெறி முடிவுகள்**											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
பாமு**1**	கே 1	**2**											
பாமு**2**	கே 2	**1**											
பாமு**3**	கே 1	**1**											
பாமு**4**	கே 1	**1**											
பாமு**5**	கே 1	**1**											

நிலை 3- அதிக ஒத்துப்போதல், நிலை 2- மிதமாக ஒத்துப்போதல், நிலை 1- குறைவாக ஒத்துப்போதல், நிலை 0- ஒத்துப்போகவில்லை

மதிப்பீட்டுத் திட்டம்:

கூறுகள்	மதிப்பீட்டின் வகை	அதிகபட்ச மதிப்பெண்கள்	குறைக்கப்பட்ட மதிப்பெண்கள்	இறுதி மதிப்பெண்கள்
தொடர்ச்சியான உள் தேர்வு	தொடர்ச்சியான உள் தேர்வு - I	100	40	40
	தொடர்ச்சியான உள் தேர்வு - II	100	40	
இறுதி பருவ தேர்வு	எழுத்து தேர்வு	100	60	60
மொத்தம்				100

இறுதி பருவ தேர்வு: (கேள்வி முறை)

- ஒவ்வொரு யூனிட்டும் இரண்டு 2 மதிப்பெண் வினாக்களையும் ஒரு 16 மதிப்பெண் வினாவையும் (இரண்டில் ஒன்று) கொண்டுள்ளது.
- பதினைந்து கேள்விகளுக்கும் பதிலளிக்க வேண்டும்.

TEXT BOOKS

1. *தமிழக வரலாறு – மக்களும் பண்பாடும்* - கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. *கணினித்தமிழ் – முனைவர் இல. சுந்தரம்.* (விகடன் பிரசுரம்).
3. *கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம்* (தொல்லியல்துறை வெளியீடு)
4. *பொருநை – ஆற்றங்கரை நாகரிகம்.* (தொல்லியல்துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print).
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).

REFERENCE BOOKS

1. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
2. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
3. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
4. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
5. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
7. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Course Code:	24MA201	Course Title:	**Complex Variables and Transforms** (Common to ALL branches)
Credits:	**4**	**L – T – P**	**3 – 1 – 0**

Course objectives:

- To impart analytical ability in solving mathematical problems as applied to the respective branches of Engineering.
- To familiarize the students with complex integration techniques and contour integration techniques which can be used in real integrals.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.

Teaching-Learning Process:

These are sample strategies which teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method does not mean only traditional method, but different type of teaching methods may be adopted to develop the outcomes.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Topics will be introduced in a multiple representation and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT I – Complex Differentiation	**[12 hours]**
Function of a complex variable – Analytic functions – Necessary conditions and sufficient conditions (excluding proof) – Cauchy – Riemann equations – Properties of analytic function – Harmonic conjugate – Construction of Analytic functions – Conformal mapping: w = z+a, az, 1/z, and bilinear transformation.	

UNIT II – Complex Integration	**[12 hours]**
Statement and application of Cauchy's integral theorem and integral formula – Taylor and Laurent expansions – Isolated singularities – Residues - Cauchy's residue theorem. Applications: Contour integration over unit circle and semicircular contours (excluding poles on axis).	

UNIT III – Laplace Transforms	**[12 hours]**
Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems – Transforms of derivatives and integrals – Initial and Final Value Theorem – Inverse Laplace Transform – Convolution Theorem (Statement only) – Solution of linear second order Ordinary differential equations with constant coefficients using Laplace transforms.	

UNIT IV – Fourier Series and Fourier Transforms	[12 hours]
Dirichlet's conditions – General Fourier series – Odd and even functions – Half range series – Harmonic analysis - Statement of Fourier integral theorem – Fourier transform pair – Parseval's identity.	

UNIT V – Partial Differential Equation	[12 hours]
Formation of partial differential equations - Classification of partial differential equations - Solutions of one dimensional wave equation, One dimensional heat equation (excluding insulated ends) – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges).	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Construct analytic functions and use their conformal mapping property in Engineering problems.	K3
CO2	Solve real and complex integrals using the Cauchy's integral formula and residue theorem.	K3
CO3	Apply Laplace transforms techniques in system modelling, digital signal processing, process control, solving boundary value problems	K3
CO4	Apply Fourier series to solve the steady state two-dimensional heat equation in Cartesian coordinates.	K3
CO5	Apply the effective mathematical tools for solutions of partial differential equations that model physical phenomena and engineering problems.	K3

COs and POs Mapping:

COs	**POs**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	1
CO5	3	2	1	-	-	-	-	-	-	-	-	-
CO6	3	2	1	-	-	-	-	-	-	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	20	20	20
Understand	20	20	20
Apply	60	60	60
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
3. Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012
4. Kandasamy. P., Thilagavathy. K, and Gunavathy. K, Engineering Mathematics Volume I & II, S. Chand & Co, New Delhi, 2005.Reference Books:

Equivalent NPTEL/SWAYAM Courses

S. No.	Course Title	Course Instructor	Host Institute
1.	Partial Differential Equations	Prof. Sivaji Ganesh	IIT Bombay
2.	Introduction to Fourier Analysis	Prof. Parasar Mohanty	IIT Kanpur
3.	Complex Analysis	Prof. Pranav Haridas	IIT Madras

Web Links and Video Lectures (E-Resources):

1. Analytic Functions, C-R Equations: https://www.nptelvideos.com/lecture.php?id=13416
2. Laplace Transform and its Existence: https://www.nptelvideos.com/lecture.php?id=13433
3. Taylor's, Laurent Series of f(z) and Singularities: https://www.nptelvideos.com/lecture.php?id=13431
4. Applications of Fourier Transform to PDEs: https://www.nptelvideos.com/lecture.php?id=13442

Course Code	**24PH201**	**Course Title:**	**PHYSICS FOR ELECTRONICS ENGINEERING (ECE & EEE)**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

- To study the electrical properties of materials including electron theory of metals.
- To familiarize with the properties of semiconductors, determination of charge carriers and device applications.
- Equipping the students to understand the applications of magnetic materials and dielectric materials.
- To establish sound grasp of knowledge on different optical properties of materials, optical displays and applications.
- To inculcate an idea of significance of Nano structures, quantum confinement and the preparation of Nano materials.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I CONDUCTING MATERIALS	[9 hours]
Classical free electron theory - Expression for electrical conductivity - Thermal conductivity, Wiede Mann Franz law, Merits & Demerits of classical free Electron Theory - Quantum free electron theory - Electron in a metal – degenerate and non-degenerate states – Fermi- Dirac statistics– Density of energy states – Energy bands in solids – Electron effective mass.	

UNIT II SEMICONDUCTING MATERIALS	[9 hours]
Direct and indirect band gap semiconductors – Intrinsic Semiconductors - Carrier concentration in intrinsic semiconductors - Variation of Fermi level with temperature – extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors – Variation of Fermi level with temperature – Hall effect and devices- Ohmic contacts– Schottky diode.	

UNIT III MAGNETIC AND DIELECTRIC MATERIALS	[9 hours]
Magnetic materials – Classification (Dia, Para & Ferro) – Hysteresis – Ferrites - $BaTiO_3$ – Application of Nd-FeB magnets. Electric polarization – Different types of polarization – Temperature and frequency dependence –Dielectric loss and dielectric breakdown – dielectric materials applications - capacitors and transformers.	

UNIT IV MATERIALS FOR ELECTRONICS	[9 hours]
Classification of optical materials –Optical process in Semiconductors-Optical absorption and emission- carrier generation and recombination processes - Absorption emission and scattering of light in metals, insulators and semiconductors (concepts only) - LCD-Photo Transistor- photo current in a P-N diode – Laser diodes -solar cell - LED – Organic LED.	

UNIT V NANO MATERIALS	[9 hours]
Nanomaterials-Quantum Confinement-Quantum Structures-Density of states for quantum well-Wire-Dots-Preparation of Nano Materials- Ball Milling - Pulsed Laser Deposition-Sol -Gel Method-Electro Deposition Method- Plasma arc method.	

Course Outcomes: On completion of the course, the student will have the ability to:

CO No	Course Outcomes	Level
CO1	Explain the electrical properties of materials.	K2
CO2	Apply semiconducting properties of materials in electronics.	K3
CO3	Infer the properties of magnetic and dielectric materials for relevant electrical and electronics engineering applications	K2
CO4	Apply the optical properties of materials in opto electronic devices.	K3
CO5	Apply the concept of Nano materials for Nano devices.	K3

COs and POs Mapping

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	2	1	2	-	-	-	-	-	-	-	-	1
CO2	2	1	2	-	-	-	-	-	-	-	-	1
CO3	2	1	1	-	-	-	-	-	-	-	-	1
CO4	3	1	1	-	-	-	-	-	-	-	-	1
CO5	3	2	1	-	-	-	-	-	-	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- NotMapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End semester Examination
	1	**2**	
Remember	20	20	20
Understand	60	40	40
Apply	20	40	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

1. Each unit consists of two 2 marks questions and one 16 marks question (either or).
2. All the fifteen questions have to be answered.

TEXT BOOKS:

1. S.O. Kasap. Principles of Electronic Materials and Devices, McGraw Hill Education (Indian Edition), 2020.
2. R.F. Pierret. Semiconductor Device Fundamentals. Pearson (Indian Edition), 2006.
3. G.W. Hanson. Fundamentals of Nano electronics. Pearson Education (Indian Edition), 2009.

REFERENCE BOOKS:

1. Jasprit Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Education (Indian Edition), 2019.
2. Charles Kittel, Introduction to Solid State Physics, Wiley India Edition, 2019.
3. Mark Fox, Optical Properties of Solids, Oxford Univ.Press, 2001.

NPTEL COURSE:

Sl.No	Course Name	Course Instructor	Course Conducting Agency
1	Solid state Physics	Prof. Amal Kumar Das	IIT Kharagpur

WEB LINKS AND VIDEO LECTURES (E-RESOURCES):

1. Electrical Conductivity: https://www.youtube.com/watch?v=QvPSVwzU-8A
2. Band Theory of solids: https://www.youtube.com/watch?v=qcE2Wcpm05k&ab_channel=nptelhrd
3. Intrinsic semiconductor: https://www.youtube.com/watch?v=JZN3DAaeOB8

Suggested Skill Activities:

1.As you look at materials and objects around your house Which do you think are conductors and insulators?

2. Identify the change when you connect a light bulb to battery using conductive materials?

3. What will happen if you connect a light bulb to battery using insulating materials?

4. List the usage of alphanumerical displays in day to life.

5.Compute the size variation and efficiency of the nano materials.

6.Illustrate the role of semiconductors in renewable energy technologies.

7.Explain the reason for using smart materials like SMA in retractable roofs.

8.List out 10 uses of magnetic materials in house.

9.Explain the role of nanomaterials in Electronics

10.Discuss about the role of semiconductor in temperature sensors which is air conditioner.

Course Code:	24CY401	Course Title:	Environmental Science and Engineering
Credits:	2	L – T – P	2-0-0

Course objectives:
To impart knowledge on the • To gain in-depth knowledge on natural processes and resources that sustain life andgovern the economy. • To know the importance of water resources which are important socially, economicallyviable and environmentally sustainable. • To impart the Knowledge of pollution and its control methods. • To mitigate the environmental and health risks associated with indiscriminate waste andfind suitable methodologies for waste management. • To balance ecological, economic and social goals, such as reducing carbon emissions,promoting renewable energy and ensuring equitable resource access.
Teaching-Learning Process:
Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. NPTEL and Other Videos 3. Smart Class Room 4. Field visit 5. Project based learning 6. Industrial Visit

UNIT I - ECOLOGY AND BIODIVERSITY	**[6 hours]**
Definition, scope and importance of environment – need for public awareness – conceptof an ecosystem - Biodiversity and its values- Biodiversity at global, national and local level- India as a mega-diversity nation – hotspots of biodiversity – threats to biodiversity – endangered and endemic speciesof India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.	

UNIT II - WATER RESOURCES AND ENVIRONMENT MICROBIOLOGY	**[6 hours]**
Water resources: Use and over- utilization of surface and groundwater – dams benefits and problems, conflicts over water –Water availability at global level, surface level, ground level- Sources-Hydro phonics -Classification of microorganism –Role of microorganism in waste water treatment-Bacterial nutrition and growth.	

UNIT III - AIR AND NOISE POLLUTION	[6 hours]
Sources and classification of air pollutants and their effect on human health-Ambient air quality and emission standards-Air pollutants-Particulate matters-Control equipments-Gravity separator-Centrifugal separator-fabric filter-Electrostatic separator, Catalytic convertors– Noise pollution-causes – Consequences-Control measures- modern tools used in pollution mitigation measures-sustainable activity of pollution control- recent case studies - Environmental Protection Act.	

UNIT IV - SOLID WASTE AND HAZARDOUS WASTE MANAGEMENT	[6 hours]
Soil contaminants–sources and management methods of -Solid Waste Hazardous waste – Plastic waste- -Biomedical waste- Hazardous waste& E-waste management -Case studies on Occupational Health and Safety Management system (OHASMS).	

UNIT V - ENVIRONMENTAL MANAGEMENT AND SUSTAINABLE DEVELOPMENT	[6 hours]
Renewable and non-renewable energy Sources- Energy Polices- Development, GDP, Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment-Sustainable goals -Sustainable habitat-Green buildings, Green materials, Energy efficiency, Sustainable transports. Carbon emission-Carbon footprint-Carbon Sequestration.	

Course Outcomes:
On completion of the course, the student will have the ability to:

CO1	Illustrate the important features of environment and its conservation.	K2
CO2	Explain the need of water resources and its application to meet the modern requirements and the necessity of its conservation.	K2
CO3	Identify the causes, effects of environmental pollution and explain the control techniques for particulate, gaseous emissions and contribute to the preventive measures in the society.	K3
CO4	Identify the different management methods of solid and hazardous waste.	K3
CO5	Explain the sustainability practices and identify green materials for sustainable development.	K2

COs and POs Mapping

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	1	-	-	-	-	1	1	-	-	-	-	-
CO2	2	1	-	-	-	1	1	-	-	-	-	-
CO3	2	-	-	-	-	1	2	1	-	-	-	-
CO4	1	-	-	-	-	2	2	1	-	-	-	-
CO5	1	-	-	-	-	1	2	1	-	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- NotMapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	60	100	40
	CIE – II	100			
	Skill Assessment – I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	**2**	
Remember	20	20	20
Understand	60	40	40
Apply	20	40	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Benny Joseph, Environmental Science and Engineering ‘, Tata McGraw-Hill, New Delhi, (2014).
2. Miguel Fischer, “Environmental Management: Ecosystems, Competitiveness and Waste Management” Nova Science Publishers, (2021)

Reference Books:

1. Dharmendra S. Sengar, ‘Environmental law ‘, Prentice hall of India Pvt Ltd, New Delhi, (2007).
2. Erach Bharucha, “Textbook of Environmental Studies”, Universities Press Pvt, Ltd, Hydrabad, (2015).
3. G. Tyler Miller, Scott E.Spoolman,“Environmental Science”,Cengag Learning IndiaPvt. Ltd, Delhi, (2014).
4. Mahuabasu, Xavier Saverimuthu, “Fundamentals of Environmental Studies”, Cambridge university press, (2017)
5. Anubha Kaushik, C.P. Kaushik, “Perspectives in Environmental Studies”, New Age International Pvt. Ltd, New Delhi, (2004). 6. Frank R. Spellman, “Handbook of EnvironmentalEngineering”, CRC Press, (2015).

Web Links and Video Lectures (E-Resources):

1. Ecology andSociety**:** https://onlinecourses.nptel.ac.in/noc24_hs149/preview
2. SustainablePower GenerationSystems**:** https://onlinecourses.nptel.ac.in/noc24_ge54/preview
3. Environmentand Development**:** https://onlinecourses.nptel.ac.in/noc24_hs150/preview

Suggested Skill Activities:

1. Why is it beneficial to follow a student centered and participatory process for environmental education?
2. Identify the endemic species of flora and fauna found nearest to your locality.
3. List the major arguments cited against the construction of dams.
4. Discuss how the symbiotic relationship between algae and bacteria is useful in the treatment of sewage in an oxidation pond.
5. List the various ways in which an individual can contribute towards pollution prevention in the society.
6. Mention any four hazardous wastes originating from households and explain their management strategies.
7. Conduct a survey and find out how chemicals and various material are distributed / cycled in your campus.
8. List the common organic materials that are suitable and unsuitable for composting.
9. List the advantages of recycling of MSW with examples.
10. What are the major obstacles in the implementation of incineration technology in developing countries?

Course Code:	24GE202	Course Title:	**Basic Civil and Mechanical Engineering**
Credits:	**4**	**L – T – P**	**4-0-0**

Course objectives:
To impart knowledge on the ● To help students acquire knowledge in the basics of surveying and the materials used for construction. ● To learn the concepts and laws of thermodynamics to predict the operation of thermodynamic cycles. ● To explain the component of power plant units and detailed explanation to IC engines their Working principles ● To explain the Refrigeration & Air-conditioning system.
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. NPTEL and Other Videos 3. Smart Class Room 4. Field visit 5. Project based learning 6. Industrial Visit

UNIT I - SURVEYING AND CIVIL ENGINEERING MATERIALS	**[12 hours]**
Surveying: Objects – types – classification – principles – measurements of distances – angles – leveling – determination of areas – illustrative examples. Civil Engineering Materials: Bricks – stones – sand – cement – concrete – steel Sections-Thermal and acoustic insulating materials- Decorative panels- water proofing materials.	

UNIT II - BUILDING COMPONENTS AND INFRASTRUCTURE	**[12 hours]**
Foundations: Types, Bearing capacity – Requirement of good foundations. Superstructure: Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring – plastering-– Introduction to Green Buildings.	

UNIT III - LAW OF THERMODYNAMICS	**[12 hours]**
Basic Concepts: Thermodynamic systems, properties with measurements – Zeroth law of thermodynamics, states, and processes- definition and classification, Thermodynamic work and heat – Classification and sign convention. Point and path functions. Statement for control mass undergoing cycle, corollaries –. Internal energy and Enthalpy – specific heats, application of First law to standard reversible processes – Isochoric, Isobaric, Isothermal, reversible adiabatic and Polytropic, Second law of thermodynamics.	

UNIT IV- POWER PLANTS AND INTERNAL COMBUSTION ENGINES	[12 hours]
Classification of Power Plants- Working principle of steam, Gas, Diesel, Hydro -electric and Nuclear Power plants- Internal combustion engines as automobile power plant – Otto cycle, Diesel cycle -Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines.	

UNIT V- REFRIGERATION AND AIR CONDITIONING SYSTEM	[12 hours]
Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system – Layout of typical domestic refrigerator – Window and Split type room Air conditioner. Properties of air - water mixture, concepts of psychometry and its process.	

Course Outcomes:

On completion of the course, the student will have the ability to:

CO1	Describe the importance, objectives and principles of surveying and construction materials.	K1
CO2	Outline the building planning and components including Infrastructure.	K2
CO3	Illustrate the power production based on the fundamentals Laws of Thermal Engineering.	K2
CO4	Illustrate the working principle of IC Engines and Power Plants	K2
CO5	Explain the principles of Refrigeration and Air Conditioning	K2

COs and POs Mapping:

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	1	1	-	-	-	-	-	-	-	-	1	1	-	2
CO 2	2	1	1	-	-	-	-	-	-	-	-	1	1	-	2
CO 3	2	1	1	-	-	-	-	-	-	-	-	1	1	-	2
CO 4	2	1	1	-	-	-	-	-	-	-	-	1	1	-	2
CO 5	2	1	1	-	-	-	-	-	-	-	-	1	1	-	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped,

Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	60	100	40
	CIE – II	100			
	Skill Assessment – I	40	40		
	Skill Assessment – II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	80	80	80
Apply	0	0	0
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. G Shanmugam, M S Palanichamy, Basic Civil and Mechanical Engineering, McGraw Hill Education; First edition, 2018.
2. Nag.P.K., "Engineering Thermodynamics", 6th Edition, Tata McGraw Hill (2017), New Delhi.
3. Natarajan, E., "Engineering Thermodynamics: Fundamentals and Applications", 2nd Edition (2014), Anuragam Publications, Chennai.
4. Ganesan.V, " Internal Combustion Engines" 4th Edition, Tata McGraw Hill, 2012.

Reference Books:

1. Ramamrutham S., ―Basic Civil Engineering‖, Dhanpat Rai Publishing Co.(P) Ltd, 2013.
2. Seetharaman S., ―Basic Civil Engineering‖, Anuradha Agencies, 2005.
3. Chattopadhyay, P, "Engineering Thermodynamics", 2nd Edition Oxford University Press, 2016.
4. Rathakrishnan, E., "Fundamentals of Engineering Thermodynamics", 2nd Edition, Prentice Hall of India Pvt. Ltd, 2006.

5. Claus Borgnakke and Richard E. Sonntag, “Fundamentals of Thermodynamics”, 10th Edition, Wiley Eastern, 2019.
6. Venkatesh. A, “Basic Engineering Thermodynamics”, Universities Press (India) Limited, 2007.
7. Gupta H.N, “Fundamentals of Internal Combustion Engines”, 2nd Edition Prentice Hall of India, 2013.
8. Mathur M.L and Mehta F.S., “Thermal Science and Engineering”, 3rd Edition, Jain Brothers Pvt. Ltd, 2017.
9. Soman. K, “Thermal Engineering”, 2nd Edition, Prentice Hall of India, 2011.

Web Links and Video Lectures (E-Resources):

1. Building materials and components**:** https://onlinecourses.nptel.ac.in/noc24_ar21/preview
2. Advanced Thermodynamics and Combustion**:** https://onlinecourses.nptel.ac.in/noc24_me135/preview
3. Applied Thermodynamics for Engineers**:** https://onlinecourses.nptel.ac.in/noc24_me137/preview
4. Refrigeration and Air-conditioning: https://onlinecourses.nptel.ac.in/noc24_me90/preview

Suggested Skill Activities:

1. Explain the classification of surveying. (i) What are the differences between prismatic compass and surveyors’ compass? (ii) What is the difference between plane surveying and geodetic surveying? 2. Explain the measurement of horizontal angles using theodolite.
3. Discuss the various physical and mechanical properties of building materials. 4. State and explain the various essential qualities of good bricks.
5. A rigid tank containing 0.4 m3 of air at 400 kPa and 30°C is connected by a valve to a piston cylinder device with zero clearance. The mass of the piston is such that a pressure of 200 kPa is required to raise the piston. The valve is opened slightly and air is allowed to flow into the cylinder until the pressure of the tank drops to 200 kPa. During this process, the heat is exchanged with the surrounding such that the entire air remains at 30°C at all times. Determine the heat transfer for this process. 6. A piston and cylinder machine contains a fluid system which passes through a complete cycle of four processes. During the cycle, the sum of all heat transfers is - 170 kJ. The system completes 100 cycles per minute. Complete the following table showing the method for each item and compute the net rate of work output in kW. 7. A piston cylinder assembly contains air (ideal gas with $\gamma = 1.4$) at 200 kPa and occupies a volume of 0.01 m3. The piston is attached to one end of a spring and the other end of the spring is fixed to a wall. The force exerted by a spring on the piston is proportional to the decrease in length of the spring from its natural length. The ambient atmospheric pressure is 100 kPa. Now, the air in the cylinder is heated till the volume is doubled and

at this instant, it is found that the pressure of the air in the cylinder is 500 kPa. Calculate the work done by the gas.
8. Stages of combustion process in SI Engine with P- θ diagram. 9. Working of thermal power plant. 10. Different types of combustion chambers in SI engine
11. Describe construction and working of window air conditioner. 12. Write note on 13. (a) packaged air conditioner (b) chilled water plant.

Course Code:	**24EE201**	**Course Title:**	**Electric Circuits**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To apply the concepts to analyze and understand electrical circuits
- To identify the knowledge on solving circuit equations using network theorems
- To interpret the transient response of electric circuits.
- To identify the phenomenon of resonance in coupled circuits.
- To illustrate Phasor diagrams and analysis of single &three phase circuits

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Blended Mode of Learning
3. Experiential Learning
4. NPTEL and Other Videos for theory topics
5. Flipped Class
6. Lab Experiment Videos

UNIT I – Basic Circuits Analysis	**[9 hours]**
Fundamentals concepts of R, L and C elements - Energy Sources - Ohm's Law -Kirchhoff's Laws - DC Circuits - Resistors in series and parallel circuits - Mesh current and node voltage methods of analysis D.C and A.C Circuits.	

UNIT II – Network Reduction and Theorems for DC and AC Circuits	[9 hours]
Network reduction: voltage and current division, source transformation - star delta conversion. Theorems - Superposition, Thevenin's and Norton's Theorem - Maximum power transfer theorem - Reciprocity Theorem - Statement, application to DC and AC Circuits	

UNIT III – Transient Response Analysis	[9 hours]
Introduction - Laplace transforms and inverse Laplace transforms - standard test signals - Transient response of RL, RC and RLC circuits using Laplace transform for Source free, Step and Sinusoidal input.	

UNIT IV – Resonance and Coupled Circuits	[9 hours]
Series and parallel resonance - frequency response - Quality factor and Bandwidth - Self and mutual inductance - Coefficient of coupling - Dot rule- Single Tuned circuits.	

UNIT V – Three Phase Circuits	[9 hours]
Analysis of three phase 3wire and 4wire circuits with star and delta connected loads, balanced and unbalanced - phasor diagram of voltages and currents - power measurement in three phase circuits.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO No	Course Outcomes	Cognitive Level
CO1	Apply the circuit laws for measuring the electrical parameters in DC & AC circuits.	K3
CO2	Apply the network theorem for measuring the electrical parameters of Domestic & Industrial Appliances.	K3
CO3	Interpret the transient response of RLC circuit for standard test signals by using Laplace Transform.	K2
CO4	Infer the frequency response to find its domain specifications.	K2
CO5	Interpret the three phase system performance under balanced and unbalanced condition.	K2

COs and POs Mapping:

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	2	1	-	2	-	-	-	-	-	-	-
CO2	3	2	1	-	2	-	-	-	-	-	-	-
CO3	2	1	-	-	2	-	-	-	-	-	-	-
CO4	3	2	-	-	2	-	-	-	-	-	-	-
CO5	2	1	-	-	2	-	-	-	-	-	-	-

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	80	40
Apply	60	0	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. William H. HaytJr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", McGraw Hill publishers, 9thedition, New Delhi, 2020.
2. Chakrabarti A, "Circuits Theory (Analysis and synthesis), DhanpatRai& Sons, New Delhi, 2020.
3. Allan H. Robbins, Wilhelm C. Miller, "Circuit Analysis Theory and Practice", Cengage Learning India, 2013.

Reference Books:

1. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, 2019.
2. Sudhakar A and Shyam Mohan SP, "Circuits and Networks Analysis and Synthesis", McGraHill, 2015.
3. Joseph A. Edminister, Mahmood Nahvi, "Electric circuits", Schaum's series, McGraw-Hill, First Edition, 2019.
4. Richard C. Dorf and James A. Svoboda, "Introduction to Electric Circuits", 7th Edition, John Wiley Sons, Inc. 2018.

Web Links and Video Lectures (E-Resources):

1. Basic Electrical Circuits: https://onlinecourses.nptel.ac.in/noc24_ee112/preview
2. Semiconductor Devices and Circuits: https://onlinecourses.nptel.ac.in/noc24_ee143/preview
3. Basic Course on Electric and Magnetic circuits : https://onlinecourses.nptel.ac.in/noc24_ee125/preview
4. Electrical Equipment and Machines : https://onlinecourses.nptel.ac.in/noc24_ee91/preview

Suggested Skill Activities:

1. List of different loads available in home & college and prepare the power rating chart.
2. Measurement of Energy consumption in home.
3. Find the current through particular element using Thevenin's theorem in a practical circuit.
4. Find the voltage across particular element using Norton's theorem in a practical circuit.
5. Analyze the transient response of R & RL load in a practical circuit.
6. Analyze the transient response of RLC circuit using PSPICE.
7. Experiment verification of series RLC circuit in Induction Heating.
8. Experiment verification of parallel RLC circuit.
9. Experimental verification of balanced three phase circuit.
10. Experimental verification of unbalanced three phase circuits.

Course Code:	24EC301	Course Title:	Electron Devices and Circuits
Credits:	**4**	**L – T – P**	**3-0-2**
Pre-requisite			**NIL**

Course objectives:

To impart knowledge on the

- Characteristics of PN junction diode, rectifiers and special diodes
- Operation of transistors for obtaining the switching responses.
- Concept of amplifiers and oscillators to generate analog signals.
- Operation of wave shaping circuits and multivibrators.
- Working principles and application of the optoelectronic devices and sensors

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Experiential Learning
5. NPTEL and Other Videos
6. Smart Class Room
7. Flipped Class

UNIT I – Semiconductor Diodes	[9 hours]

PN junction diode, forward and reverse bias characteristics, Rectifiers – Half Wave and Full Wave Rectifier, Zener and Avalanche breakdown, Zener diode, Varactor diode, Tunnel diode- Gallium Arsenide device.

Practical Topics:

1. Verify the characteristics of PN-diode working in forward and reverse bias condition
2. Verify the characteristics of Zener-diode working in forward and reverse bias condition
3. Implementation of Full Wave Rectifier with Filters.

UNIT II – Transistors	[9 hours]

Bipolar Junction Transistors: NPN –PNP, transistor, Principle of Operation: Common Emitter, Common Base and Common Collector Configurations. Field Effect Transistors: Junction field Effect Transistor (JFET) – Drain and Transfer characteristics, MOSFET-Characteristics, Comparison of MOSFET with JFET, Uni Junction Transistor (UJT), Silicon Controlled Rectifier (SCR), CMOS.

Practical Topics:

1. Plot Input, Output characteristics for BJT in CE mode
2. Determine output, transfer characteristics of Enhancement MOSFET

UNIT III - Feedback Amplifiers and Oscillators	[9 hours]
Feedback Concepts, gain with feedback, Effect of feedback on gain stability, distortion, bandwidth, input and output impedances; topologies of feedback amplifiers - Barkhausen criterion for oscillation, phase shift, Wien bridge — Hartley & Colpitts oscillators, Clapp oscillator-crystal oscillators	
Practical Topics: 1. Design and implementation of Hartley oscillators.	

UNIT IV - Wave Shaping and Multivibrator Circuits	[9 hours]
Pulse circuits, Attenuators, RC integrator and differentiator circuits, diode clampers and clippers, Multivibrators: Astable Multivibrator, Monostable Multivibrator, Bistable Multivibrator, Schmitt Trigger	
Practical Topics: 1. Design and implementation RC integrator and differentiator circuits 2. Design and implementation diode clampers and clippers	

UNIT V – Optoelectronic Devices and Sensors	[9 hours]
Construction operation and characteristics of seven segment Displays, LCD, Plasma devices, Photo conductive cells, Photodiodes and, Optocouplers, Photomultiplier Tube. Optical sensors: light intensity – wavelength and color – light dependent resistors, photo transistor	
Practical Topics: 1. Automatic ON and OFF Light Circuit using Phototransistor	

Laboratory component: **30 Hours**

S.No.	Name of the experiment
1	Study of electronic instruments and components
2	Verify the characteristics of PN-diode working in forward and reverse bias condition
3	Verify the characteristics of Zener diode working in forward and reverse bias condition
4	Implementation of Full Wave Rectifier with Filters.
5	Plot Input, Output characteristics for BJT in CE mode
6	Determine output, transfer characteristics of Enhancement MOSFET
7	Design and implementation of Hartley oscillators.
8	Design and implementation of RC integrator and differentiator circuits
9	Design and implementation of diode clampers and clippers
10	Automatic ON and OFF Light Circuit using Phototransistor

Course Outcomes:

On completion of the course, the student will have the ability to:

COs	Course outcomes	Cognitive domain
CO1	Explain the working principle of diodes to use it as switching devices in electronic circuits.	K2
CO2	Infer the switching characteristics of transistors to compare the current controlled and voltage-controlled devices for real time applications.	K2
CO3	Construct oscillators and amplifiers for various signal generation circuits.	K3
CO4	Construct the wave shaping circuits to modify waveforms for realizing analog signal.	K3
CO5	Explain the application of optoelectronic devices and sensors in various fields to sense the physical input quantity.	K2

COs and POs Mapping:

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	2	1	1	-	-	-	-	-	2	-	-	1
CO2	2	1	1	-	-	-	-	-	2	-	-	1
CO3	2	1	1	-	-	-	-	-	2	-	-	1
CO4	3	2	1	-	-	-	-	-	2	-	-	1
CO5	2	1	1	-	-	-	-	-	2	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

Assessment Pattern:

Bloom's Category	Internal Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	60	40	40
Apply	20	40	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or choice).
- All the fifteen questions have to be answered.

Text Books:

1. Zedra Smith, "Microelectronic Circuits: Theory And Applications," 7th edition, Oxford Higher Education, 2014.
2. Salivahanan S, Suresh Kumar N, Vallavaraj A, "Electronic Devices and circuits", Fifth Edition, Tata McGraw- Hill, 2022.
3. Ben G. Streetman and Sanjay Banerjee, "Solid State Electronic Devices", Pearson India, 2016 (Seventh Edition).
4. Thomas Grandke, Henry Bolte, 'Sensors – A Comprehensive Sensors,' John Wiley

Reference Books:

1. Robert Boylestad and Louis Nashelsky, "Electron Devices and Circuit Theory", Pearson Prentice Hall, 10th edition, July 2008.
2. R.S.Sedha," A Text Book of Applied Electronics", S.Chand Publications, 2006.
3. Floyd, "Electronic Devices", Ninth Edition, Pearson Education, 2012.
4. Yang, "Fundamentals of Semiconductor devices", McGraw Hill International Edition, 1978.

Web Links and Video Lectures (E-Resources):

1. PN Junction Diode: https://nptelvideos.com/video.php?id=2442&c=4
2. Diode Rectifier circuits: https://nptelvideos.com/video.php?id=2441&c=4
3. NPN –PNP, transistor operation: https://nptelvideos.com/video.php?id=2439&c=4
4. Feedback amplifiers: https://nptel.ac.in/courses/117106088
5. Diode clampers and clippers: https://nptelvideos.com/video.php?id=408
6. Optical sensors: https://onlinecourses.nptel.ac.in/noc22_ph01/preview

Suggested Skill Activities:

1. Apply the concept of PN junction diode design Half wave rectifier for electronic circuits.
2. Convert AC signals to DC by using the concept of Rectifier
3. Construct the electronic switch using transistor in any one application
4. Regulate the voltage using the characteristics of Zener diode.
5. Design LED flasher/ change colour using transistor
6. Make the model of Automatic light lamp for the traffic system using transistor
7. Make a proximity sensor using BC547 NPN transistor, photo Diode and LED

Course Code:	**24EE231**	**Course Title:**	**ELECTRIC CIRCUITS LABORATORY**
Credits:	**1**	**L – T – P**	**0-0-2**

Course objectives:
To provide hands on training to the students in: ● To simulate various electric circuits using Pspice/ Matlab/e-Sim / Scilab ● To gain practical experience on electric circuits and verification of theorems.
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 7. Project based learning 8. Lab Experiment Videos

EXPERIMENTS	**[60 hours]**
1. Simulation and experimental verification of KCL in series and parallel electrical circuit using fundamental laws. 2. Simulation and experimental verification of KVL in series and parallel electrical circuit using fundamental laws. 3. Simulation and experimental verification of electrical circuit problems using Thevenin's theorem. 4. Simulation and experimental verification of electrical circuit problems using Norton's theorem.	

5. Simulation and experimental verification of electrical circuit problems using Superposition theorem. 6. Simulation and Experimental validation of R-L electric circuit transients 7. Simulation and Experimental validation of R-C electric circuit transients 8. Simulation and Experimental validation of RLC electric circuit transients 9. Design and implementation of series resonance circuit. 10. Design and implementation parallel resonance circuit. 11. Simulation of three phase balanced star, delta networks circuit (Power and Power factor calculations). 12. Simulation of three phase unbalanced star, delta networks circuit (Power and Power factor calculations).

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Apply the concept of Kirchhoff's laws for measuring current and voltage in electrical circuits.	K3
CO2	Identify the different types of network theorems for solving AC and DC circuits	K3
CO3	Outline the transient characteristics of RLC circuits.	K2
CO4	Make use of the frequency response of the electric circuit to obtain its characteristics.	K3
CO5	Interpret the three phase star and delta connected load with balanced and unbalanced system.	K2

COs and POs Mapping:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	1	-	2	-	-	-	-	-	-	-	3	-	-
CO2	3	2	1	-	2	-	-	-	-	-	-	-	3	-	-
CO3	2	1	-	-	2	-	-	-	-	-	-	-	3	-	-
CO4	3	2	-	-	2	-	-	-	-	-	-	-	3	-	-
CO5	2	1	-	-	2	-	-	-	-	-	-	-	3	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

The weightage of Continuous Internal Evaluation (CIE) is 60% and for End Semester Examination (ESE) is 40%.

S.No	Component	Type of Assessment	Max Marks	Reduced Marks	Total	Final Marks
1.	Continuous Internal Examination (CIE)-Laboratory	Continuous Assessment	75	75	100	60
2.		Model Lab Exam	25	25		
3.	End Semester Examination (ESE)	Lab Exam	100	40	40	40
					Total	100

Text Books:

1. William H. HaytJr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis",McGraw Hill publishers, 9thedition, New Delhi, 2020.
2. Chakrabarti A, "Circuits Theory (Analysis and synthesis), DhanpatRai& Sons, New Delhi, 2020.
3. Allan H. Robbins, Wilhelm C. Miller, "Circuit Analysis Theory and Practice", Cengage Learning India, 2013.

Reference Books:

1. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, 2019.
2. Sudhakar A and Shyam Mohan SP, "Circuits and Networks Analysis and Synthesis",McGraHill, 2015.
3. Joseph A. Edminister, MahmoodNahvi, "Electric circuits", Schaum's series, McGraw-Hill, First Edition, 2019.
4. Richard C. Dorf and James A. Svoboda, "Introduction to Electric Circuits", 7th Edition, John Wiley Sons, Inc. 2018.

Course Code:	**24GE231**	**Course Title:**	**WORKSHOP PRACTICE**
Credits:	**1.5**	**L – T – P**	**0-0-3**

Course objectives:

To provide hands on training to the students in:

- Applying basic techniques to measure a field, infer masonry work and install plumbing design.
- Fabricating carpentry, foundry, sheet metal and welding works to practice on workshop trades and making end products.
- Utilizing machining processes like turning, drilling, tapping in parts and 3D printing for performing the jobs.
- Designing electrical wiring layout with MCBs and RCCBs, developing staircase wiring and illumination design circuits for buildings.
- Assembling simple electronic components on PCB by soldering and desoldering and testing with IoT based interfaces.
- Developing blogs and website design for the complete access over the network.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Project based learning
2. Industrial Visit

GROUP – A (Civil and Mechanical)

PART I - CIVIL ENGINEERING PRACTICES	**[5 hours]**

1. FIELD MEASUREMENT, MASONRY WORK AND PLUMBING

a. Calculate the area of a built-up space and a small parcel of land-use standard measuring tape and digital distance measuring devices.

b. Visit a nearby site where construction is at initial stage and observe for following (if necessary, visit two/three times with a gap of a week). If drawings are available relate/match activities with the drawings.

i. Digging and filling.

ii. Foundation preparations.

iii. Brick/stone masonry.

iv. Concrete laying and curing.

v. Laying of sewerage/sanitary lines.

vi. Bar bending and bar laying for columns, beams and ceiling.

vii. Onsite testing for quality.

viii. Onsite preparation for construction work.

ix. Erection and removal of form work, scaffolding, centering/shuttering. Prepare a brief report on the construction activities, methods, tools, equipments and materials being used. c. Installation of water lines for wash basin and showers faucet.

PART II MECHANICAL ENGINEERING PRACTICES	[5 hours]
2. CARPENTRY, FOUNDRY, WELDING AND SHEET METAL a. Carpentry: Prepare T/L/Lap Joint from given wooden work piece and make a Box/Tray out of plywood using modern power tools. b. Welding: Make a Butt/Lap of MS plate using Arc welding process. c. Casting: Demonstration of Pattern making by sand moulding. d. Sheet Metal: Fabrication of Sheet Metal Tray and Funnels. 3. LATHE, DRILLING MACHINE AND 3D PRINTER a. Designing a driller component using radial machine. b. Perform a job using facing and turning in lathe. c. Printing simple 3D geometric shapes using SLA printer.	

GROUP – B (Electrical, Electronics and IT)

PART III - ELECTRICAL ENGINEERING PRACTICES	[3 hours]
4. ELECTRICAL WIRING a. Design a wiring circuit integrating energy meter, MCBs and RCCBs. b. Develop fluorescent lamp wiring, staircase wiring and electric fan wiring circuits.	

PART IV - ELECTRONICS ENGINEERING PRACTICES	[4 hours]
5. IOT BASED SOLUTIONS AND PCB a. Design a single layer PCB layout structure. b. Fabricate single layer PCB printing. c. Assembling, soldering and desoldering practice on single layer PCB. d. GPIO programming in ESP8266, sensor and actuator interfacing with internet enabled microcontroller device. e. Integration of microcontroller-based system with Cloud platform.	

PART V - COMPUTER SCIENCE AND ENGINEERING PRACTICES	[3 hours]
6. INTERACTIVE DYNAMIC WEBSITE a. Design a website for an application using HTML and CSS. b. Convert the designed website into responsive website using Bootstrap. c. Add dynamism to the website by using JavaScript and embed the social media components to the website. d. Incorporate the database interaction with the website. e. Deploy the developed website in the server.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Apply basic techniques for field measurements, masonry work and plumbing.	K3
CO2	Make use of workshop trades like carpentry, foundry, sheet metal and welding for practicing on manufacturing of components.	K3
CO3	Develop simple components using Lathe, Drilling Machine and 3D Printer.	K3
CO4	Construct the electrical wiring circuits for buildings based on their requirement.	K3
CO5	Develop IoT based solutions and PCB for real world use cases.	K3
CO6	Build and host an interactive dynamic website.	K3

COs and POs Mapping:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	1	1	2	-	-	-	1	1	-	1	3	2	1
CO2	3	2	1	1	2	-	-	-	1	1	-	1			
CO3	3	2	1	1	2	-	-	-	1	1	-	1			
CO4	3	2	1	1	2	-	-	-	1	1	-	1	1	-	-
CO5	3	2	1	1	2	-	-	-	1	1	-	1			
CO6	3	2	1	1	2	-	-	-	1	1	-	1	-	1	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped,

Level 0- Not Mapped

Scheme of Evaluation:

The weightage of Continuous Internal Evaluation (CIE) is 60% and for End Semester Examination (ESE) is 40%.

<table>
<tr><th>S.No</th><th>Component</th><th>Type of Assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final Marks</th></tr>
<tr><td>1.</td><td rowspan="2">Continuous Internal Examination (CIE)-Laboratory</td><td>Continuous Assessment</td><td>75</td><td>75</td><td rowspan="2">100</td><td rowspan="2">60</td></tr>
<tr><td>2.</td><td>Model Lab Exam</td><td>25</td><td>25</td></tr>
<tr><td>3.</td><td>End Semester Examination (ESE)</td><td>Lab Exam</td><td>100</td><td>40</td><td>40</td><td>40</td></tr>
<tr><td colspan="6">Total</td><td>100</td></tr>
</table>

Assessment Pattern

Bloom's Category	Terminal Examination
Remember	0
Understand	0
Apply	100
Analyze	0
Evaluate	0
Create	0

Text Books:

1. AICTE's Prescribed Textbook: Workshop / Manufacturing Practices (with Lab Manual) ISBN: 978-93-91505-332
2. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.

Reference Books:

1. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
2. Gowri P. Hariharan and A. Suresh Babu," Manufacturing Technology – I" Pearson Education, 2008.
3. Roy A. Lindberg, "Processes and Materials of Manufacture", 4 th edition, Prentice Hall India, 1998.
4. Rao P.N., "Manufacturing Technology", Vol. I & Vol. II, Tata McGraw Hill House, 2017.

Course Code:	**24EN201**	**Course Title:**	**Presentation and Language Skills Laboratory** (Common to AI&DS, AE, BME, CE, CSE, CSE(AI&ML), EEE, ECE, MECH)
Credits:	**1.5**	**L – T – P**	**0-0-3**

Course Objectives:

- To apply critical listening skills.
- To make use of critical thinking skills.
- To apply stress as well as tonal variation.
- Make use of language skills to produce error free sentences
- To experiment with presentation skills.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Lab experiment videos
2. Blended Mode of Learning
3. Project based Learning
4. Smart Classroom
5. Flipped Class

UNIT I		**[12 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	**Topic**	**Hours**
1	Listening to audios (online platforms) and making a critical appreciation of audio content	3
2	Listening to breaking news	2
3	Listening to British council / Cambridge English (Selected topics)	2
CLASSROOM ACTIVITIES		
4	Speaking current issues (selected topics)	2
5	Making conversations at work place, Public Speaking (based on festivals and celebrations)	3

UNIT II		[12 hours]
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	**Topic**	**Hours**
1	English Movie clips and software in the Lab C (Globarena)	3
2	Vocabulary Development through movies/ short films/ Documentaries	3
CLASSROOM ACTIVITIES		
3	Speaking - Just a minute talk and expressions for plans and decisions	3
4	Describing a product	3

UNIT III		[12 hours]
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	**Topic**	**Hours**
1.	Listening to TED talks, scientific lectures.	3
2.	Reading Comprehension strategies	2
3.	Reading- Editorials	2
CLASSROOM ACTIVITIES		
1.	Speaking- Introduction to Phonetics- Speech sounds- Vowels and Consonants- Stress- Rising/ Falling Tone	2
2.	Writing- A day in my life	2
3.	Writing- Situational Dialogues	1

UNIT IV		[12 hours]
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl.No.	**Topic**	**Hours**
1.	Reading Popular Blogs Listening Editorials	3
2.	Creating a Blog	2
CLASSROOM ACTIVITIES		

1.	Errors in Pronunciation. Error detection	3
2.	Writing - Terminology for Engineers. Writing Articles and preparing day to day scripts.	2 2

UNIT V		**[12 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	**Topic**	**Hours**
1.	Prepare PowerPoint presentation (topics selected by students)	3
2.	Reading newspaper articles	2
CLASSROOM ACTIVITIES		
1.	Present the selected topic.	3
2.	Making a short speech / Extempore	2
3.	Writing - Expanding a Proverb Writing Instructions	2

Course Outcomes:

On completion of the course, the student will have the ability to:

CO No.	**Course Outcomes**	**Cognitive Level**
CO1	Build communicative competence through critical listening skills.	K3
CO2	Make use of critical thinking skills to express plans and opinions.	K3
CO3	Apply stress as well as tonal variations for effective communication.	K3
CO4	Make use of language skills to produce error free sentences.	K3
CO5	Experiment with presentation skills to address confidently.	K3

COs and POs Mapping:

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	-	-	-	-	-	-	-	-	-	3	-	3
CO2	-	-	-	-	-	-	-	-	-	3	-	3
CO3	-	-	-	-	-	-	-	-	-	3	-	3
CO4	-	-	-	-	-	-	-	-	-	-	-	3
CO5	-	-	-	-	-	-	-	-	-	3	-	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Assessment Pattern:

Name of the Test	Marks	Total	Reduced to
Continuous Assessment (Experiments 1-10)	50	100	50
Model Examination	50		
End Semester Lab Exam	100	100	50
		TOTAL	**100**

Textbooks:

1. Raman, Meenakshi and Sangeetha Sharma. Professional Communication. Oxford University Press, Oxford, 2014.
2. Dr. Chellammal. V. Learning to Communicate. Allied Publishers, New Delhi, 2003.
3. Mohan, Krishna. And Meera Bannerjee. Developing Communication Skills. Macmillan India Ltd., 1990.

Reference Books:

1. Murphy – Raymond. English Grammar in Use BOOK with Answers: A Self-Study. Reference
2. and Practice Book for Intermediate Learners of English. Fourth edition: Cambridge University
3. Press – 2012.

MANUALS/ SOFTWARE: Open Sources / Websites

ROHINI COLLEGE OF ENGINEERING AND TECHNOLOGY

(AUTONOMOUS)

(Anjugramam-Kanyakumari Main Road, Palkulam,Variyoor P.O.-629 401, K.K.Dist.)

Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai

Accredited with A+ Grade by NAAC

Department of Electronics and Communication Engineering

M.E. Communication Systems

Curriculum & Syllabus

(*2024-2025 Admitted Students Onwards*)

Vision Statement of RCET

To be an academic institute of continuous excellence towards education and research in rural regime and provide service to nation in terms of nurturing potentially higher social, ethical and engineering companion graduands.

Mission Statement of RCET

To foster and promote technically competent graduands by imparting the state of art Engineering education in rural regime.

To enunciate research assisted scientific learning by dissemination of knowledge towards science, agriculture, industry and national security.

Vision of the Department

To promote ethical and innovative Electronics and Communication Engineers through excellence in teaching, training and research so as to contribute to the advancement of the rural society and mankind.

Mission of the Department

- To focus on quality teaching and learning that will make students to adapt to the needs of the industry and higher learning.
- To infuse a spirit of social responsibility, innovation, creativity and ethical practices through all round development activities of students.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1 Graduates shall be able to lead a successful career by applying the Scientific and Engineering fundamentals to formulate and solve the real-life problems.

PEO2 Graduates shall be able to practice the ethics of their profession, consistent with a sense of social responsibility and aptitude for innovations as they work individually and in multi-disciplinary teams.

PEO3 Graduates shall be receptive to recent technologies so as to excel in industry and accomplish professional competence through lifelong learning.

PROGRAMME OUTCOMES (POs)

PO1 An ability to independently carry out research /investigation and development work to solve practical problems.

PO2 An ability to write and present a substantial technical report/document

PO3 Students should be able to demonstrate a degree of mastery over the area as per the specialization of the Thermal Engineering. The mastery should be at a level higher than the requirements in the appropriate bachelor program

CREDIT INFO		
Sl.No	Category	Credits
1	Foundation Course (FC)	4
2	Professional Core Courses (PCC)	34
3	Professional Electives Courses (PEC)	13
4	Research Methodology and IPR (RMC)	2
5	Open Electives Courses (OEC)	3
6	Employability Enhancement Courses (EEC)	19
7	Audit Course	--
Total Credits		75

Foundation Course (FC)							
Sl. No	**Course Code**	**Course Title**	**Course Type**	**L**	**T**	**P**	**Credit**
1.	24CM101	Linear Algebra, Probability and Queueing Theory	FC	3	1	0	4

Professional Core Courses (PCC)							
Sl. No.	**Course Code**	**Course Title**	**Course Type**	**L**	**T**	**P**	**Credit**
1	24CM102	Statistical Signal Processing	PCC	3	0	0	3
2	24CM103	Modern Digital Communication Systems	PCC	3	0	0	3
3	24CM104	Advanced Wireless Networks	PCC	3	0	0	3
4	24CM105	Radiating Systems	PCC	3	0	0	3
5	24CM131	Digital Communication Systems Laboratory	PCC	0	0	3	1.5
6	24CM132	Advanced Digital Signal Processing Laboratory	PCC	0	0	3	1.5
7	24CM201	RF System Design	PCC	3	0	0	3
8	24CM202	Microwave Integrated Circuits	PCC	3	0	2	4
9	24CM203	Optical Communication and Networking	PCC	3	0	0	3
10	24CM204	Machine Learning	PCC	3	0	2	4
11	24CM231	Wireless Communication Laboratory	PCC	0	0	4	2
12	24CM301	4G/5G Communication Networks	PCC	3	0	0	3

Professional Elective Courses (PEC): Semester II, Elective I							
Sl. No.	**Course Code**	**Course Title**	**Course Type**	**L**	**T**	**P**	**Credit**
1	24CM211	Electromagnetic Interference andCompatibility	PEC	3	0	0	3

2	24CM212	Advanced Satellite Communication andNavigation Systems	PEC	3	0	0	3
3	24CM213	High Speed Switching and Networking	PEC	3	0	0	3
4	24CM214	Signal Integrity for High Speed Design	PEC	3	0	0	3
5	24CM215	Wavelets and Subband Coding	PEC	3	0	0	3

Professional Elective Courses (PEC): Semester II, Elective II							
Sl. No.	**Course Code**	**Course Title**	**Course Type**	**L**	**T**	**P**	**Credit**
1	24CM221	Multimedia Compression Techniques	PEC	3	0	0	3
2	24CM222	Cognitive Radio Networks	PEC	3	0	0	3
3	24CM223	Speech Processing	PEC	3	0	0	3
4	24CM224	mm Wave Communication	PEC	3	0	0	3
5	24CM225	Analog and Mixed Signal VLSI Design	PEC	3	0	0	3

Professional Elective Courses (PEC): Semester III, Elective III							
Sl. No.	**Course Code**	**Course Title**	**Course Type**	**L**	**T**	**P**	**Credit**
1	24CM311	Ultra-Wide Band Communications	PEC	3	0	0	3
2	24CM312	VLSI for Wireless Communication	PEC	3	0	0	3
3	24CM313	MEMS and NEMS	PEC	3	0	0	3
4	24CM314	Advanced Antenna Design	PEC	3	0	0	3
5	24CM315	Software Defined Radios	PEC	3	0	0	3
6	24CM311	Ultra-Wide Band Communications	PEC	3	0	0	3

Professional Elective Courses (PEC): Semester III, Elective IV							
Sl. No.	**Course Code**	**Course Title**	**Course Type**	**L**	**T**	**P**	**Credit**
1	24CM321	Image Processing and Video Analytics	PEC	3	0	2	4
2	24CM322	Radar Signal Processing	PEC	3	0	2	4
3	24CM323	Telecommunication System Modelingand Simulation	PEC	3	0	2	4
4	24CM324	Signal Detection and Estimation	PEC	3	0	2	4
5	24CM325	Real Time Embedded Systems	PEC	3	0	2	4

AUDIT COURSES (AC)							
Sl. No.	**Course Code**	**Course Title**	**Course Type**	**L**	**T**	**P**	**Credit**
1	24AC201	English for Research Paper Writing	AC	2	0	0	*
2	24AC202	Disaster Management	AC	2	0	0	*
3	24AC203	Constitution of India	AC	2	0	0	*
4	24AC204	நற்றமிழ் இலக்கியம்	AC	2	0	0	*
** Non-Credit Course*							

OPEN ELECTIVE COURSES (OEC)							
Sl. No.	**Course Code**	**Course Title**	**Course Type**	**L**	**T**	**P**	**Credit**
1	24CI341	Integrated Water Resources Management	OEC	3	0	0	3
2	24CI342	Water, Sanitation and Health	OEC	3	0	0	3
3	24CI343	Principles of Sustainable Development	OEC	3	0	0	3
4	24CI344	Environmental Impact Assessment	OEC	3	0	0	3
5	24CP311	Blockchain Technologies	OEC	3	0	0	3
6	24CP310	Deep Learning	OEC	3	0	0	3
7	24IS342	Vibration and Noise Control Strategies	OEC	3	0	0	3
8	24TE341	Energy Conservation and Management in Domestic Sectors	OEC	3	0	0	3
9	24TE342	Electric Vehicle Technology	OEC	3	0	0	3
10	24TE343	New Product Development	OEC	3	0	0	3
11	24CI345	Sustainable Management	OEC	3	0	0	3
12	24IS341	Micro and Small Business Management	OEC	3	0	0	3
13	24IS343	Intellectual Property Rights	OEC	3	0	0	3
14	24IS344	Ethical Management	OEC	3	0	0	3
15	24EN341	IoT for Smart Systems	OEC	3	0	0	3
16	24EM342	Smart Grid	OEC	3	0	0	3
17	24TC344	Design Thinking	OEC	3	0	0	3
18	24CP341	Principles of Multimedia	OEC	3	0	0	3
19	24CI346	Environmental Sustainability	OEC	3	0	0	3
20	24TE345	Textile Reinforced Composites	OEC	3	0	0	3
21	24TE346	Nanocomposite Materials	OEC	3	0	0	3

Employability Enhancement Courses (EEC)							
Sl. No.	**Course Code**	**Course Title**	**Course Type**	**L**	**T**	**P**	**Credit**
1	24CM251	Term Paper Writing and Seminar	EEC	0	0	2	1
2	24CM351	Project Work I	EEC	0	0	12	6
3	24CM451	Project Work II	EEC	0	0	24	12

Research Methodology and IPR (RMC)							
Sl. No.	**Course Code**	**Course Title**	**Course Type**	**L**	**T**	**P**	**Credit**
1.	24RM101	Research Methodology and IPR	RMC	2	0	0	2

SCHEME OF INSTRUCTION FOR FIRST YEAR M.E

1st SEMESTER

S. No.	Course Code	Course Title	Course Category	L	T	P	C
THEORY COURSES							
1.	24CM101	Linear Algebra, Probability and Queueing Theory	FCC	3	1	0	4
2.	24RM101	Research Methodology and IPR	RMC	2	0	0	2
3.	24CM102	Statistical Signal Processing	PCC	3	0	0	3
4.	24CM103	Modern Digital Communication Systems	PCC	3	0	0	3
5.	24CM104	Advanced Wireless Networks	PCC	3	0	0	3
6.	24CM105	Radiating Systems	PCC	3	0	0	3
7	24AC1XX	Audit Course – I*	AC	2	0	0	0
LABORATORY COURSES							
8.	24CM131	Digital Communication Systems Laboratory	PCC	0	0	3	1.5
9.	24CM132	Advanced Digital Signal Processing Laboratory	PCC	0	0	3	1.5
		Total		**19**	**1**	**6**	**21**

2nd SEMESTER

S. No.	Course Code	Course Title	Course Category	L	T	P	C
THEORY COURSES							
1.	24CM201	RF System Design	PCC	3	0	0	3
2.	24CM202	Microwave Integrated Circuits	PCC	3	0	2	4
3.	24CM203	Optical Communication and Networking	PCC	3	0	0	3
4.	24CM204	Machine Learning	PCC	3	0	2	4
5.	24CM21X	Professional Elective I	PEC	3	0	0	3
6.	24CM22X	Professional Elective II	PEC	3	0	0	3
7.	24AC2XX	Audit Course – II*	AC	2	0	0	2
LABORATORY COURSES							
8.	24CM231	Wireless Communication Laboratory	PCC	0	0	4	2
9.	24CM251	Term Paper Writing and Seminar	EEC	0	0	2	1
		Total		**20**	**0**	**10**	**23**

Course Code:	**24CM101**	**Course Title:**	**LINEAR ALGEBRA PROBABILITY AND QUEUING THEORY**
Credits:	**4**	**L – T – P**	**3 – 1 – 0**

Course objectives:

- To develop a working knowledge of the central ideas of Linear Algebra.
- To understand the basic concepts of probability, one and two dimensional random variables and to introduce some standard distributions applicable to engineering which can describe real life phenomenon.
- To develop a knowledge of linear programming models and apply the simplex method for solving linear programming problems.
- To understand the basic concepts of random processes which are widely used in IT fields.
- To understand the concept of queueing models and apply in engineering.

Teaching-Learning Process:

These are sample strategies which teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method does not mean only traditional method, but different type of teaching methods may be adopted to develop the outcomes.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Topics will be introduced in a multiple representation and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT I – Linear Algebra	**[12 hours]**
Vector spaces – norms – Inner Products – Eigenvalues using QR transformations – QR factorization – generalized eigenvectors – Canonical forms – singular value decomposition and	

applications – pseudo inverse – least square approximations.

UNIT II – Probability and Random Variables	**[12 hours]**
Probability – Axioms of probability – Conditional probability – Baye's theorem – Random variables – Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a random variable.	

UNIT III – Random Processes	**[12 hours]**
Joint distributions – Marginal and conditional distributions – Functions of two-dimensional random variables – Regression curve – Correlation.	

UNIT IV – Queueing Theory	**[12 hours]**
Markovian queues – Single and multi - server models – Little's formula – Steady state analysis – Self - service queue.	

UNIT V – Linear Programming	**[12 hours]**
Formulation – Graphical solution – Simplex method – Big-M method – Variants of Simplex method – Transportation and Assignment problems.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Domain
CO1	Apply the concepts of Linear Algebra to solve real time problems.	K3
CO2	Develop the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.	K3
CO3	Apply the concept of random processes in engineering problems.	K3

CO4	Apply the concept of Queuing Models in real life problem	K3
CO5	Solve transportation and assignment problems using suitable techniques.	K3

COs and POs Mapping:

COs	**POs**		
	1	**2**	**3**
CO1	3	3	1
CO2	3	2	2
CO3	2	2	2
CO4	3	3	1
CO5	3	3	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment – I	40	40		
	Skill Assessment – II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Skill Assessment Components: Individual Assignment / Worksheet / Case Study / Mini Project

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	20	20	20
Understand	20	20	20
Apply	60	60	60
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or choice).
- All the fifteen questions have to be answered.

Reference Books:

1. Gupta.S.C., and Kapoor, V.K., "Fundamentals of Mathematical Statistics", 12th Edition, Sultan Chand and Sons, 2020.
2. Jay L. Devore, "Probability and statistics for Engineering and the Sciences", 8th Edition, Cengage Learning, 2014.
3. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", 9th Edition, Pearson Education, Asia, 2016.
4. Sheldon M.Ross, "Probability and Statistics for Engineers and Scientists", Academic Press
5. Bronson, R., "Matrix Operation" Schaum's outline series, Tata McGraw Hill, New York, 2011.

Web Links and Video Lectures (E-Resources):

1. Vector Spaces : https://www.nptelvideos.com/lecture.php?id=13956
2. Queuing Models: M/M/I, Birth and death process, Little's formulae:

https://www.nptelvideos.com/lecture.php?id=14466

3. Probability Distributions : https://www.nptelvideos.com/lecture.php?id=14400

Equivalent NPTEL/SWAYAM Courses:

S.No.	Course Title	Course Instructor	Host Institute
1	Linear Algebra	Prof. Dilip P. Patil	IISc Bangalore
2	Introduction to Probability Theory and Stochastic Processes	Prof. S Dharmaraja	IIT Delhi

Course Code:	**24RM101**	**Course Title:**	**RESEARCH METHODOLOGY AND IPR**
Credits:	**2**	**L – T – P**	**2-0-0**

Course objectives:

- To study various research process and design
- To prepare and explore various data collection methods and sources
- To study about various research data analysing techniques and reporting formats
- To study the various practices involved in Intellectual Property Rights
- To study about the registration of Patent

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. NPTEL and Other Videos
3. Smart Class Room
4. Flipped Class
5. Technical Seminar
6. Poster Presentation

UNIT I – RESEARCH DESIGN	**[6 hours]**
Overview of research process and design, Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys.	

UNIT II – DATA COLLECTION AND SOURCES	[6 hours]
Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data- Preparing, Exploring, examining and displaying.	

UNIT III – DATA ANALYSIS AND REPORTING	[6 hours]
Overview of Multivariate analysis, Hypotheses testing and Measures of Association. PresentingInsights and findings using written reports and oral presentation.	

UNIT IV – INTELLECTUAL PROPERTY RIGHTS	[6 hours]
Intellectual Property – The concept of IPR, Evolution and development of concept of IPR, IPR development process, Trade secrets, utility Models, IPR & Bio diversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.	

UNIT V – PATENTS	[6 hours]
Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification, Types of patent application, process E-filling, Examination of patent, Grant of patent, Revocation, Equitable Assignments, Licences, Licensing of related patents, patent agents, Registration of patent agents	

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Domain
CO1	Describe the various processes and design for research methodology	K2
CO2	Make use of literature review to find research gaps and research	K3

	objectives	
CO3	Summarize the various data analysis methods and report generating formats	K2
CO4	Explain the various practices in intellectual property rights	K2
CO5	Recognize about the registration of patent considering various factors	K2

COs and POs Mapping:

COs	**POs**		
	1	**2**	**3**
CO1	2	-	-
CO2	2	1	-
CO3	2	2	-
CO4	3	1	-
CO5	3	2	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0-Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE) -	CIE – I	100	60	100	40
	CIE – II	100			
	Skill Assessment - I	40			

Theory	Skill Assessment - II	40	40		
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or choice).
- All the fifteen questions have to be answered

Reference Books:

1. Cooper Donald R, Schindler Pamela S and Sharma JK, "Business Research Methods", Tata McGraw Hill Education, 11e (2012).
2. Catherine J. Holland, "Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets", Entrepreneur Press, 2007.
3. David Hunt, Long Nguyen, Matthew Rodgers, "Patent searching: tools & techniques", Wiley, 2007.
4. The Institute of Company Secretaries of India, Statutory body under an Act of parliament, "Professional Programme Intellectual Property Rights, Law and practice", September 2013.

Web Links and Video Lectures (E-Resources):

1. https://onlinecourses.nptel.ac.in/noc23_ge36/preview

Suggested Skill Activities:

1. Developing a Research Plan
2. Data Collection Analysis for a defined problem
3. Poster preparation
4. Thesis Report Writing
5. Case studies using patent database

Course Code:	24CM102	**Course Title:**	**STATISTICAL SIGNAL PROCESSING**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To introduce the basics of random signal processing
- To learn the concept of estimation and signal modeling
- To know about optimum filters and adaptive filtering and its applications

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1.Chalk and Talk
2.Interactive Simulations
3.Blended Mode of Learning
4.Experiential Learning
5.NPTEL and Other Videos
6.Smart Class Room
7.Flipped Class

UNIT I – DISCRETE RANDOM SIGNAL PROCESSING	**[9 hours]**

Discrete random processes – Ensemble averages – Wide sense stationary process – Properties - Ergodic process – Sample mean & variance - Auto-correlation and Auto-correlation matrices- Auto covariance and Cross covariance- Properties – White noise process – Wiener Khintchine relation - Power spectral density – Filtering random process – Spectral Factorization Theorem – Special types of Random Processes – AR,MA, ARMA Processes – Yule-Walker equations.

UNIT II – PARAMETER ESTIMATION THEORY	**[9 hours]**
Principle of estimation and applications-Properties of estimates-unbiased and consistent estimators, Minimum Variance Unbiased Estimates (MVUE)-Cramer Rao bound- Efficient estimators; Criteria of estimation: Methods of maximum likelihood and its properties; Bayesian estimation: Mean square error and MMSE, Mean Absolute error, Hit and Miss cost function and MAP estimation	

UNIT III – SPECTRUM ESTIMATION	**[9 hours]**
Estimation of spectra from finite duration signals, Bias and Consistency of estimators - Non-Parametric methods: Periodogram, Modified Periodogram, Bartlett, Welch and Blackman-Tukey methods, Parametric Methods: AR, MA and ARMA spectrum estimation - Detection of Harmonic signals - Performance analysis of estimators. MUSIC and ESPRIT algorithms	

UNIT IV – SIGNAL MODELING AND OPTIMUM FILTERS	**[9 hours]**
Introduction- Least square method – Pade approximation – Prony’s method – Levinson Recursion – Lattice filter - FIR Wiener filter – Filtering – Linear Prediction – Non Causal and Causal IIR Wiener Filter -– MSE – State-space model and the optimal state estimation problem, discrete Kalman filter, continuous-time Kalman filter, extended Kalman filter.	

UNIT V – ADAPTIVE FILTERS	**[9 hours]**

FIR Adaptive filters - Newton's steepest descent method – Widrow Hoff LMS Adaptive algorithm – Convergence – Normalized LMS – Applications: Noise cancellation, channel equalization, echo canceller, Adaptive Recursive Filters: RLS adaptive algorithm, Exponentially weighted RLS-sliding window RLS. Matrix inversion Lemma, Initialization, tracking of non-stationarity.

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Domain
CO1	Analyze the discrete time random processes	K4
CO2	Apply appropriate model for estimation and signal modeling for the given problem	K3
CO3	Analyze non-parametric and parametric methods for spectral estimation	K4
CO4	Identify an optimum filter for the given problem	K3
CO5	Identify an adaptive filter for different applications	K3

COs and POs Mapping:

COs	POs		
	1	2	3
CO1	2	1	2
CO2	2	1	2
CO3	2	1	3
CO4	3	-	3
CO5	3	-	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	20	20	20
Understand	20	20	20
Apply	60	60	60
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

<u>End semester Examination: (QP PATTERN)</u>

- Each unit consists of two 2 marks questions and one 13 marks question (either or).
- One 16 marks question (either or) will be from any one of the five units.
- All the sixteen questions have to be answered.

REFERENCE BOOKS

1. Monson. H. Hayes, Statistical Digital Signal Processing and Modelling, John Willey and Sons, 1996 (Reprint 2008)
2. Simon Haykin, Adaptive Filter Theory, Pearson Prentice Hall, 5th edition, 2014.
3. D.G. Manolakis, V.K. Ingle and S.M. Kogon, Statistical and Adaptive Signal Processing,Artech House Publishers, 2005.
4. Steven. M. Kay, Modern Spectral Estimation, Theory and Application, Pearson India, 2009.
5. A.Veloni, N I. Miridakis, E Boukouvala, Digital and Statistical Signal Processing, CRCPress, 2019.
6. S Nandi, D Kundu, Statistical Signal Processing- Frequency Estimation, Springer NatureSingapore, 2nd edition , 2020.
7. M.D. Srinath, P.K. Rajasekaran and R. Viswanathan, Statistical Signal Processing withApplications, PHI, 1996.

Course Code:	**24CM103**	**Course Title:**	**MODERN DIGITAL COMMUNICATION SYSTEMS**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To understand the coherent and noncoherent receivers and their performance under AWGN channel conditions
- To understand the effect of signalling through bandlimited channels and Equalization techniques used to overcome ISI
- To understand different channel models, channel capacity and different block coding techniques
- To understand the principle of convolutional coding and different decoding techniques
- To understand the basics of OFDM as a multicarrier communication and CDMA as a multiuser communication technique.

Teaching-Learning Process:
Suggested strategies that teachers may use to effectively achieve the course outcomes: 1.Chalk and Talk 2.Interactive Simulations 3.Blended Mode of Learning 4.Project based Learning 5.Experiential Learning 6.NPTEL and Other Videos 7.Smart Class Room 8.Flipped Class

UNIT I – COHERENT AND NON-COHERENT COMMUNICATION	**[9 hours]**
Coherent receivers – Optimum receivers in WGN – IQ modulation & demodulation – QAM modulation and demodulation Noncoherent receivers in random phase channels; MFSK receivers – Rayleigh and Rician channels – Partially coherent receivers – DPSK; M-PSK; M-DPSK-BER Performance Analysis. Carrier Synchronization Bit synchronization.	
UNIT II – EQUALIZATION TECHNIQUES	**[9 hours]**
Band Limited Channels- ISI – Nyquist Criterion- Controlled ISI-Partial Response signals- Equalization algorithms– Linear equalizer – Decision feedback equalization – Adaptive Equalization algorithms.	

UNIT III – BLOCK CODED DIGITAL COMMUNICATION	**[9 hours]**
Architecture and performance – Binary block codes; – Shannon's channel coding theorem; Channel capacity; Matched filter; Concepts of Spread spectrum communication – Coded BPSK and DPSK demodulators– Linear block codes; Hamming; Golay; Cyclic; BCH ; Reed – Solomon codes. Space time block codes.	
UNIT IV – CONVOLUTIONAL CODED DIGITAL COMMUNICATION	**[9 hours]**

Representation of codes using Polynomial, State diagram, Tree diagram, and Trellis diagram – Decoding techniques using Maximum likelihood, Viterbi algorithm, Sequential and Threshold methods – Error probability performance for BPSK and Viterbi algorithm, Turbo Coding.

UNIT V – MULTICARRIER AND MULTIUSER COMMUNICATIONS	[9 hours]
Single Vs multicarrier modulation, orthogonal frequency division multiplexing (OFDM), Modulation and demodulation in an OFDM system, An FFT algorithmic implementation of an OFDM system, Bit and power allocation in multicarrier modulation, Peak-to-average ratio in multicarrier modulation. Introduction to CDMA systems, multiuser detection in CDMA systems – optimum multiuser receiver, suboptimum detectors, successive interference cancellation.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Domain
CO1	Differentiate coherent and non-coherent receivers and analyze their performance underAWGN channel conditions	K2
CO2	Illustrate the effect of signaling through bandlimited channels and Equalizationtechniques used to overcome ISI	K2
CO3	Determine the channel capacity and design various block coding techniques to combatchannel errors	K2
CO4	Construct convolutional coders and analyze the performance of different decoding techniques.	K4
CO5	Describe the basics of OFDM as a multicarrier communication and CDMA as a multiusercommunication technique.	K2

COs and POs Mapping:

COs	POs		
	1	2	3

CO1	2	-	2
CO2	2	-	2
CO3	3	-	2
CO4	3	-	-
CO5	2	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0-Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	**Continuous Internal Examination**		**End Semester Examination**
	1	**2**	
Remember	20	20	20

Understand	20	20	20
Apply	60	60	60
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. John G. Proakis and Masoud Salehi "Digital Communication", Fifth Edition, Mc Graw Hill Publication, 2014
2. Simon Haykin, "Digital communication Systems", John Wiley and sons, 2014.
3. Bernard Sklar and Pabitra Kumar Ray, "Digital Communications Fundamentals & Applications ", second edition, Pearson Education, 2009.
4. Lathi B P and Zhi Ding, "Modern Digital and Analog communication Systems", Oxford University Press, 2011
5. Richard Van Nee & Ramjee Prasad, "OFDM for Multimedia Communications" Artech House Publication, 2001
6. Theodore S.Rappaport, 'Wireless Communications", 2nd edition, Pearson Education,2002

Course Code:	24CM104	**Course Title:**	**ADVANCED WIRELESS NETWORKS**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

The students should be made to:

- Study about advanced wireless network, LTE, 4G and Evolutions from LTE to LTE.
- Study about wireless IP architecture, Packet Data Protocol and LTE network architecture
- Study about adaptive link layer, hybrid ARQ and graphs routing protocol.
- Study about mobility management, cellular network, and micro cellular networks

Teaching-Learning Process:
Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. Interactive Simulations 3. Blended Mode of Learning 4. Project based Learning 5. NPTEL and Other Videos 6. Smart Class Room 7. Flipped Class

UNIT I – INTRODUCTION	**[9 hours]**
Introduction to 1G/2G/3G/4G Terminology. Evolution of Public Mobile Services -Motivation for IP Based Wireless Networks -Requirements and Targets for Long Term Evolution (LTE) - Technologies for LTE- 4G Advanced Features and Roadmap Evolutions from LTE to LTE-A - Wireless Standards. Network Model-Network Connectivity-Wireless Network Design with Small World Properties	

UNIT II – WIRELESS IP NETWORK ARCHITECTURES	**[9 hours]**
3GPP Packet Data Networks - Network Architecture - Packet Data Protocol (PDP) Context - Configuring PDP Addresses on Mobile Stations - Accessing IP Networks through PS Domain – LTE network Architecture - Roaming Architecture- Protocol Architecture- Bearer Establishment Procedure -Inter-Working with other RATs	

UNIT III – ADAPTIVE LINK AND NETWORK LAYER	[9 hours]
Link Layer Capacity of Adaptive Air Interfaces-Adaptive Transmission in Ad Hoc Networks Adaptive Hybrid ARQ Schemes for Wireless Links-Stochastic Learning Link Layer Protocol Infrared Link Access Protocol-Graphs and Routing Protocols-Graph Theory-Routing with Topology Aggregation-Network and Aggregation Models	

UNIT IV – MOBILITY MANAGEMENT	[9 hours]
Cellular Networks-Cellular Systems with Prioritized Handoff-Cell Residing Time Distribution Mobility Prediction in Pico- and Micro-Cellular Networks	

UNIT V – QUALITY OF SERVICE	[9 hours]
QoS Challenges in Wireless IP Networks - QoS in 3GPP - QoS Architecture, Management and Classes -QoS Attributes - Management of End-to-End IP QoS - EPS Bearers and QoS in LTE networks.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Domain
CO1	Get an exposure to the latest 4G networks and LTE	K2
CO2	Understand about the wireless IP architecture and LTE network architecture.	K2
CO3	Know the adaptive link layer and network layer graphs and protocol.	K2
CO4	Understand the mobility management and cellular network	K2
CO5	Understand the wireless sensor network architecture and its concept	K2

COs and POs Mapping:

COs	POs		
	1	**2**	**3**
CO1	3	1	2
CO2	3	-	2
CO3	2	-	2
CO4	2	-	2
CO5	2	-	2

Level 3- Highly Map1ped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0-Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	**2**	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0

Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. Ayman ElNashar, Mohamed El-saidny, Mahmoud Sherif, "Design, Deployment and Performance of 4G-LTE Networks: A Practical Approach", John Wiley & Sons, 2014.
2. Crosspoint Boulevard, "Wireless and Mobile All-IP Networks", Wiley Publication, 2005.
3. Jyh-Cheng Chen and Tao Zhang, "IP-Based Next-Generation Wireless Networks Systems, Architectures, and Protocols", John Wiley & Sons, Inc. Publication,2006.
4. Minoru Etoh, "Next Generation Mobile Systems 3G and Beyond," Wiley Publications,2005.
5. Savo Glisic," Advanced Wireless Networks-Technology and Business Models", Third Edition, John Wiley & Sons, Ltd, 2016
6. Savo Glisic,"Advanced Wireless Networks-4G Technologies", John Wiley & Sons, Ltd,2006.
7. Stefania Sesia, IssamToufik and Matthew Baker, "LTE – The UMTS Long Term Evolution from Theory to Practice", John Wiley & Sons, Inc. Publication, Second Edition, 2011.

Course Code:	**24CM105**	**Course Title:**	**RADIATING SYSTEMS**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

- To understand Antenna basics
- To learn about Antenna arrays and their characteristics
- To study about operating Antennas
- To familiarize with modern Antennas and Measurement Techniques
- To learn about recent trends in Antenna Design

Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. Interactive Simulations 3. Lab experiment videos 4. Blended Mode of Learning 5. Project based Learning 6. Experiential Learning 7. NPTEL and Other Videos 8. Smart Class Room 9. Flipped Class	
UNIT I – Antenna Fundamentals & Wire Antennas	**[9 hours]**
Introduction –Types of Antennas – Radiation Mechanism – Current distribution on wire antennas – Maxwell 's equations – Antenna fundamental parameters – Radiation integrals – Radiation from surface and line current distributions – dipole, monopole, loop antenna	
UNIT II – Antenna Arrays	**[9 Hours]**
Linear array –uniform array, end fire and broad side array, gain, beam width, side lobe level; Linear array synthesis techniques – Binomial and Chebyshev distributions; Two dimensional uniform arrays; phased array antennas, smart antennas, switched beam and adaptive arrays, Mutual Coupling in Finite Arrays	
UNIT III – Aperture Antennas	**[9 hours]**
Field equivalence principle, Radiation from Rectangular and Circular apertures, Babinets principle, Slot antenna; Horn antenna; Reflector antenna, aperture blockage, and design consideration. Radiation Mechanism and Excitation techniques, Microstrip dipole; Patch, Rectangular patch, Circular patch – Microstrip array and feed network; Lens Antennas	

UNIT IV – Modern Antennas & Measurement Techniques	**[9 hours]**
Base station antennas, PIFA – Antennas for WBAN – RFID Antennas -Automotive antennas, MIMO Antennas, Diversity techniques – Antenna impedance and radiation pattern measurements	

UNIT V – Recent Trends in Antenna Design	[9 hours]
UWB antenna arrays – Smart antennas- Vivaldi antenna arrays – Artificial magnetic conductors/High impedance surfaces – Antennas in medicine – Plasma antennas – Antennas for millimeter wave communication - optimization techniques – Numerical methods	

Course outcomes: On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Domain
CO1	Understand the fundamentals behind the different techniques in antenna technology.	K2
CO2	Understand the challenges associated in designing antennas based on different technologies	K2
CO3	Understand the capability and assess the performance of various antennas	K2
CO4	Identify the antennas specific to the applications, design and characterize	K3
CO5	Understand the need for optimizing in antenna design and the methodologies for the same.	K2

COs and POs Mapping:

COs	POs		
	1	2	3
CO1	1	-	1
CO2	3	-	2
CO3	2	-	2
CO4	3	-	3
CO5	2	3	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not

Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	20	20	20
Understand	20	20	20
Apply	60	60	60
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 13 marks question (either or).
- One 16 marks question (either or) will be from any one of the five units.
- All the sixteen questions have to be answered.

REFERENCE BOOKS

1. Balanis.A, "Antenna Theory Analysis and Design", John Wiley and Sons, New York, 3rdEdition,1982.
2. Frank B. Gross, "Frontiers in Antennas", Mc Graw Hill, 2011.
3. S. Drabowitch, A. Papiernik, H.D.Griffiths, J.Encinas, B.L.Smith, "Modern Antennas", Springer Publications, 2nd Edition, 2007.
4. Krauss.J.D, "Antennas", John Wiley and sons, New York, 2nd Edition, 1997.
5. I.J. Bahl and P. Bhartia, "Microstrip Antennas", Artech House, Inc.,1980
6. W.L.Stutzman and G.A.Thiele, "Antenna Theory and Design", John Wiley& Sons Inc., 2ndEdition, 1998.
7. Jim R. James,P.S.Hall ,"Handbook of Microstrip Antennas" IEE Electromagnetic wave seriesVolume 2,1989.

Course Code:	**24CM131**	**Course Title**	**Digital communication systems laboratory**
Credits:	**1.5**	**L – T – P**	**0-0-3**

Course objectives:

To impart knowledge on the

- To study & measure the performance of digital communication systems.
- To provide a comprehensive knowledge of Wireless Communication
- To learn about the design of digital filter and its adaptive filtering algorithms.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. PowerPoint presentation
2. Interactive Simulations
3. Lab experiment videos
4. Experiential Learning
5. NPTEL and Other Videos
6. Smart Class Room

[45 hours]

S.No.	Name of the Experiment
1	Generation & detection of binary digital modulation techniques using SDR
2	Spread Spectrum Communication System-Pseudo random binary sequence generation-Baseband DSSS.
3	MIMO system transceiver design using MATLAB/SCILAB/LABVIEW
4	Performance evaluation of simulated CDMA system
5	Channel Coder/decoder design (block codes / convolutional codes/ turbo codes)
6	OFDM transceiver design using MATLAB /SCILAB/LABVIEW
7	Channel equalizer design using MATLAB (LMS, RLS algorithms)
8	Design and Analysis of Spectrum Estimators (Bartlett, Welch) using MATLAB
9	BER performance Analysis of M-ary digital Modulation Techniques (coherent & non coherent) in AWGN Environment using MATLAB/SCILAB/LABVIEW
10	Design and performance analysis of Lossless Coding Techniques - Huffman Coding and Lempel Ziv Algorithm using MATLAB/SCILAB/LABVIEW
11	Noise / Echo cancellation using MATLAB (LMS / RLS algorithms).

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Domain
CO1	Summarize the adaptive filtering algorithms	K2
CO2	Generate and detect digital communication signals of various modulation techniques using MATLAB.	K3
CO3	Explain cellular mobile communication technology and propagation model.	K2
CO4	Apply mathematical formulation to analyse spectrum estimation of a signal and bit ratedetermination of a transmission link.	K3
CO5	Analyse the performance of optimization algorithms for equalizing the channel ornoise/echo cancellation	K4
CO6	Design synchronization algorithm for Digital Communication systems.	K4

COs and POs Mapping:

COs	POs		
	1	**2**	**3**
CO1	2	1	2
CO2	2	1	2
CO3	2	1	2
CO4	2	1	3
CO5	2	1	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	40
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Lab Exam	100	60	60	60
				Total	100

Course Code:	24CM132	Course Title	Advanced Digital Signal Processing Laboratory
Credits:	1.5	L – T – P	0-0-3

Course objectives:

To impart knowledge on the

- To enable the student to verify the basic principles of random signal processing, spectral estimation methods and additive white Gaussian noise (AWGN) channel characterization
- To design and conduct experiments, as well as to analyze and interpret data to produce meaningful conclusions and match with theoretical concepts.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. PowerPoint presentation
2. Interactive Simulations
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos

Sl.No.	Name of the Experiment
1	Study of SDR
2	Estimation of power spectrum of the given random sequence using Nonparametric methods (Welch Tukey/ Bartlett)
3	Upsampling the discrete time sequence by L times and plot the spectrum of both the given sequence and upsampled sequence
4	Downsampling the discrete time sequence by M times and plot the spectrum of both the given sequence and down sampled sequence
5	Design an adaptive filter to extract a desired signal from the given noisy signal by cancelling the noise using LMS & RLS Algorithm
6	Implementation of Digital Filter Banks

[45 hours]

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Domain
CO1	Explain deterministic/Random sequences using simulation tool	K2
CO2	Analyze the frequency response of FIR/IIR digital filters for the given specifications	K4
CO3	Analyze power spectrum of the given random sequence using parametric/nonparametric estimation methods	K4
CO4	Apply LMS/RLS algorithm for adaptive filters	K3
CO5	Analyse the discrete time systems at various sampling rates	K4

COs and POs Mapping:

COs	POs		
	1	**2**	**3**
CO1	3	1	3
CO2	3	2	3

CO3	3	2	3
CO4	3	1	3
CO5	3	1	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	40
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Lab Exam	100	60	60	60
				Total	100

Course Code:	**24CM201**	**Course Title:**	**RF System Design**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

- Be familiar with RF transceiver system design for wireless communications
- Be exposed to design methods of receivers and transmitters used in communication systems
- Design RF circuits and systems using an advanced design tool.
- Exemplify different synchronization methods circuits and describe their block schematic and design criteria
- Measure RF circuits and systems with a spectrum analyzer.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Interactive Simulations
3. Lab experiment videos
4. Blended Mode of Learning
5. Project based Learning
6. Experiential Learning
7. NPTEL and Other Videos
8. Smart Class Room
9. Flipped Class

UNIT-I Basics of Radio Frequency System Design	**[9 hours]**

Definitions and models of Linear systems and Non-linear system. Specification parameters: Gain, noise figure, SNR, Characteristic impedance, S-parameters, Impedance matching and Decibels. Elements of digital base band signalling: complex envelope of band pass signals, Average value, RMS value, Crest factor, Sampling, jitter, modulation techniques, filters, pulse shaping, EVM, BER, sensitivity, selectivity, dynamic range and, adjacent and alternate channel power leakages

UNIT II – Radio Architectures and Design Considerations	**[9 hours]**

Super heterodyne architecture, direct conversion architecture, Low IF architecture, band-pass sampling radio architecture, System Design Considerations for an Analog Frontend Receiver in Cognitive Radio Applications, Interference, Near, In-band & wide-band considerations.

UNIT III – Amplifier Modeling and Analysis	[9 hours]
Noise: Noise equivalent model for Radio frequency device, amplifier noise model, cascade performance, minimum detectable signal, performance of noisy systems in cascade. Non-Linearity: Amplifier power transfer curve, gain compression, AM-AM, AM-PM, polynomial approximations, Saleh model, Wiener model and Hammerstein model, intermodulation, Single and two tone analyses, second and third order distortions and measurements, SOI and TOI points, cascade performance of nonlinear systems.	
UNIT IV – Mixer and Oscillator Modeling and Analysis	**[9 hours]**
Mixers: Frequency translation mechanisms, frequency inversion, image frequencies, spurious calculations, principles of mixer realizations. Oscillators: phase noise and its effects, effects of oscillator spurious components, frequency accuracy, oscillator realizations: Frequency synthesizers, NCO.	

UNIT V – Applications of Systems Design	[9 hours]
Multimode and multiband Super heterodyne transceiver: selection of frequency plan, receiver system and transmitter system design – Direct conversion transceiver: receiver system and transmitter system design.	

Course outcomes: On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Understand the specifications of transceiver modules	K2
CO2	Understand pros and cons of transceiver architectures and their associated design considerations	K2
CO3	Understand the impact of noise and amplifier non-linearity of amplification modules andalso will learn the resultant effect during cascade connections	K2
CO4	Get exposure about spurs and generation principles during signal generation and frequency translations	K2
CO5	Understand the case study of transceiver systems and aid to select specification parameters	K2

COs and POs Mapping:

COs	POs		
	1	**2**	**3**
CO1	3	--	3
CO2	2	--	2
CO3	2	--	3
CO4	2	--	2
CO5	2	--	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	**2**	
Remember	**20**	**20**	**20**
Understand	**20**	**20**	**20**
Apply	**60**	**60**	**60**
Analyze	**0**	**0**	**0**
Evaluate	**0**	**0**	**0**
Create	**0**	**0**	**0**

<u>End semester Examination: (QP PATTERN)</u>

- Each unit consists of two 2 marks questions and one 13 marks question (either or).
- One 16 marks question (either or) will be from any one of the five units.

- All the sixteen questions have to be answered.

References:

1. The Design of CMOS Radio-Frequency Integrated Circuits by Thomas H. Lee. Cambridge UniversityPress, 2004.
2. Qizheng Gu, "RF System Design of Transceivers for Wireless Communications", Springer ,2005.
3. Kevin McClaning, "Wireless Receiver Design for Digital Communications," Yes Dee Publications,2012.
4. M C Jeruchim, P Balapan and K S Shanmugam, "Simulation of Communication systems: Modeling,Methodology and Techniques", Kluwer Academic/Plenum Publishers, 2nd Edition, 2000.

Course Code:	**24CM202**	**Course Title:**	**Microwave Integrated Circuits**
Credits:	**4**	**L – T – P**	**3-0-2**

Course objectives:

- To familiarize different transmission lines used at Microwave frequencies
- To design impedance matching networks using lumped and distributed elements
- To design and analyze different microwave components
- To use SMITH chart to analyze the region of stability and instability for designingamplifiers and oscillators
- To simulate and to test the microwave components under laboratory conditions

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Interactive Simulations
3. Blended Mode of Learning
4. Experiential Learning
5. NPTEL and Other Videos
6. Smart Class Room
7. Flipped Class

UNIT I – Planar Transmission Lines and Components	**[9 hours]**

Review of Transmission line theory – S parameters-Transmission line equations – reflection coefficient – VSWR – Microstrip lines: Structure, waves in microstrip, Quasi-TEM approximation, Coupled lines: Even mode and odd mode analysis – Microstrip discontinuities and components – Strip line – Slot line – Coplanar waveguide – Filters – Power dividers and

Couplers	
Practical Topics: 1. Study of transmission line parameters – Impedance analysis	
UNIT II – Impedance Matching Networks	**[9 hours]**
Circuit Representation of two port RF/Microwave Networks: Low Frequency Parameters, High Frequency Parameters, Transmission Matrix, ZY Smith Chart, Design of Matching Circuits using Lumped Elements, Matching Network Design using Distributed Elements	
Practical Topics: 1. Design of impedance matching networks 2. Design of low pass and high pass filter 3. Design of band-pass and band-stop filters	
UNIT III – Microwave Amplifier and Oscillator Design	**[9 hours]**
Characteristics of microwave transistors – Stability considerations in active networks – Gain Consideration in Amplifiers – Noise Consideration in active networks – Broadband Amplifier design – Oscillators: Oscillator versus Amplifier Design – Oscillation conditions – Design and stability considerations of Microwave Transistor Oscillators.	
Practical Topics: 1. Design of branch line couplers	
UNIT IV – Mixers and Control Circuits	**[9 hours]**
Mixer Types – Conversion Loss – SSB and DSB Mixers – Design of Mixers: Single Ended Mixers – Single Balanced Mixers – Sub Harmonic Diode Mixers, Microwave Diodes, Phase Shifters – PIN Diode Attenuators	
Practical Topics: 1. Design of phase shifters 2. Design of Mixers	
UNIT V – Microwave IC Design and Measurement Techniques	**[9 hours]**
Microwave Integrated Circuits – MIC Materials- Hybrid versus Monolithic MICs – Multichip Module Technology – Fabrication Techniques, Miniaturization techniques, Introduction to SOC, SOP, Test fixture measurements, probe station measurements, thermal and cryogenic measurements, experimental field probing techniques.	
Practical Topics: 1. Design of Power dividers	

Laboratory Component: **[30 hours]**

S.No.	Name of the Experiment
1	Study of transmission line parameters – Impedance analysis using ANSYS Software
2	Design of impedance matching networks using ANSYS Software
3	Design of low pass and high pass filter using ANSYS Software
4	Design of band-pass and band-stop filters using ANSYS Software
5	Design of branch line couplers using ANSYS Software
6	Design of phase shifters
7	Design of Mixers
8	Design of Power dividers

Course outcomes:

On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Understand the concepts of planar transmission line	K2
CO2	Analyze impedance matching circuits using LC components and stubs.	K4
CO3	Analyze microwave components.	K4
CO4	Perform stability analysis and be able to design amplifiers and oscillators at microwave frequencies.	K3
CO5	Perform simulations, fabricate and test microwave devices.	K3

COs and POs Mapping:

COs	POs		
	1	**2**	**3**
CO1	2	3	2
CO2	2	3	2
CO3	3	3	3
CO4	2	2	2
CO5	2	2	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	**20**	**20**	**20**
Understand	**20**	**20**	**20**
Apply	**60**	**60**	**60**
Analyze	**0**	**0**	**0**
Evaluate	**0**	**0**	**0**
Create	**0**	**0**	**0**

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

REFERENCES:

1. Jia Sheng Hong, M. J. Lancaster, "Microstrip Filters for RF/Microwave Applications",John Wiley & Sons, 2001
2. David M. Pozar, "Microwave Engineering", John Wiley & Sons, 4th edition 2012
3. Reinhold Ludwig and Powel Bretchko, RF Circuit Design – Theory and Applications", Pearson Education Asia, First Edition,2001.
4. Thomas H.Lee, "Planar Microwave Engineering", Cambridge University Press, 2004
5. Matthew M. Radmanesh, "Radio Frequency and Microwave Electronics", PearsonEducation, 2002.

Course Code:	**24CM203**	**Course Title:**	**Optical Communication and Networking**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

- To enable the student to understand the basic principles of operation of optical system components, the different network architectures and issues associated with network design.
- To enable the student to understand the differences in the design of data plane and the control plane and the routing, switching and the resource allocation methods and the network management and protection methods in vogue.

Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. Interactive Simulations 3. Lab experiment videos 4. Blended Mode of Learning 5. Project based Learning 6. Experiential Learning 7. NPTEL and Other Videos 8. Smart Class Room 9. Flipped Class	
UNIT I – Optical System Components and Network Design	**[9 hours]**
Optical System Components – MZIM, Multiplexers; filters; switches; wavelength converters; optical amplifiers – EDFA, Raman Amplifiers and hybrid; Transmission system Engineering – System Model, Aimer penalty – transmitter, receiver, cross talk, dispersion compensation, wavelength stabilization, FWM.	
UNIT II – Coherent Systems	**[9 hours]**
Basic principles of Coherent detections – Practical constraints – Injection laser line width state of polarization, local oscillator power, fiber limitations; Modulation formats – ASK, FSK, PSK, DPSK and polarization shift keying (POL SK); Demodulation schemes – Homodyne, Heterodyne – Synchronous and Non synchronous detection; Comparison; Carrier recovery inCoherent detection	

UNIT III – Optical Network Architectures	**[9 hours]**
Introduction to Optical Networks; First Generation optical networks –SONET / SDH Network, Second Generation (WDM) Optical Networks, Need for Multilayered Architecture-, Layers and Sub-layers, Spectrum partitioning, Optical Network Nodes, Network Access Stations, Overlay Processor, Logical network overlays.	
UNIT IV – Network Connections	**[9 hours]**

Connection Management and Control; Static Networks, Wavelength Routed Networks; Linear Lightwave networks; Logically Routed Networks; Routing and Wavelength Assignment, Traffic Grooming in Optical Networks

UNIT V – Optical Network Survivability	**[9 hours]**
Protection and Restoration Objectives, Fault Protection and Restoration Techniques in the Logical Layer – Point-to-Point Systems, SONET Self-Healing Rings, Interconnection Techniques, Architectures with Arbitrary Mesh Topologies, Optical-Layer Protection: Point-to-Point and Ring Architectures, Mesh Architectures	

Course outcomes: On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Demonstrate an understanding of the differences and challenges involved in the design ofoptical systems and networks.	K2
CO2	Apply his knowledge for designing a fiber optic system addressing the channelimpairments.	K3
CO3	Summarize the architectures and the protocol stack in use in optical networks andwould be able to identify a suitable backbone infrastructure for our present and future communication needs.	K2
CO4	Explain how connections are managed in the network and the pros and cons of thedifferent approaches	K2
CO5	Summarize the need for network survivability and the methodologies used.	K2

COs and POs Mapping:

COs	**POs**		
	1	**2**	**3**
CO1	**3**	**1**	2
CO2	**3**	**1**	2

CO3	**3**	**1**	2
CO4	**2**	**-**	3
CO5	**3**	**-**	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- NotMapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	**20**	**20**	**20**
Understand	**20**	**20**	**20**
Apply	**60**	**60**	**60**
Analyze	**0**	**0**	**0**
Evaluate	**0**	**0**	**0**
Create	**0**	**0**	**0**

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 13 marks question (either or).
- One 16 marks question (either or) will be from any one of the five units.
- All the sixteen questions have to be answered.

REFERENCES:

1. Max Ming-Kang Liu, "Principles and Applications of Optical Communication", Tata McGraw Hill Education Pvt., Ltd., New Delhi. 2010
2. Thomas E. Stern, Georgios Ellinas, Krishna Bala, "Multiwavelength Optical Networks – Architecture, Design and control ", Cambridge University Press, 2nd Edition, 2009.
3. Rajiv Ramaswami and Kumar N. Sivarajan, "Optical Networks : A Practical Perspective", Harcourt Asia Pte Ltd., Second Edition 2006.

Course Code:	**24CM204**	**Course Title:**	**Machine Learning**
Credits:	**4**	**L – T – P**	**3-0-2**

Course objectives:

- To understand the concepts and mathematical foundations of machine learning and types ofproblems tackled by machine learning
- To explore the different supervised learning techniques including ensemble methods
- To learn different aspects of unsupervised learning and reinforcement learning
- To learn the role of probabilistic methods for machine learning
- To understand the basic concepts of neural networks and deep learning

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Interactive Simulations
3. Lab experiment videos
4. Blended Mode of Learning
5. Project based Learning
6. Experiential Learning
7. NPTEL and Other Videos
8. Smart Class Room
9. Flipped Class

UNIT I – Introduction and Mathematical Foundations	**[9 hours]**

What is Machine Learning? Need –History – Definitions – Applications - Advantages, Disadvantages& Challenges -Types of Machine Learning Problems – Mathematical Foundations - Linear Algebra & Analytical Geometry -Probability and Statistics- Bayesian Conditional Probability -Vector Calculus & Optimization - Decision Theory - Information theory

UNIT II – Supervised Learning	**[9 hours]**

Introduction-Discriminative and Generative Models -Linear Regression - Least Squares - Under-fitting / Overfitting -Cross-Validation – Lasso Regression- Classification - Logistic Regression- Gradient Linear Models -Support Vector Machines –Kernel Methods -Instance based Methods - K-Nearest Neighbours - Tree based Methods –Decision Trees –ID3 – CART - Ensemble Methods –Random Forest - Evaluation of Classification Algorithms

Practical Topics:

1. Implement a Linear Regression with a Real Dataset (https://www.kaggle.com/harrywang/housing). Experiment with different features in buildinga model. Tune the model's hyperparameters.
2. Implement a binary classification model. That is, answers a binary question such as "Are houses in this neighborhood above a certain price?"(use data from exercise 1). Modify the classification threshold and determine how that modification influences the model. Experiment with different classification metrics to determine your model's effectiveness
3. Classification with Nearest Neighbours. In this question, you will use the scikit-learn's KNNclassifer to classify real vs. fake news headlines. The aim of this question is for you to read the scikit-learn API and get comfortable with training/validation splits. Use California Housing Dataset

UNIT III – Unsupervised Learning and Reinforcement Learning	**[9 hours]**

Introduction - Clustering Algorithms -K – Means – Hierarchical Clustering - Cluster Validity - Dimensionality Reduction –Principal Component Analysis – Recommendation Systems - EM algorithm. Reinforcement Learning – Elements -Model based Learning – Temporal Difference Learning

Practical Topics:

1. In this exercise, you'll experiment with validation sets and test sets using the dataset. Split atraining set into a smaller training set and a validation set. Analyze deltas between

training set and validation set results. Test the trained model with a test set to determine whether your trained model is overfitting. Detect and fix a common training problem. 2. Implement the k-means algorithm using https://archive.ics.uci.edu/ml/datasets/Codon+usage dataset.

UNIT IV – Probabilistic Methods for Learning	[9 hours]
Introduction -Naïve Bayes Algorithm -Maximum Likelihood -Maximum Apriori -Bayesian Belief Networks -Probabilistic Modelling of Problems -Inference in Bayesian Belief Networks – Probability Density Estimation - Sequence Models – Markov Models – Hidden Markov Models	
1. Implement the Naïve Bayes Classifier using https://archive.ics.uci.edu/ml/datasets/Gait+Classification dataset	

UNIT V – Neural Networks and Deep Learning	[9 hours]
Neural Networks – Biological Motivation- Perceptron – Multi-layer Perceptron – Feed Forward Network – Back Propagation-Activation and Loss Functions- Limitations of Machine Learning – Deep Learning– Convolution Neural Networks – Recurrent Neural Networks – Use cases	

Laboratory Component: **[30 hours]**

SL.No.	Name of the Experiment
1	Implement a Linear Regression with a Real Dataset (https://www.kaggle.com/harrywang/housing). Experiment with different features in building a model. Tune the model's hyperparameters.
2	Implement a binary classification model. That is, answers a binary question such as "Are houses in this neighbourhood above a certain price?"(use data from exercise 1). Modify theclassification threshold and determine how that modification influences the model.Experiment with different classification metrics to determine your model's effectiveness
3	Classification with Nearest Neighbours. In this question, you will use the scikit-learn's KNN classifier to classify real vs. fake news headlines. The aim of this question is for

	you to read the scikit-learn API and get comfortable with training/validation splits. Use California Housing Dataset
4	In this exercise, you'll experiment with validation sets and test sets using the dataset. Split atraining set into a smaller training set and a validation set. Analyze deltas between training set and validation set results. Test the trained model with a test set to determine whether your trained model is overfitting. Detect and fix a common training problem.
5	Implement the k-means algorithm using https://archive.ics.uci.edu/ml/datasets/Codon+usage dataset
6	Implement the Naïve Bayes Classifier using https://archive.ics.uci.edu/ml/datasets/Gait+Classification dataset
7	Project - (in Pairs) project must implement one or more machine learning algorithms andapply them to some data. a. project may be a comparison of several existing algorithms, or it may propose a new algorithm in which case you still must compare it to at least one other approach. b. pick a project of your own design, or you can choose from the set of pre-defined projects. c. You are free to use any third-party ideas or code that you wish as long as it is publicly available. d. You must properly provide references to any work that is not your own in the write-up. e. Project proposal You must turn in a brief project proposal. Your project proposal should describe the idea behind your project. You should also briefly describe software you will need to write, and papers (2-3) you plan to read. a.Your project may be a comparison of several existing algorithms, or it may propose a newalgorithm in which case you still must compare it to at least one other approach. b. You can either pick a project of your own design, or you can choose from the set of pre- defined projects. c. You are free to use any third-party ideas or code that you wish as long as it is publicly available. d. You must properly provide references to any work that is not your own in the write-up. Project proposal You must turn in a brief project proposal. Your project proposal should

	describe the idea behind your project. You should also briefly describe software you will need to write, and papers (2-3) you plan to read.

Course outcomes:

On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Explain the outline problems for each type of machine learning	K2
CO2	Model a Decision tree and Random Forest for an application	K3
CO3	Develop Probabilistic Discriminative and Generative algorithms for an application and analyze the results.	K3
CO4	Apply typical Clustering algorithms for different types of applications.	K3
CO5	Develop an HMM for a Sequence Model type of application and identify applications suitable for different types of Machine Learning with suitable justification.	K3

COs and POs Mapping:

COs	**POs**		
	1	**2**	**3**
CO1	3	-	3
CO2	3	2	3
CO3	3	1	3
CO4	3	1	2
CO5	3	-	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	**100**

Assessment Pattern

Bloom's Category	**Continuous Internal Examination**		**End Semester Examination**
	1	**2**	
Remember	**20**	**20**	**20**
Understand	**20**	**20**	**20**
Apply	**60**	**60**	**60**
Analyze	**0**	**0**	**0**
Evaluate	**0**	**0**	**0**
Create	**0**	**0**	**0**

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

References:

1. Stephen Marsland, "Machine Learning: An Algorithmic Perspective", Chapman & Hall/CRC,2nd Edition, 2014.

2. Kevin Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012
3. Ethem Alpaydin, “Introduction to Machine Learning”, Third Edition, Adaptive Computationand Machine Learning Series, MIT Press, 2014
4. Tom M Mitchell, “Machine Learning”, McGraw Hill Education, 2013.
5. Peter Flach, “Machine Learning: The Art and Science of Algorithms that Make Sense of Data”,First Edition, Cambridge University Press, 2012.
6. Shai Shalev-Shwartz and Shai Ben-David, “Understanding Machine Learning: From Theoryto Algorithms”, Cambridge University Press, 2015
7. Christopher Bishop, “Pattern Recognition and Machine Learning”, Springer, 2007.
8. Hal Daumé III, “A Course in Machine Learning”, 2017 (freely available online)
9. Trevor Hastie, Robert Tibshirani, Jerome Friedman, “The Elements of Statistical Learning”, Springer, 2009 (freely available online)
10. Aurélien Géron , Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems 2nd Edition, o'reilly, (2017)

Course Code:	**24CM231**	**Course Title:**	**Wireless Communication Laboratory**
Credits:	**1.5**	**L – T – P**	**0-0-3**

Course objectives:

- To enable the student to verify the basic principles of random signal processing, spectral estimation methods, wireless and AWGN channel characterization, application of adaptive filter algorithms for communication system design, coding and modulation design, synchronization aspects and the overall baseband system design.
- To design and conduct experiments, as well as to analyze and interpret data to produce meaningful conclusions and match with theoretical concepts.
- To enable the student to appreciate the practical aspects of baseband system design and understand the associated challenges

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. PowerPoint presentation 2. Interactive Simulations 3. Lab experiment videos 4. Blended Mode of Learning 5. Project based Learning 6. Experiential Learning 7. NPTEL and Other Videos 8. Smart Class Room

Laboratory Component **[45hours]**

Sl.No.	Name of the Experiment
1	Spectral Characterisation of communication signals (using Spectrum Analyzer)
2	Design and analysis of digital modulation techniques on an SDR platform
3	Carrier and Symbol timing Synchronization using SDR platform
4	CDMA signal generation and RAKE receiver design using DSP/MATLAB/ SIMULINK
5	Design and performance analysis of error control encoder and decoder (Blockand Convolutional Codes)
6	Wireless Channel equalizer design using DSP (ZF / LMS / RLS)
7	Wireless Channel Estimation and Diversity Combining

Course outcomes: On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Develop the physical models of wireless channels.	K3
CO2	Analyze the digital modulation techniques	K4
CO3	Measure capacity of AWGN channel, LTI Gaussian channels and various fading channels	K3
CO4	Illustrate the uplink and downlink model of AWGN channel, fading channels and multiuser diversity	K2

COs and POs Mapping:

COs	POs		
	1	2	3
CO1	3	1	1
CO2	3	1	3
CO3	1	2	3
CO4	1	3	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	40
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Lab Exam	10 0	60	60	60
				Total	100

Course Code:	24CM211	Course Title:	Electromagnetic Interference and Compatibility
Credits:	3	L – T – P	3-0-0

Course Objectives:

- To gain broad conceptual understanding of the various aspects of electromagnetic (EM) interference and compatibility
- To develop a theoretical understanding of electromagnetic shielding effectiveness
- To understand ways of mitigating EMI by using shielding, grounding and filtering
- To understand the need for standards and to appreciate measurement methods
- To understand how EMI impacts wireless and broadband technologies

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Project based Learning
4. Experiential Learning
5. NPTEL and Other Videos
6. Smart Class Room
7. Flipped Class

UNIT-I Introduction & Sources of EM Interference	[9 hours]
Introduction - Classification of sources - Natural sources - Man-made sources - Survey of the electromagnetic environment.	

UNIT-II EM Shielding	[9 hours]
Introduction - Shielding effectiveness - Far-field sources - Near-field sources - Low-frequency, magnetic field shielding - Effects of apertures	

UNIT-III Interference Control Techniques	[9 hours]
Equipment screening - Cable screening - grounding - Power-line filters - Isolation - Balancing - Signal-line filters - Nonlinear protective devices.	

UNIT-IV EMC Standards, Measurements And Testing	[9 hours]
Need for standards - The international framework - Human exposure limits to EM fields -EMC measurement techniques - Measurement tools - Test environments.	

UNIT-V EMC Considerations in Wireless And Broadband Technologies	[9 hours]
Efficient use of frequency spectrum - EMC, interoperability and coexistence - Specifications and alliances - Transmission of high-frequency signals over telephone and power networks – EMC and digital subscriber lines - EMC and power line telecommunications.	

Course outcomes: On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Demonstrate knowledge of the various sources of electromagnetic interference	K2
CO2	Explain the effect of electromagnetic fields couple through apertures, and solve simple problems based on that understanding	K2
CO3	Explain the EMI mitigation techniques of shielding and grounding	K2
CO4	Explain the need for standards and EMC measurement methods	K2
CO5	Summarize the impact of EMC on wireless and broadband technologies	K2

COs and POs Mapping:

COs	POs		
	1	**2**	**3**
CO1	2	1	3
CO2	2	1	3
CO3	3	-	3
CO4	3	-	2
CO5	3	-	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) -Theory	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End Semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 13 marks question (either or).
- One 16 marks question (either or) will be from any one of the five units.
- All the sixteen questions have to be answered.

Reference Books

1. Christopoulos C, Principles and Techniques of Electromagnetic Compatibility, CRC Press, Second Edition, Indian Edition, 2013.
2. Paul C R, Introduction to Electromagnetic Compatibility, Wiley India, Second Edition,2008
3. Kodali V P, Engineering Electromagnetic Compatibility, Wiley India, Second Edition,2010
4. Henry W Ott, Electromagnetic Compatibility Engineering, John Wiley & Sons Inc, Newyork,2009.

5. Scott Bennett W, Control and Measurement of Unintentional Electromagnetic Radiation, John Wiley& Sons Inc., Wiley Interscience Series, 1997.

Course Code:	**24CM212**	**Course Title:**	**Advanced Satellite Communication and Navigation Systems**
Credits:	**3**	**L – T – P**	**3-0-0**

Course Objectives:

- Learn M2M developments and satellite applications
- Understand Satellite Communication in IPv6 Environment

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Project based Learning
4. Experiential Learning
5. NPTEL and Other Videos
6. Smart Class Room
7. Flipped Class

UNIT-I Overview of Satellite Communication	**[9 hours]**
Overview of satellite communication and orbital mechanics Link budget Parameters, Link budget calculations, Auxiliary Equations, Performance Calculations.	

UNIT-II M2M Developments and Satellite Applications	**[9 hours]**
Overview of the Internet of Things and M2M- M2M Applications Examples and Satellite Support-Satellite Roles Context and Applications- Antennas for Satellite M2M Applications- M2M Market Opportunities for Satellite Operators-Ultra HD Video/TV and Satellite Implications-High Throughput Satellites (HTS) and Ka/Ku Spot Beam Technologies-Aeronautical, Maritime and other Mobility Services.	

UNIT-III Satellite Communication in Ipv6 Environment	**[9 hours]**
Overview of IPv6 and its benefits for Satellite Networks - Migration and Coexistence-- Implementation scenarios and support- Preparations for IPv6 in Satellite communication- Satellite specific Protocol	

issues in IPv6 – Impact of IPv6 on Satellite Network architecture and services- Detailed transitional plan- IPv6 demonstration over satellites - Key results and recommendations

UNIT-IV Satellite Navigation and Global Positioning System	**[9 hours]**
Overview of Radio and Satellite Navigation, GPS Principles, Signal model and Codes, Satellite Signal Acquisition, Mathematical model of GPS observables, Methods of processing GPS data, GPS Receiver Operation and Differential GPS. IRNSS, GAGAN, GLONASS and Galileo.	

UNIT-V Deep Space Networks and Inter Planetary Missions	**[9 hours]**
Introduction – Functional description - Design procedure and performance criterion-Mars exploration Rover- Mission and spacecraft summary-Telecommunication subsystem overview- Ground Subsystem-Telecom subsystem and Link performance Telecom subsystem Hardware and software Chandrayaan-1 Mission - Mission and spacecraft summary-Telecommunication subsystem overview- Ground Subsystem-Telecom subsystem and Link performance. Mangalyaan Mission - Mission and spacecraft summary-Telecommunication subsystem overview- Ground Subsystem-Telecom subsystem and Link performance	

Course outcomes: On completion of the course, the student will have the ability to:

COs	**Course Outcome**	**Cognitive domain**
CO1	Explain the Satellite navigation and global positioning system	K2
CO2	Summarize the deep space networks and inter planetary missions	K2
CO3	Summarize the different interferences and attenuation mechanisms affecting the satellite link design.	K2
CO4	Explain the different communication, sensing and navigational applications of satellite	K2
CO5	Summarize the implementation aspects of existing satellite-based systems.	K2

COs and POs Mapping:

COs	**POs**		
	1	**2**	**3**
CO1	**2**	**1**	**3**
CO2	**2**	**1**	**3**
CO3	**3**	**-**	**3**
CO4	**3**	**-**	**2**

CO5	**3**	**-**	**2**

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
Total					100

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 13 marks question (either or).
- One 16 marks question (either or) will be from any one of the five units.
- All the sixteen questions have to be answered.

Reference Books

1. Adimurthy.V,"Concept design and planning of India's first interplanetary mission" Current Science, VOL. 109, NO. 6, 1054 25 SEPTEMBER 2015.

2. Anil K. Maini, Varsha Agrawal, 'Satellite Technology: Principles and Applications', Third Edition, Wiley, 2014.
3. Daniel Minoli' "Innovations in Satellite Communication and Satellite Technology" Wiley, 2015.
4. Daniel Minoli, "Satellite Systems Engineering in an IPv6 Environment", CRC Press, First Edition, 2009.
5. Hofmann-Wellenhof B., Lichtenegger H., and Elmar Wasle, "Global Navigational Satellite Systems" Springer-Verlag, 2008.
6. Jim Taylor, " Deep Space Communications" John Wiley & Sons, 2016.
7. Louis J. Ippolito, Jr. "Satellite Communications Systems Engineering: Atmospheric Effects, Satellite Link Design and System Performance", Second Edition, 2017.

Course Code:	**24CM213**	**Course Title:**	**High Speed Switching and Networking**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

- To explore the various space division switches
- To enable the various network performance analysis
- To get the clear idea about the various multimedia application
- To get a clear idea about the traffic and Queuing systems.
- Interpret the basics of security management and the various attacks & its countermeasures

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Project based Learning
4. Experiential Learning
5. NPTEL and Other Videos
6. Smart Class Room
7. Flipped Class

UNIT I – Switching Architectures	[9 hours]
Shared medium switches – Shared memory switches – Space division switches – Cross bar based switching architecture – Input queued, Output queued and Combined input-output queued switches – Non blocking and blocking cross bar switches – Banyan networks – Batcher Banyan networks – Optical switches – Unbuffered and buffered switches – Buffering strategies – Optical packet switches and Optical burst switches – MEMS optical switches	

UNIT II – Network Performance Analysis	[9 hours]
Objectives and requirements for Quality of Service (QoS) in high performance networks. Architecture of high performance networks (HPN), design issues, protocols for HPN, VHF backbone networks, virtual interface architectures, virtual interface for networking, High-speed switching and routing - internet and PSTN IP switching techniques, SRP protocols, SRP authentication, and key exchange, comparison of TCP/IP, FTP, TELNET, queuing systems, network modeling as a graph	

UNIT III – Multimedia Networking Applications	[9 hours]
Streaming stored Audio and Video, Best effort service, protocols for real time interactive applications, Beyond best effort, scheduling and policing mechanism, integrated services, RSVP-differentiated services.	

UNIT IV – Packet Queues And Delay Analysis	[9 hours]
Littles theorem, Birth and Death process, queueing discipline- Control & stability -, Markovian FIFO queueing system, Non-markovian - PollaczekKhinchin formula and M/G/1, M/D/1, self-similar models and Batch-arrival model, Networks of Queues – Burkes theorem and Jackson Theorem	

UNIT V – Network Security And Management	[9 hours]
Principles of cryptography – Elliptic-AES Authentication – integrity – key distribution and certification– Access control and: fire walls – DoS-attacks and counter measures – security in many layers. Infrastructure for network management – The internet standard management framework – SMI, MIB,SNMP, Security and administration – ASN.1.	

Course outcomes: On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Explain the fundamental concepts of the switching architecture involved in various switching types	K2
CO2	Describe the basics of various protocols and QOS in the network performance	K2
CO3	Summarize the various types of multimedia networking application	K2
CO4	Illustrate the concepts of various analysis method involved in the processing	K2
CO5	Explain fundamental issues involved in providing the security as well as the management	K2

COs and POs Mapping:

COs	POs		
	1	**2**	**3**
CO1	**1**	-	2
CO2	2	-	2
CO3	2	-	2
CO4	2	-	2
CO5	2	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0-Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	**20**	**20**	**20**
Understand	**20**	**60**	**40**
Apply	**60**	**20**	**40**
Analyze	**0**	**0**	**0**
Evaluate	**0**	**0**	**0**
Create	**0**	**0**	**0**

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 13 marks question (either or).
- One 16 marks question (either or) will be from any one of the five units.
- All the sixteen questions have to be answered.

Reference Books

1. Achille Pattavina, "Switching Theory Architectures and performance in Broadband ATM networks", John wiley & sons Ltd. New York, 2007.
2. Elhanany, Itamar, Hamdi and Mounir, "High Performance Packet Switching Architectures", Springer 2007.
3. Walrand .J. Varatya, "High Performance Communication Network", Morgan Kaufmann – Harcourt Asia Pvt. Ltd., 2nd Edition, 2000.
4. Fred Halsall and Lingana Gouda Kulkarni, "Computer Networking and the Internet", Fifth Edition, Pearson Education, 2012
5. Nader F.Mir, "Computer and Communication Networks", Pearson Education, 2009

Course Code:	24CM214	Course Title:	Signal Integrity For High Speed Design
Credits:	3	L – T – P	3-0-0

Course objectives:

- To identify sources affecting the speed of digital circuits.
- To introduce methods to improve the signal transmission characteristics

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Project based Learning
4. Experiential Learning
5. NPTEL and Other Videos
6. Smart Class Room
7. Flipped Class

UNIT I – Signal Propagation on Transmission Lines	[9 hours]
Transmission line equations, wave solution, wave vs. circuits, initial wave, delay time, Characteristic impedance , wave propagation, reflection, and bounce diagrams Reactive terminations – L, C , static field maps of micro strip and strip line cross-sections, per unit length parameters, PCB layer stackups and layer/Cu thicknesses, cross-sectional analysis tools, Zo and Td equations for microstrip and stripline Reflection and terminations for logic gates, fan-out, logic switching , input impedance into a transmission-line section, reflection coefficient, skin-effect, dispersion	

UNIT II – Multi-Conductor Transmission Lines and Cross-Talk	[9 hours]
Multi-conductor transmission-lines, coupling physics, per unit length parameters ,Near and far-end cross-talk, minimizing cross-talk (stripline and microstrip) Differential signaling, termination, balanced circuits ,S-parameters, Lossy and Lossless models.	

UNIT III – Non-Ideal Effects	[9 hours]
Non-ideal signal return paths – gaps, BGA fields, via transitions, Parasitic inductance and capacitance, Transmission line losses – Rs, tanδ , routing parasitic, Common-mode current, differential-mode current , Connectors	

UNIT IV – Power Considerations and System Design	[9 hours]
SSN/SSO , DC power bus design , layer stack up, SMT decoupling ,, Logic families, power consumption, and system power delivery , Logic families and speed Package types and parasitic ,SPICE, IBIS models ,Bit streams, PRBS and filtering functions of link-path components , Eye diagrams , jitter , inter-symbol interference Bit-error rate ,Timing analysis	

UNIT V – Clock Distribution and Clock Oscillators	[9 hours]
Timing margin, Clock slew, low impedance drivers, terminations, Delay Adjustments, canceling parasitic capacitance, Clock jitter.	

Course outcomes: On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Identify the sources affecting the speed of digital circuits.	K2
CO2	Identify the methods to improve the signal transmission characteristics	K2
CO3	Summarize the Characterize and model multi conductor transmission line	K2
CO4	Analyse the clock distribution system and its parameters	K4
CO5	Analyze the non-ideal effects of transmission line	K4

COs and POs Mapping:

COs	POs		
	1	2	3
CO1	1	-	1
CO2	2	-	1
CO3	1	-	1
CO4	2	2	2
CO5	2	2	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- NotMapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) -	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II				

Theory		40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	**20**	**20**	**20**
Understand	**20**	**60**	**40**
Apply	**60**	**20**	**40**
Analyze	**0**	**0**	**0**
Evaluate	**0**	**0**	**0**
Create	**0**	**0**	**0**

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 13 marks question (either or).
- One 16 marks question (either or) will be from any one of the five units.
- All the sixteen questions have to be answered.

Reference Books

1. H. W. Johnson and M. Graham, High-Speed Digital Design: A Handbook of Black Magic, Prentice Hall, 1993.
2. Douglas Brooks, Signal Integrity Issues and Printed Circuit Board Design, Prentice Hall PTR, 2003.
3. S. Hall, G. Hall, and J. McCall, High-Speed Digital System Design: A Handboo of Interconnect Theory and Design Practices, Wiley-Interscience, 2000.
4. Eric Bogatin , Signal Integrity – Simplified , Prentice Hall PTR, 2003.

Course Code:	24CM215	Course Title:	**Wavelets and Sub band Coding**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To introduce the fundamentals concepts of wavelet transforms.
- To study system design using Wavelets
- To learn the different wavelet families & their applications.
- To study signal compression and sub-band coding

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Project based Learning
4. Experiential Learning
5. NPTEL and Other Videos
6. Smart Class Room
7. Flipped Class

UNIT I – Introduction to Wavelets	[9 hours]
Introduction to Multirate signal processing- Decimation and Interpolation, Quadrature Mirror Filters, Subband coding, Limitations of Fourier transform, Short time Fourier transform and its drawbacks, Continuous Wavelet transform, Time frequency representation, Wavelet System and its characteristics, Orthogonal and Orthonormal functions and function space	

UNIT II – Multiresolution Concept And Discrete Wavelet Transform	[9 hours]
Multiresolution formulation of wavelet systems- signal spaces, scaling function, wavelet function and its properties, Multiresolution analysis, Haar scaling and wavelet function, Filter banks- Analysis and Synthesis, 1D and 2D Discrete wavelet transform, Wavelet Packets, Tree structured filter bank, Multichannel filter bank, Undecimated wavelet transform	

UNIT III – Wavelet System Design	[9 hours]

Refinement relation for orthogonal wavelet systems, Restrictions on filter coefficients, Design of Daubechies orthogonal wavelet system coefficients, Design of Coiflet and Symlet wavelets.

UNIT IV – Wavelet Families	**[9 hours]**
Continuous Wavelets- Properties of Mexican hat wavelet, Morlet, Gaussian and Meyer wavelets. Orthogonal wavelets- Properties of Haar wavelets, Daubechies wavelets, Symlets, Coiflets and Discrete Meyer wavelets. Properties of Biorthogonal wavelets, Applications of wavelet families.	

Course outcomes: On completion of the course, the student will have the ability to:

COs	**Course Outcome**	**Cognitive domain**
CO1	Explain the fundamental concepts of wavelet transforms	K2
CO2	Describe the detailed knowledge about wavelet transform	K2
CO3	Summarize the system design using wavelets.	K2
CO4	Compare different wavelet families.	K2
CO5	Analyze the signal compression techniques and sub-band coding	K4

COs and POs Mapping:

COs	**POs**		
	1	**2**	**3**
CO1	2	-	2
CO2	1	1	2
CO3	2	1	3
CO4	3	1	2
CO5	3	1	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	**20**	**20**	**20**
Understand	**20**	**60**	**40**
Apply	**60**	**20**	**40**
Analyze	**0**	**0**	**0**
Evaluate	**0**	**0**	**0**
Create	**0**	**0**	**0**

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 13 marks question (either or).
- One 16 marks question (either or) will be from any one of the five units.
- All the sixteen questions have to be answered.

REFERENCE

1. J. Jacob Wikner, Mikael Gustavsson, Nianxiong Tan "CMOS Data Converters for Communications" Springer, 2000.
2. Van de Plassche, Rudy J., "CMOS Integrated Analog-to-Digital and Digital-to-Analog Converters" Springer, 2003.

Course Code:	24CM221	Course Title:	Multimedia Compression Techniques
Credits:	**3**	**L – T – P**	**3-0-0**

Course Objectives:

To impart knowledge on the

- To understand the basic ideas of compression algorithms related to multimedia components-Text, speech, audio, image and Video.
- To understand the principles and standards and their applications with an emphasis onunderlying technologies, algorithms, and performance.
- To appreciate the use of compression in multimedia processing applications
- To understand and implement compression standards in detail.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Interactive Simulations
3. Lab experiment videos
4. Blended Mode of Learning
5. Project based Learning
6. Experiential Learning
7. NPTEL and Other Videos
8. Smart Class Room
9. Flipped Class

UNIT I - Fundamentals of Compression	[9 hours]
Introduction to multimedia – Graphics, Image and Video representations – Fundamental concepts of video, digital audio – Storage requirements of multimedia applications – Need for compression – Taxonomy of compression Algorithms - Elements of Information Theory – Error Free Compression – Lossy Compression	

UNIT II - Text Compression	[9 hours]
Huffman coding – Adaptive Huffman coding – Arithmetic coding – Shannon-Fano coding – Dictionary techniques – LZW family algorithms	

UNIT III - Image Compression	[9 hours]
Image Compression: Fundamentals –– Compression Standards – JPEG Standard – Sub-band coding – Wavelet Based compression – Implementation using Filters – EZW, SPIHT coders – JPEG 2000 standards – JBIG and JBIG2 standards.	

UNIT IV- Audio Compression	[9 hours]
Audio compression Techniques – law, A-Law companding – Frequency domain and filtering – Basic sub-band coding – Application to speech coding – G.722 – MPEG audio – progressive encoding – Silence compression, Speech compression – Formant and CELP vocoders.	

UNIT V-Video Compression	[9 hours]
Video compression techniques and Standards – MPEG video coding: MPEG-1 and MPEG-2 video coding: MPEG-3 and MPEG-4 – Motion estimation and compensation techniques – H.261 Standard – DVI technology – DVI real time compression – Current Trends in Compression standards.	

Course Outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Domain
CO1	Summarize the basic compression algorithms familiar with the use of MATLAB and its equivalent open source environments	K2
CO2	Explain the basic compression standards	K2

CO3	Analyze the different approaches of compression algorithms in multimedia related mini projects.	K2
CO4	Explain the various audio, speech compression techniques	K2
CO5	Summarize the MPEG video coding techniques.	K2

COs and POs Mapping:

COs	POs		
	1	**2**	**3**
CO1	2	-	2
CO2	1	1	2
CO3	2	1	3
CO4	3	1	2
CO5	3	1	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0-Not Mapped

Scheme of Evaluation:

Component	Type of Assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	60	100	40
	CIE – II	100			
	Skill Assessment – I	40	40		
	Skill Assessment - II	40			

End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End Semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered

REFERENCE BOOKS:

1. Khalid Sayood: Introduction to Data Compression", Morgan Kauffman Harcourt India,Third Edition, 2010.
2. David Solomon, "Data Compression – The Complete Reference", Fourth Edition,Springer Verlog, New York, 2006.
3. Yun Q.Shi, Huifang Sun, "Image and Video Compression for Multimedia Engineering, Algorithms and Fundamentals", CRC Press, 2003.
4. Mark S. Drew, Ze-Nian Li, "Fundamentals of Multimedia", PHI, 2009

Course Code:	24CM222	Course Title:	Cognitive Radio Networks
Credits:	**3**	**L – T – P**	**3-0-0**

Course Objectives:

- Understand the fundamental concepts of cognitive radio networks.
- Develop the cognitive radio, as well as techniques for spectrum holes detection that cognitive radio takes advantages in order to exploit it.
- Understand the functions of MAC layer and Network layer and its various protocols
- Understand fundamental issues regarding dynamic spectrum access, the radio-resource management and trading
- Interpret the basics of security management and the various attacks & its countermeasures

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Interactive Simulations
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – Introduction to Cognitive Radio	[9 hours]
Cognitive Radio : Techniques and signal processing History and background, Communication policy and Spectrum Management, Cognitive radio cycle, Cognitive radio architecture, SDR architecture for cognitive radio, Spectrum sensing Single node sensing: energy detection, cyclo stationary and wavelet based sensing- problem formulation and performance analysis based on probability of detection Vs SNR. Cooperative sensing: different fusion rules, wideband spectrum	
UNIT II – Spectrum Sensing And Trading	**[9 hours]**

Introduction –Spectrum Sensing – Multiband Spectrum Sensing – Sensing Techniques – Other algorithms – Comparison – Performance Measure & Design Trade-Offs : Receiver operating characteristics – Throughput Performance measure –Fundamental limits and trade-off. Introduction to spectrum trading, classification to spectrum trading, radio resource pricing, brief discussion on economics theories in DSA (utility, auction theory), classification of auctions (single auctions, double auctions, concurrent, sequential)

UNIT III – MAC Protocols and Network Layer Design	**[9 hours]**
Functionality of MAC protocol in spectrum access –classification –Interframe spacing and MAC challenges – QOS – Spectrum sharing in CRAHN –CRAHN models – CSMA/CA based MAC protocols for CRAHN – Routing in CRN– Centralized and Distributed protocols – Geographical Protocol	
UNIT IV – Dynamic Spectrum Access and Management	**[9 hours]**
Spectrum broker, Dynamic spectrum access architecture- centralized dynamic spectrum access, distributed dynamic spectrum access, Inter- and intra-RAN dynamic spectrum allocation, Spectrum management, Spectrum sharing, Spectrum mobility issues	
UNIT V – Trusted Cognitive Radio Networks and Research Challenges	**[9 hours]**
Trust for CRN : Fundamentals – Models – Effects of Trust Management –Security properties in CRN – Route Disruption attacks –Jamming attacks –PU Emulation attacks. Network layer and transport layer issues, cross layer design for cognitive radio networks.	

Course Outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Domain
CO1	Explain the fundamental concepts of cognitive radio networks	K2
CO2	Summarize the basics of various spectrum sensing techniques and algorithms.	K2
CO3	Explain the functions of MAC layer and Network layer and its various	K2

	protocols	
CO4	Explain the concepts of cooperative spectrum sensing and handoff process	K2
CO5	Summarize the fundamental issues regarding dynamic spectrum access, the radio-resource management and trading, as well as a number of optimization techniques for better spectrum exploitation.	K2

COs and POs Mapping:

COs	**POs**		
	1	**2**	**3**
CO1	3	2	1
CO2	2	1	1
CO3	2	1	1
CO4	3	2	1
CO5	3	2	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0-Not Mapped

Scheme of Evaluation:

Component	**Type of Assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE)	CIE – I	100	60	100	40
	CIE – II	100			
	Skill Assessment – I	40	40		
	Skill Assessment - II	40			

End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	**2**	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End Semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions.
- One 16 marks question (either or) will be from any one of the five units.
- All the fifteen questions have to be answered.

REFERENCE BOOKS

1. Cognitive Radio, Software Defined Radio and Adaptive Wireless Systems", Hüseyin Arslan, Springer,ISBN 978-1-4020-5541-6 (HB), 2007.
2. Linda Doyle, "Essentials of Cognitive Radio", Cambridge University Press, 2009.
3. Kwang-Cheng Chen, Ramjee Prasad, "Cognitive radio networks", John Wiley & Sons Ltd., 2009.
4. Cognitive Radio Technology", by Bruce A. Fette, Elsevier, ISBN 10: 0-7506-7952-2, 2006.
5. Alexander M. Wyglinski, Maziar Nekovee, and Y. Thomas Hou, "Cognitive Radio Communicationsand Networks - Principles and Practice", Elsevier Inc., 2010.

CourseCode:	24CM223	Course Title	SPEECH PROCESSING
Credits:	3	L – T – P	3-0-0

Course Objectives:

- To introduce speech production and related parameters of speech.
- To illustrate the concepts of speech signal representations and coding.
- To understand different speech modeling procedures such Markov and their implementation issues
- To gain knowledge about text analysis and speech synthesis.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Interactive Simulations
3. Lab experiment videos
4. Blended Mode of Learning
5. Project based Learning
6. Experiential Learning
7. NPTEL and Other Videos
8. Smart Class Room
9. Flipped Class

UNIT I – Fundamentals of Speech Processing	[9 hours]
Introduction – Spoken Language Structure – Phonetics and Phonology – Syllables and Words – Syntax and Semantics – Probability, Statistics and Information Theory – Probability Theory – Estimation Theory – Significance Testing – Information Theory.	

UNIT II - Speech Signal Representations and Coding	[9 hours]
Overview of Digital Signal Processing – Speech Signal Representations – Short time Fourier Analysis –Acoustic Model of Speech Production – Linear Predictive Coding – Cepstral Processing – Formant Frequencies – The Role of Pitch – Speech Coding – LPC Coder, CELP, Vocoders.	

UNIT III – Speech Recognition	[9 hours]
Hidden Markov Models – Definition – Continuous and Discontinuous HMMs – Practical Issues – Limitations. Acoustic Modeling – Variability in the Speech Signal – Extracting Features – PhoneticModeling – Adaptive Techniques – Confidence Measures – Other Techniques.	

UNIT IV – Text Analysis	[9 hours]
Lexicon – Document Structure Detection – Text Normalization – Linguistic Analysis – Homograph Disambiguation – Morphological Analysis – Letter-to-sound Conversion – Prosody – Generation schematic – Speaking Style – Symbolic Prosody – Duration Assignment – Pitch Generation.	

UNIT V – Speech Synthesis	[9 hours]
Attributes – Formant Speech Synthesis – Concatenative Speech Synthesis – Prosodic Modification of Speech – Source-filter Models for Prosody Modification – Evaluation of TTS Systems.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Domain
CO1	Model speech production system and describe the fundamentals of speech.	K2
CO2	Compare the different speech parameters.	K2
CO3	Summarize an appropriate statistical speech model for a given application.	K2

CO4	Summarize the speech recognition system	K2
CO5	Illustrate the different text analysis and speech synthesis techniques	K2

COs and POs Mapping:

COs	**POs**		
	1	**2**	**3**
CO1	3	-	2
CO2	3	-	2
CO3	3	-	2
CO4	3	-	2
CO5	3	-	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0-Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	50	50	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End Semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions.
- One 16 marks question (either or) will be from any one of the five units.
- All the fifteen questions have to be answered.

REFERENCE BOOKS

1. Ben Gold and Nelson Morgan, "Speech and Audio Signal Processing, Processing and Perception ofSpeech and Music", Wiley- India Edition, 2006
2. Claudio Becchetti and Lucio Prina Ricotti, "Speech Recognition", John Wiley and Sons, 1999.
3. Daniel Jurafsky and James H Martin, "Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Pearson Education, 2002
4. Frederick Jelinek, "Statistical Methods of Speech Recognition", MIT Press, 1997.
5. Lawrence Rabiner and Biing-Hwang Juang, "Fundamentals of Speech Recognition", PearsonEducation, 2003.
6. Steven W. Smith, "The Scientist and Engineer‟s Guide to Digital Signal Processing", CaliforniaTechnical Publishing, 1997.
7. Thomas F Quatieri, "Discrete-Time Speech Signal Processing – Principles and Practice", PearsonEducation, 2004.

Course Code:	**24CM224**	**Course Title**	**mm Wave Communication**
Credits:	**3**	**L – T – P**	**3-0-0**

Course Objectives:

- To understand the fundamentals of Millimeter wave devices and circuits.
- To understand the various components of Millimeter wave Communications system.
- To know the antenna design at Millimeter wave frequencies.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Interactive Simulations
3. Lab experiment videos
4. Blended Mode of Learning
5. Project based Learning
6. Experiential Learning
7. NPTEL and Other Videos
8. Smart Class Room
9. Flipped Class

UNIT I – Introduction	**[9 hours]**
Millimeter wave characteristics- millimeter wave wireless, implementation challenges, Radio wavepropagation for mm wave: Large scale propagation channel effects, small scale channel effects, Outdoor and Indoor channel models, Emerging applications of millimeter wave communications.	

UNIT II – mm Wave Devices and Circuits	**[9 hours]**
Millimeter wave generation and amplification: Peniotrons, Ubitrons, Gyrotrons and Free electron lasers.HEMT, models for mm wave Transistors, transistor configurations, Analog mm wave components: Amplifiers, Mixers, VCO, PLL. Metrics for analog mm wave devices, Consumption factor theory,Trends and architectures for mm wave wireless, ADC’s and DAC’s.	

UNIT III – mm Wave Communication Systems	[9 hours]
Modulations for millimeter wave communications: OOK, PSK, FSK, QAM, OFDM, Millimeterwave link budget, Transceiver architecture, Transceiver without mixer, Receiver without Oscillator,Millimeter wave calibration, production and manufacture, Millimeter wave design considerations.	

UNIT IV – mm Wave Mimo Systems	[9 hours]
Massive MIMO Communications, Spatial diversity of Antenna Arrays, Multiple Antennas, MultipleTransceivers, Noise coupling in MIMO system, Potential benefits for mm wave systems, Spatial,Temporal and Frequency diversity, Dynamic spatial, frequency and modulation allocation.	
UNIT V – Antennas for mm Wave Systems	**[9 hours]**
Antenna beamwidth, polarization, advanced beam steering and beam forming, mm wave design consideration, On-chip and In package mm wave antennas, Techniques to improve gain of on-chip antennas, Implementation for mm wave in adaptive antenna arrays, Device to Device communications over 5G systems, Design techniques of 5G mobile.	

Course Outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Domain
CO1	Explain the millimeter wave characteristics and implementation challenges faced.	K2
CO2	Summarize the millimeter devices and circuits.	K2
CO3	Apply the knowledge on the Modulation techniques for millimeter wave communications.	K3
CO4	Develop an antenna for millimeter wave frequencies.	K3
CO5	Summarize the millimeter wave technology.	K2

COs and POs Mapping:

COs	POs		
	1	**2**	**3**
CO1	**2**	**-**	2
CO2	**2**	**-**	2
CO3	**2**	**-**	2
CO4	**2**	**-**	3
CO5	**2-**	**-**	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End Semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 13 marks question (either or).
- One 16 marks question (either or) will be from any one of the five units.
- All the sixteen questions have to be answered.

REFERENCES:

1. K.C. Huang, Z. Wang, "Millimeter Wave Communication Systems", Wiley-IEEE Press,March 2011.
2. Robert W. Heath, Robert C. Daniel, James N. Theodore S. Rappaport, Murdock, "Millimeter Wave Wireless Communication", Prentice Hall, 2014.
3. Xiang, W; Zheng, K; Shen, X.S; "5G Mobile Communications: Springer, 2016.

Course Code:	24CM225	Course Title:	Analog and Mixed Signal VLSI Design
Credits:	3	L – T – P	3-0-0

Course Objectives:

To impart knowledge on the

- To study the concepts of MOS large signal model and small signal model
- To understand the concepts of D/A conversion methods and their architectures.
- To learn filters for ADC.
- To study about the switched capacitor circuits.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Interactive Simulations
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – Introduction and Basic MOS Devices	[9 hours]
Challenges in analog design-Mixed signal layout issues- MOSFET structures and characteristics large signal and small signal model of single stage Amplifier-Source follower- Common gate stage – Cascode Stage – large and small signal analysis of differential amplifier with active load, pole-zero estimation, zero value time constant method, frequency response of CS, cascade and Cascode amplifiers.	

UNIT II – Submicron Circuit Design	[9 hours]
Submicron CMOS process flow, Capacitors and resistors, Current mirrors, Digital Circuit Design, Delay Elements – Adders- OP Amp parameters and Design	

UNIT III – Data Converters	[9 hours]
Static and dynamic errors in DAC and ADC – Architectures & Characteristics of Sample and Hold Digital to Analog Converters- DAC- R-2R, weighted DAC, multiplying DAC, segmented DACand sigma delta DAC. ADC – Flash ADC, pipelined ADC, successive approximation ADC, sigma delta ADC.	

UNIT IV – SNR in Data Converters	[9 hours]
Overview of SNR of Data Converters- Clock Jitters- Improving Using Averaging – Decimating Filters for ADC- Band pass and High Pass Sinc Filters- Interpolating Filters for DAC	

UNIT V – Switched Capacitor Circuits	[9 hours]
Resistors, First order low pass Circuit, Switched capacitor Amplifier, Switched Capacitor Integrator – Design of flip around sample and hold circuit – pipelined ADC.	

Course Outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Domain
CO1	Summarize the Basic MOS devices characteristics their frequency responses	K2
CO2	Explain the submicron circuit.	K2
CO3	Apply the knowledge on the DAC & ADC conversions.	K3
CO4	Analyze the SNR in Data converters.	K3

CO5	Illustrate the switched capacitor circuits	K2

COs and POs Mapping:

COs	POs		
	1	**2**	**3**
CO1	3	-	3
CO2	3	-	3
CO3	3	-	3
CO4	3	1	2
CO5	3	1	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0-Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 13 marks question (either or).
- One 16 marks question (either or) will be from any one of the five units.
- All the sixteen questions have to be answered.

REFERENCE BOOKS

1. J. Jacob Wikner, Mikael Gustavsson, Nianxiong Tan "CMOS Data Converters for Communications" Springer, 2000.
2. Van de Plassche, Rudy J., "CMOS Integrated Analog-to-Digital and Digital-to-Analog Converters"

Course Code:	24CM251	Course Title:	Term Paper Writing and Seminar
Credits:	1	L – T – P	0-0-2

Course objectives:

- To develop their scientific and technical reading and writing skills that they need tounderstand and construct research articles.
- To obtain information from a variety of sources (i.e., Journals, dictionaries, referencebooks) and then place it in logically developed ideas.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Blended Mode of Learning
4. NPTEL and Other Videos
5. Smart Class Room

The work involves the following steps:

- Selecting a subject, narrowing the subject into a topic
- Stating an objective
- Collecting the relevant bibliography (at least 15 journal papers)
- Preparing a working outline
- Studying the papers and understanding the authors contributions and critically analyzing each paper.
- Preparing a working outline
- Linking the papers and preparing a draft of the paper.
- Preparing conclusions based on the reading of all the papers.
- Writing the Final Paper and giving final Presentation

Activity	Instructions	Submissionweek	Evaluation
Selection of area of interest and Topic Stating an Objective	You are requested to select an areaof interest, topic and state an objective	2nd week	**3 %** Based on clarity of thought, current relevance and clarity in writing
Collecting Information about your area & topic	1. List 1 Special Interest Groupsor professional society 2. List 2 journals 3. List 2 conferences, symposiaor workshops 4. List 1 thesis title 5. List 3 web presences (mailinglists, forums, news sites) 6. List 3 authors who publishregularly in your area 7. Attach a call for papers (CFP)from your area.	3rd week	**3%** (the selected information must be area specific and of international and national standard)
Collection of Journal papers in the topic in the context of the objective – collect 20 & then filter	• You have to provide a complete list of references you will be using- Based onyour objective -Search various digital libraries andGoogle Scholar • When picking papers to read - try to: • Pick papers that are related to each other in some ways and/or that are in the same field so that you can write a meaningful survey out of them, • Favour papers from well-known journals and conferences, • Favour "first" or "foundational" papers in the	4th week	**6%** (the list of standard papers and reason for selection)

	field (as indicated in other people's survey paper), • Favour more recent papers, • Pick a recent survey of the field so you can quickly gainan overview, • Find relationships with respect to each other and toyour topic area (classification scheme/categorization) • Mark in the hard copy of papers whether complete work or section/sections of the paper are being considered		
Reading and notes for first 5 papers	Reading Paper Process • For each paper form a Table answering the following questions: • What is the main topic of the article? • What was/were the main issue(s) the author said they want to discuss? • Why did the author claim it was important? • How does the work build on other's work, in the author's opinion? • What simplifying assumptions does the author claim to be making? • What did the author do? • How did the author claim they were going to evaluate their work and compare it to others? • What did the author say were the limitations of their research? • What did the author say were the important directions for future	5th week	**8%** (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)

	research? • Conclude with limitations/issues not addressed by the paper (from the perspective of your survey)		
Reading and notes for next5 papers	Repeat Reading Paper Process	6th week	**8%** (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)
Reading and notes for final 5 papers	Repeat Reading Paper Process	7th week	**8%** (the table given should indicate your understanding of the paper and the evaluation is based on
Draft outline 1 and Linking papers	Prepare a draft Outline, your surveygoals, along with a classification / categorization diagram	8th week	**8%** (this component will be evaluated based on the linking and classificationamong the papers)
Abstract	Prepare a draft abstract and give apresentation	9th week	**6%** (Clarity, purpose andconclusion) **6%** Presentation & VivaVoce
Introduction Background	Write an introduction and background sections	10th week	**5%** (clarity)

Sections of the paper	Write the sections of your paper based on the classification / categorization diagram in keepingwith the goals of your survey	11th week	**10%** (this component will be evaluated based on the linking and classificationamong the papers)
Your conclusions	Write your conclusions and futurework	12th week	**5%** (conclusions – clarity and your ideas)
Final Draft	Complete the final draft of yourpaper	13th week	**10%** (formatting, English, Clarity andlinking) **4%** Plagiarism CheckReport
Seminar	A brief 15 slides on your paper	14th & 15thweek	**10%** (based on presentationand Viva-voce)

Course outcomes: On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Analyze and evaluate theoretical literature.	K4
CO2	Select and use research methods depends on research problem and goals.	K3
CO3	Analyze empirical data and interpret research results and make conclusions	K4
CO4	Develop the final text of the term paper	K3

COs and POs Mapping:

COs	POs		
	1	**2**	**3**
CO1	**3**	**3**	2
CO2	**3**	**3**	2
CO3	**3**	**3**	2

CO4	**3**	**3**	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- NotMapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	40
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Lab Exam	100	60	60	60
				Total	100

Course Code:	**24AC201**	**Course Title:**	**ENGLISH FOR RESEARCH PAPER WRITING**
Credits:	**2**	**L – T – P**	**2-0-0**

Course objectives:

- To Develop how to improve writing skills and level of readability
- To plan what to write in each section
- To Apply the skills needed when writing a Title
- To develop the skills needed when writing the Conclusion
- Make use of the use of the quality of paper at very first-time submission

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. NPTEL and Other Videos
3. Smart Class Room
4. Field visit
5. Project based learning
6. Industrial Visit

UNIT I - Introduction to Research Paper Writing	**[6 hours]**
Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness	

UNIT II - Presentation Skills	**[6 hours]**
Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction	

UNIT III - Title Writing Skills	[6 hours]
Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check	

UNIT IV- Result Writing Skills	[6 hours]
Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions	

UNIT V- Verification Skills	[6 hours]
Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first-time submission	

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Domain
CO1	Develop the writing skills and level of readability	K3
CO2	Develop the presentation skills.	K3
CO3	Apply the skills needed when writing a title	K3
CO4	Develop the skills needed when writing the Conclusion	K3
CO5	Analyze the quality of good paper.	K4

COs and POs Mapping:

COs	POs		
	1	2	3
CO1	1	3	3
CO2	1	3	2
CO3	1	3	2
CO4	1	3	2
CO5	1	3	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0-Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	60	100	40
	CIE – II	100			
	Skill Assessment – I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern:

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011
2. Day R How to Write and Publish a Scientific Paper, Cambridge University Press 2006
3. Goldbort R Writing for Science, Yale University Press (available on Google Books) 2006
4. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book 1998.

Course Code:	**24AC202**	**Course Title:**	**DISASTER MANAGEMENT**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

- Summarize basics of disaster
- Explain a critical understanding of key concepts in disaster risk reduction and

humanitarianresponse • Illustrate disaster risk reduction and humanitarian response policy and practice from multipleperspectives. • Describe an understanding of standards of humanitarian response and practical relevance inspecific types of disasters and conflict situations. • Develop the strengths and weaknesses of disaster management approaches
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. NPTEL and Other Videos 3. Smart Class Room 4. Field visit

UNIT I – INTRODUCTION	**[6 hours]**
Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude	

UNIT II – REPERCUSSIONS OF DISASTERS AND HAZARDS	**[6 hours]**
Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.	

UNIT III – DISASTER PRONE AREAS IN INDIA	**[6 hours]**
Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics	

UNIT IV – DISASTER PREPAREDNESS AND MANAGEMENT	[9 hours]
Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.	

UNIT V – RISK ASSESSMENT	[9 hours]
Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival	

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Domain
CO1	Summarize the basics of disaster	K2
CO2	Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response	K2
CO3	Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives	K2
CO4	Describe the standards of humanitarian response and practical relevance in specific types of disasters and conflict situations	K2
CO5	Summarize the strengths and weaknesses of disaster management approaches	K2

COs and POs Mapping:

COs	POs		
	1	2	3
CO1	2	--	2
CO2	2	--	2

CO3	2	--	2
CO4	2	--	1
CO5	2	1	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped,Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	40	60	60
				Total	100

Assessment Pattern:

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

<u>End semester Examination: (QP PATTERN)</u>

- Each unit consists of two 2 marks questions and one 13 marks question (either or).
- One 16 marks question (either or) will be from any one of the five units.

- All the sixteen questions have to be answered.

References:

1. Goel S. L., Disaster Administration And Management Text And Case Studies",Deep& Deep Publication Pvt. Ltd., New Delhi,2009
2. NishithaRai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'NewRoyal book Company,2007.
3. Sahni, PardeepEt.Al. ," Disaster Mitigation Experiences And Reflections", PrenticeHall OfIndia, New Delhi,2001

Course Code:	**24AC203**	**Course Title:**	**Constitution of India**
Credits:	**3**	**L – T – P**	**2-0-0**

COURSE OBJECTIES:

- Understand the premises informing the twin themes of liberty and freedom from a civil rightsperspective
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional
- Role and entitlement to civil and economic rights as well as the emergence nation hood in theearly years of Indian nationalism.
- To address the role of socialism in India after the commencement of the BolshevikRevolutionin1917and its impact on the initial drafting of the Indian Constitution.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Project based Learning
4. Experiential Learning
5. NPTEL and Other Videos
6. Smart Class Room
7. Flipped Class

UNIT I – HISTORY OF MAKING OF THE INDIAN CONSTITUTION	[4 hours]
History, Drafting Committee, (Composition & Working)	

UNIT II – PHILOSOPHY OF THE INDIAN CONSTITUTION	[4 hours]
Preamble, Salient Features	

UNIT III – CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES	[6 hours]
Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.	

UNIT IV – ORGANS OF GOVERNANCE	[6 hours]
Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.	

UNIT V – LOCAL ADMINISTRATION	[6 hours]

District's Administration head: Role and importance, Municipalities: Introduction , Mayor and role of Elected Representative, CEO, Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy(Different departments), Village level:Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT VI – ELECTION COMMISSION	**[4 hours]**
Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women	

Course outcomes:

At the end of this course the students will be able to:

CO No.	Course Outcomes	Cognitive Domain
CO1	Summarize the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.	K2
CO2	Summarize the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.	K2
CO3	Summarize the circumstances surrounding the foundation of the Congress Socialist Party[CSP] under the leadership of Jawaharlal Nehru and the eventual failure of theproposal of direct elections through adult suffrage in the Indian Constitution.	K2
CO4	Explain the concepts of cooperative spectrum sensing and handoff process	K2

COs and POs Mapping:

COs	**POs**

	1	**2**	**3**
CO1	1	2	-
CO2	1	1	-
CO3	1	-	-
CO4	1	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped,Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	10 0	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	40	60	60
				Total	100

Assessment Pattern:

Bloom's Category	**Continuous Assessment Tests**		**Terminal Examination**
	1	**2**	
Remember	20	20	20
Understand	20	60	40

Apply	60	20	40
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions.
- One 16 marks question (either or) will be from any one of the five units.
- All the fifteen questions have to be answered.

REFERENCE BOOKS

1. The Constitution of India,1950(Bare Act), Government Publication.
2. Dr.S.N.Busi, Dr.B. R.Ambedkar framing of Indian Constitution,1st Edition, 2015.
3. M.P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis,2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

ROHINI COLLEGE OF ENGINEERING AND TECHNOLOGY

(AUTONOMOUS)

(Anjugramam-Kanyakumari Main Road, Palkulam,Variyoor P.O.-629 401, K.K.Dist.)

Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai

Accredited with A+ Grade by NAAC

M.E. EMBEDDED SYSTEM TECHNOLOGIES

(M.E.EEE)

Curriculum & Syllabus

(*2024-2025 Admitted Students Onwards*)

Vision Statement of RCET

To be an academic institute of continuous excellence towards educationand research in rural regime and provide service to nation in terms of nurturingpotentially higher social, ethical and engineering companion graduands.

Mission Statement of RCET

- To foster and promote technically competent graduands by imparting thestate of art Engineering education in rural regime.
- To enunciate research assisted scientific learning by dissemination ofknowledge towards science, agriculture, industry and national security.

Vision of the Department

To create technically competent technocrats to meet the demand of Electrical and Electronics industry and societal need for the wellbeing of human kinds.

Mission of the Department

- To provide knowledge and skills necessary for professional development in Electrical and Electronics Engineering.
- To promote research and creativity in the area of Electrical and Electronics Engineering.
- To promote team work and professional conduct in societal activities.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1 Graduates of the programme will possess career in electrical and allied fields.

PEO2 Graduates will have the ability to adapt to the growing technological requirement of the society through lifelong learning and team work.

PEO3 Graduates of the programme will possess knowledge to pursue higher studies.

PROGRAM OUTCOMES (POs)

PO1 An ability to independently carry out research /investigation and development work to solve practical problems.

PO2 An ability to write and present a substantial technical report/document.

PO3 Students should be able to demonstrate a degree of mastery in Embedded System Technologies. The mastery should be at a level higher than the requirements in the appropriate bachelor program

PROGRAM SPECIFIC OUTCOMES (PSO)

PSO1 Ability to design and analyze various issues in power system, control and Instrumentation systems and power electronic and drive system.

PSO2 Ability to design and simulate real time problems in electrical system using modern software tools.

PSO3 Ability to apply the knowledge for the development of renewable energy to meet the demand of society.

CREDIT INFO		
Sl.No	**Category**	**Credits**
1	Foundation Courses (FC)	4
2	Professional Core Courses (PCC)	35
3	Research Methodology And Ipr Courses (RMC)	2
4	Professional Elective Courses (PEC)	12
5	Employability Enhancement Courses (EEC)	18
6	Open Electives Courses (OEC)	3
7	Audit Courses (AC)	-
Total Credits		**74**

Foundation Courses (FC)							
Sl.no	Course Code	Course Title	Course Type	L	T	P	Credit
1.	24ES101	Applied Mathematics for Embedded Systems Technologists	FC	3	1	0	4
Professional Core Courses (PCC)							
Sl.no	Course Code	Course Title	Course Type	L	T	P	Credit
1.	24ES102	Design of Embedded Systems	PCC	3	0	0	3
2.	24ES103	Embedded System Networks	PCC	3	0	0	3
3.	24ES104	Microcontroller Based System Design	PCC	3	0	0	3
4.	24ES105	VLSI Design and Reconfigurable Architecture	PCC	3	0	0	3
5.	24ES131	Embedded System Laboratory - I	PCC	0	0	4	2
6.	24ES132	Programming and Algorithms Laboratory	PCC	0	0	4	2
7.	24ES201	Real Time Operating System	PCC	3	0	0	3
8.	24ES202	Advanced Digital System Design	PCC	3	0	0	3

9.	24ES203	Embedded Control for Electric Drives	PCC	3	0	0	3
10.	24ES204	IoT for Smart Systems	PCC	3	0	0	3
11.	24ES251	Embedded System Laboratory - II	PCC	0	0	4	2
12.	24ES252	Embedded Programming Laboratory	PCC	0	0	4	2
13.	24ES301	Software for Embedded Systems	PCC	3	0	0	3
Professional Elective Courses (PEC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1.	24ES205	Wireless And Mobile Communication	PEC	3	0	0	3
2.	24ES206	Virtual Instrumentation	PEC	3	0	0	3
3.	24ES207	Embedded Processor Development	PEC	3	0	0	3
4.	24ES208	Automotive Embedded System	PEC	3	0	0	3
5.	24ES212	Intelligent Control and Automation	PEC	3	0	0	3
6.	24ES213	Unmanned Aerial Vehicle	PEC	3	0	0	3
7.	24ES214	DSP Based System Design	PEC	3	0	0	3
8.	24ES215	Machine Learning and Deep Learning	PEC	3	0	0	3
9.	24ES302	Computer Vision	PEC	3	0	0	3
10.	24ES303	Multimedia Communication	PEC	3	0	0	3
11.	24ES304	Embedded Networking and Automation of Electrical System	PEC	3	0	0	3
12.	24ES305	Smart System Design	PEC	3	0	0	3
13.	24ES306	Embedded Computing	PEC	3	0	0	3
14.	24ES307	Embedded Systems Security	PEC	3	0	0	3
15.	24ES308	Robotics and Automation	PEC	3	0	0	3
16.	24ES310	Reconfigurable Processor and SoC Design	PEC	3	0	0	3
17.	24ES311	MEMS and NEMS Technology	PEC	3	0	0	3
18.	24ES312	Entrepreneurship and Embedded Product Development	PEC	3	0	0	3
19.	24ES313	Embedded System for Biomedical Applications	PEC	3	0	0	3
20.	24ES314	Renewable Energy and Grid Integration	PEC	3	0	0	3
21.	24ES315	Electric Vehicles and Power Management	PEC	3	1	0	4
22.	24ES316	Python Programming for Machine Learning	PEC	3	0	0	3
23.	24ES317	Smart Grid	PEC	3	0	0	3
Research Methodology Courses (RMC)							

S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1.	24RM101	Research Methodology and IPR	RMC	2	0	0	2
Open Electives Courses (OEC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1.	24CI341	Integrated Water Resources Management	OEC	3	0	0	3
2.	24CI342	Water, Sanitation and Health	OEC	3	0	0	3
3.	24CI343	Principles of Sustainable Development	OEC	3	0	0	3
4.	24CI344	Environmental Impact Assessment	OEC	3	0	0	3
5.	24CP311	Block chain Technologies	OEC	3	0	0	3
6.	24CP310	Deep Learning	OEC	3	0	0	3
7.	24IS342	Vibration and Noise Control Strategies	OEC	3	0	0	3
8.	24TE341	Energy Conservation and Management in Domestic Sectors	OEC	3	0	0	3
9.		Additive Manufacturing	OEC	3	0	0	3
10.	24TE342	Electric Vehicle Technology	OEC	3	0	0	3
11.	24TE343	New Product Development	OEC	3	0	0	3
12.	24CI345	Sustainable Management	OEC	3	0	0	3
13.	24IS341	Micro and Small Business Management	OEC	3	0	0	3
14.	24IS343	Intellectual Property Rights	OEC	3	0	0	3
15.	24IS344	Ethical Management	OEC	3	0	0	3
16.	24CP342	Security Practices	OEC	3	0	0	3
17.	24CP343	Cloud Computing Technologies	OEC	3	0	0	3
18.	24TC344	Design Thinking	OEC	3	0	0	3
19.	24CP341	Principles of Multimedia	OEC	3	0	0	3
20.	24CP345	Big Data Analytics	OEC	3	0	0	3
21.	24CP346	Internet of Things and Cloud	OEC	3	0	0	3
22.	24CP347	Medical Robotics	OEC	3	0	0	3
23.	24CP348	Embedded Automation	OEC	3	0	0	3
24.	24TE346	Environmental Sustainability	OEC	3	0	0	3
25.	24TE345	Textile Reinforced Composites	OEC	3	0	0	3
26.	24TE346	Nano composite Materials	OEC	3	0	0	3
27.	24RM342	IPR, Bio safety and Entrepreneurship	OEC	3	0	0	3
Employability Enhancement Courses (EEC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit

1.	24ES251	Project Work - I	EEC	0	0	12	6
2.	24ES451	Project Work - II	EEC	0	0	24	12
Non Credit/ Audit Course							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1.	24AC101	English for Research Paper Writing	AC	2	0	0	0
2.	24AC102	Disaster Management	AC	2	0	0	0
3.	24AC104	Constitution of India	AC	2	0	0	0

Recommended Courses for SEMESTER-I

S.No.	Course Code	Course Title	Category	L	T	P	C
THEORY COURSES							
1	24ES101	Applied Mathematics for Embedded Systems Technologists	FC	3	1	0	4
2	24RM101	Research Methodology and IPR	RMC	2	0	0	2
3	24ES102	Design of Embedded Systems	PCC	3	0	0	3
4	24ES103	Embedded System Networks	PCC	3	0	0	3
5	24ES104	Microcontroller Based System Design	PCC	3	0	0	3
6	24ES105	VLSI Design and Reconfigurable Architecture	PCC	3	0	0	3
7	24AC1XX	Audit Course I*	AC	2	0	0	0
LABORATORY COURSES							
8	24ES131	Embedded System Laboratory - I	PCC	0	0	4	2
9	24ES132	Programming and Algorithms Laboratory	PCC	0	0	4	2
TOTAL				**19**	**1**	**8**	**22**

Recommended Courses for SEMESTER-II

S.No.	Course Code	Course Title	Category	L	T	P	C
THEORY COURSES							
1	24ES201	Real Time Operating System	PCC	3	0	0	3
2	24ES202	Advanced Digital System Design	PCC	3	0	0	3
3	24ES203	Embedded Control for Electric Drives	PCC	3	0	0	3
4	24ES204	IoT for Smart Systems	PCC	3	0	0	3
5	24ES2XX	Professional Elective I	PEC	3	0	0	3
6	24ES2XX	Professional Elective II	PEC	3	0	0	3
7	24AC1XX	Audit Course II*	AC	2	0	0	0
LABORATORY COURSES							
8	24ES251	Embedded System Laboratory - II	PCC	0	0	4	2
9	24ES252	Embedded Programming Laboratory	PCC	0	0	4	2
TOTAL				**20**	**0**	**8**	**22**

Course Code:	24ES101	Course Title:	Applied Mathematics for Embedded Systems Technologists
Credits:	4	L – T – P	3 – 1 – 0

Course objectives:

- To understand the techniques of Fourier transform to solve partial differential equations.
- To become familiar with graph theory for modelling the embedded system.
- To acquire knowledge in probability, random variables and standard distributions
- To understand the basic concept of random variables and queuing theories to address stochastic and dynamic environment in embedded technology.

Teaching-Learning Process:

These are sample strategies which teachers can use to accelerate the attainment of the various course outcomes.

- Lecture methoddoes not mean only traditional method, but different type of teaching methods may be adopted to develop the outcomes.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Topics will be introduced in a multiple representation and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT I –Fourier Transform Techniques for Partial Differential Equations	[12 hours]

Fourier transform: Definitions - Properties – Transform of elementary functions - Dirac delta function – Convolution theorem – Parseval's identity – Solutions to partial differential equations: Heat equation - Wave equation - Laplace and Poison's equations.

UNIT II – Graph Theory	[12 hours]

Introduction to paths, trees, vector spaces - Matrix coloring and directed graphs - Some basic algorithms – Shortest path algorithms – Depth - First search on a graph – Isomorphism – Theoretic algorithms – Performance of graph theoretic algorithms – Graph theoretic computer languages.

UNIT III – Optimization Techniques	[12 hours]

Linear programming - Basic concepts – Graphical and simplex methods – Big M method - Two phase

simplex method - Revised simplex method - Transportation problems – Assignment problems.

UNIT IV – Probability and Random Variables	[12 hours]
Probability – Axioms of probability – Conditional probability – Baye's theorem - Random variables - Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Exponential, Normal distributions – Functions of one dimensional random variable.	

UNIT V – Queueing Theory	[12 hours]
Single and multiple servers - Markovian queuing models - Finite and infinite capacity queues – Finite source model – Queuing applications.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Use the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering
CO2	Apply Graph theory concept to solve real world application like routing, TSP/Traffic Control etc…
CO3	Construct a linear programming model from problem description, and apply the simple method for solving linear programming problems.
CO4	Apply the ideas of probability and random variables in solving engineering problems.
CO5	Apply the concept of Queuing Models in real life problems

COs and POs Mapping:

CO'S	PO1	PO2	PO3
CO1	2	3	1
CO2	3	3	2
CO3	3	3	2
CO4	2	2	1
CO5	3	3	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40

	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Skill Assessment Components: Individual Assignment / Worksheet / Case Study / Mini Projet

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. Taha H.A., " Operations Research: An Introduction “, 9th Edition, Pearson Education Asia, New Delhi, 2016.
2. Walpole R.E., Myer R.H., Myer S.L., and Ye, K., " Probability and Statistics for Engineers and Scientists ", 7th Edition, Pearson Education, Delhi, 2002.
3. Sankara Rao, K., “Introduction to Partial Differential Equations”, Prentice Hall of India Pvt. Ltd., New Delhi, 1997.
4. Narasingh Deo, " Graph Theory with Applications to Engineering and Computer Science ", Prentice Hall India,1997.

Web Links and Video Lectures (E-Resources):

1. Probability Distributions: https://www.nptelvideos.com/lecture.php?id=14400
2. Applications of Fourier Transform to PDEs:https://www.nptelvideos.com/lecture.php?id=13442
3. Graph Theory:https://www.nptelvideos.com/lecture.php?id=13728

Equivalent NPTEL/SWAYAM Courses:

S.No.	Course Title	Course Instructor	Host Institute
1	Probability and Statistics	Prof. Somesh Kumar	IIT Kharagpur
2	Advanced Engineering Mathematics	Dr. P. Panigrahi Prof. J. Kumar Prof. P.D. Srivastava Prof. Somesh Kumar	IIT Kharagpur

Course Code:	24RM101	Course Title:	Research Methodology and IPR
Credits:	**2**	**L – T – P**	**2-0-0**

Course objectives:

To impart knowledge on the

- Importance of research methodology and Intellectual Property Rights.
- Rights for the protection of their invention done in their project work.
- Registration of patents in our country and foreign countries of invention, designs and thesis or theory written.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Blended Mode of Learning
3. Project based Learning
4. NPTEL and Other Videos
5. Smart Class Room
6. Flipped Class

UNIT I –Research Design	[9 hours]
Overview of research process and design, Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys.	

UNIT II – Data Collection and Sources	[9 hours]
Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data - Preparing, Exploring, examining and displaying.	

UNIT III – Data Analysis and Reporting	[9 hours]
Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation.	

UNIT IV – Intellectual Property Rights	[9 hours]
Intellectual Property – The concept of IPR, Evolution and development of concept of IPR, IPR development process, Trade secrets, utility Models, IPR & Bio diversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.	

UNIT V – Patents	[9 hours]
Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification, Types of patent application, process E-filling, Examination of patent, Grant of patent, Revocation, Equitable Assignments, Licences, Licensing of related patents, patent agents, Registration of patent agents.	

Course outcomes: On completion of the course, the student will have the ability to:

CO1	Formulate a research problem and explain the concepts related to research design
CO2	Depict the methods of data collection and analysis
CO3	Analyze research data and related information.
CO4	Understand the importance of IPR in growth of individuals & Nation.
CO5	Recognize the importance of Report writing.

COs and POs Mapping:

COs	PO1	PO2	PO3
CO1	**2**	**1**	1
CO2	**2**	**1**	-
CO3	**2**	**1**	1
CO4	**2**	**2**	-
CO5	**2**	**3**	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Typeof assessment	Max Mar ks	Reduce d Marks	Tot al	Fin al mar

					ks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	10 0	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. D P Neeraj Pandey and KhushdeepDharni, ‘Intellectual Property Rights’, First edition, PHI learning Pvt. Ltd., Delhi, 2014.
2. Uma Sekaran and Roger Bougie, ‘Research methods for Business’, 5th Edition, Wiley India, New Delhi, 2012.
3. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students” ,2nd edition, Juta Academic, 2001.
4. Ramakrishna B &Anilkumar H S, ‘Fundamentals of Intellectual Property Rights’, Ist edition, Notion Press, 2017.

Reference Books:

1. William G Zikmund, Barry J Babin, Jon C.Carr, AtanuAdhikari,Mitch Griffin, “Business Research methods”, A South Asian Perspective, 8th Edition, Cengage Learning, New Delhi, 2012.

Web Links and Video Lectures (E-Resources):

1. Research Methodology: https://onlinecourses.nptel.ac.in/noc23_ge36/preview
2. Intellectual Property:https://onlinecourses.nptel.ac.in/noc22_hs59/preview

Suggested Skill Activities:

1. Case Study Analysis:
   - Select a research paper or real-world case study related to a specific research methodology (qualitative, quantitative, mixed methods, etc.).
   - Critically analyze the methodology used, its strengths, weaknesses, and appropriateness for the research question.
   - Discuss alternative methodologies that could have been used and their implications.

2. Designing Research Proposals:
    - Divide students into groups and assign them different research topics.
    - Have each group develop a research proposal including research questions, objectives, methodology, sampling techniques, and data analysis methods.
    - Present proposals to the class for peer review and feedback.
3. Data Analysis Exercises:
    - Provide students with datasets (real or simulated) and ask them to perform various types of data analysis (descriptive statistics, regression analysis, content analysis, etc.).
    - Emphasize interpretation of results and drawing meaningful conclusions based on data.
4. IPR Case Analysis:
    - Assign students to analyze landmark intellectual property cases.
    - Discuss the legal principles involved (e.g., infringement, fair use, licensing agreements) and the impact of these cases on IPR law.
5. Trademark and Copyright Exercises:
    - Ask students to identify trademarks and copyrights in everyday products or creative works.
    - Discuss the process of registering trademarks and copyrights, and the benefits of intellectual property protection for businesses and creators.

Course Code:	**24ES102**	**Course Title:**	**Design of Embedded systems**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To provide knowledge on the basics, building blocks of Embedded System.
- To discuss Input/output Interfacing & Bus Communication with processors.
- To Teach automation using scheduling algorithms and Real time operating system.
- To Identify the design approaches for uniprocessor and multiprocessor
- To Interpret on different Phases & Modeling of a new embedded product.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Power point presentation
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – INTRODUCTION TO EMBEDDED SYSTEMS	[9 hours]
Introduction to Embedded Systems –built in features for embedded Target Architecture - selection of Embedded processor – DMA- memory devices – Memory management methods-memory mapping - cache replacement policies- Timer and Counting devices- Watchdog Timer - Real Time Clock - Software Development tools-IDE - assembler – compiler – linker – simulator – debugger	

UNIT II – EMBEDDED NETWORKING BY PROCESSORS	[9 hours]
Embedded Networking: Introduction - I/O Device Ports & Buses- multiple interrupts and interrupt service mechanism – Serial Bus communication protocols -RS232 standard–RS485–USB–Inter Integrated Circuits (I2C)- CAN Bus –Wireless protocol based on Wifi– Bluetooth - Zigbee	

UNIT III – RTOS BASED EMBEDDED SYSTEM DESIGN	[9 hours]
Introduction to basic concepts of RTOS- Need, Task, process & threads- interrupt routines in RTOS- Multiprocessing and Multitasking - Preemptive and non-preemptive scheduling - Task communicationcontext switching- interrupt latency and deadline shared memory- message passing- Interprocess Communication – synchronization between processes-semaphores, Mailbox- pipes- priority inversion, priority inheritance- comparison of Real time-Operating systems – VxWorks- uC/OS-II, RT Linux	

UNIT IV – MODELLING WITH HARDWARE/SOFTWARE DESIGN APPROACHES	[9 hours]
Modelling embedded systems- embedded software development approach --Overview of UML modeling with UML, UML Diagrams-- Hardware/Software Partitioning- Co-Design Approaches for System Specification and modeling- CoSynthesis- features comparing -Single-processor Architectures	

& Multi-Processor Architectures--design approach on parallelism in uniprocessors & Multiprocessors.

UNIT V – EMBEDDED SYSTEM APPLICATION DEVELOPMENT	**[9 hours]**
Objectives, different Phases & Modeling of the Embedded product development life cycle (ELDC). - Case studies on Digital Camera, Adaptive Cruise control in a Car, Mobile Phone software for key inputs.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Demonstrate the functionalities of processor internal blocks, based on their requirement.
CO2	Analyze the Bus standards are chosen based on interface overheads to improve processor performance
CO3	Analyze the role and features of RT operating system, that makes multitask execution possible by processors.
CO4	Apply multiple CPU based on either hardcore or softcore helps data overhead management with processing- speed reduction for processor execution.
CO5	Apply Embedded consumer product design based on phases of product development.

COs and POs Mapping:

CO's	PO1	PO2	PO3
CO1	2	2	-
CO2	3	2	-
CO3	3	2	-
CO4	2	**1**	-
CO5	2	**1**	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Typeof assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		

	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Rajkamal, 'Embedded system-Architecture, Programming, Design', TMH,2011.
2. Peckol, "Embedded system Design",JohnWiley&Sons,2010

Reference Books:

1. Lyla B Das," Embedded Systems-An Integrated Approach",Pearson2013
2. Elicia White," Making Embedded Systems", O'Reilly Series,SPD,2011
3. Bruce Powel Douglass," Real-Time UML Workshop for Embedded Systems,Elsevier,2011
4. Advanced Computer architecture , By Rajiv Chopra, S Chand , 2010
5. Jorgen Staunstrup, Wayne Wolf ,Hardware / Software Co- Design Principles and Practice, Springer, 2009.

Web Links and Video Lectures (E-Resources):

1. Embedded system design: https://archive.nptel.ac.in/courses/108/102/108102169/

Suggested Skill Activities:

1. Design and Implement a Processor:
   - Task students with designing a simple processor architecture (such as a reduced instruction set computer, RISC) using FPGA tools like Verilog or VHDL.
   - Include components like instruction decoding, ALU operations, and memory access.
2. Real-World Applications and Projects:
   - Assign projects related to real-world signal processing applications, such as audio processing, video compression, or wireless communication systems.

Course Code:	**24ES103**	**Course Title:**	**Embedded System Networking**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives: To impart knowledge on the • To expose the students to the fundamentals of wired embedded networking techniques. • To introduce the concepts of embedded ethernet. • To expose the students to the fundamentals of wireless embedded networking. • To discuss the fundamental building blocks of digital instrumentation. • To introduce design of Programmable measurement & control of electrical Device
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. PowerPoint presentation 3. Interactive Simulations 4. Lab experiment videos 5. Blended Mode of Learning 6. Project based Learning 7. Experiential Learning 8. NPTEL and Other Videos 9. Smart Class Room 10. Flipped Class

UNIT I - EMBEDDED PROCESS COMMUNICATION WITH INSTRUMENT BUS	**[9 hours]**
Embedded networking: Introduction – Cluster of instruments in System: Introduction to bus protocols – comparison of bus protocols – RS 232C, RS 422, RS 485 and USB standards – embedded ethernet – MOD bus, LIN bus and CAN bus.	

UNIT II – EMBEDDED ETHERNET	**[9 hours]**
Elements of a network – Inside Ethernet – Building a Network : Hardware options – Cables, Connections and network speed – Ethernet controllers – Inside the internet protocol – Exchanging messages using UDP and TCP – Email for Embedded systems using FTP – Keeping devices and network secure	

UNIT III – WIRELESS EMBEDDED NETWORKING	**[9 hours]**
Wireless sensor networks – Introduction – Node architecture – Network topology -Localization – Time synchronization – Energy efficient MAC protocols – SMAC – Energy efficient and robust	

routing – Data centric routing - WSN Applications - Home Control - Building Automation - Industrial Automation

UNIT IV – BUILDING SYSTEM AUTOMATION	[9 hours]
Sensor Types & Characteristics: Sensing Voltage, Current, flux, Torque, Position, Proximity, Accelerometer - Data acquisition system- Signal conditioning circuit design- Uc Based & PC based data acquisition – UC for automation and protection of electrical appliances –processor based digital controllers for switching Actuators: Stepper motors, Relays –System automation with multi-channel Instrumentation and interface	

UNIT V –COMMUNICATION FOR LARGE ELECTRICAL SYSTEM AUTOMATION	[9 hours]
Data Acquisition, Monitoring, Communication, Event Processing, and Polling Principles, SCADA system principles – outage management– Decision support application - substation automation, extended control feeder automation, Performance measure and response time, SCADA Data Models, need, sources, interface	

Course outcomes: On completion of the course, the student will have the ability to:

CO1	Analyze the different bus communication protocols used for embedded networking
CO2	Explain the basic concepts of embedded networking
CO3	Apply the embedded networking concepts in wireless networks
CO4	Relate different data acquisition concepts.
CO5	Build a system automation for different applications

COs and POs Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	2	-	-	3	1
CO2	-	2	-	-	2	1
CO3	3	2	2	3	2	3
CO4	2	-	3	3	-	2
CO5	3	-	3	3	-	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Typeof assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

1. **Text Books:** Mohammad Ilyas And ImadMahgoub, 'Handbook of sensor Networks: Compact wireless and wired sensing systems', CRC Press,2005.

Reference Books:

1. Krzysztof Iniewski,"Smart Grid ,Infrastructure& Networking",TMcGH,2012.

Course Code:	24ES104	Course Title:	Microcontroller Based System Design
Credits:	3	L – T – P	3-0-0

Course objectives:

To impart knowledge on the

- To illustrate the architecture of PIC Microcontroller and RISC processor.
- To compare the architecture and programming of 8,16,32 bit RISC processor.
- To construct the implementation of DSP in ARM processor.
- To discuss on memory management, application development in RISC processor.
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the conceptsacquired over the 5 Units of the subject for improved employability skills.

Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. Interactive Simulations 3. Lab experiment videos 4. Blended Mode of Learning 5. Project based Learning 6. Experiential Learning 7. NPTEL and Other Videos 8. Smart Class Room 9. Flipped Class

UNIT I – PIC Microcontroller	**[9 hours]**
Architecture - memory organization - addressing modes - instruction set - PIC programming in Assembly & C - I/O port, Data Conversion, RAM & ROM Allocation, Timer programming, practice in MP-LAB.	

UNIT II – ARM Architecture	**[9 hours]**
Architecture - memory organization - addressing modes - The ARM Programmer's model - Registers - Pipeline - Interrupts - Coprocessors – Interrupt Structure	

UNIT III – Peripherals of PIC and ARM Microcontroller	**[9 hours]**
PIC: ADC, DAC and Sensor Interfacing –Flash and EEPROM memories. ARM: I/O Memory – EEPROM – I/O Ports – SRAM –Timer –UART - Serial Communication with PC – ADC/DAC Interfacing.	

UNIT IV – ARM Microcontroller Programming	**[9 hours]**
ARM general Instruction set – Thumb instruction set –Introduction to DSP on ARM – Implementation example of Filters	

UNIT V –Design with PIC And ARM Microcontrollers	**[9 hours]**
PIC implementation - Generation of Gate signals for converters and Inverters - Motor Control – Controlling DC/ AC appliances – Measurement of frequency - Standalone Data Acquisition System –ARM Implementation- Simple ASM/C programs- Loops –Look up table- Block copy-	

subroutines-Hamming Code.

Course outcomes: On completion of the course, the student will have the ability to:

CO1	Illustrate the basics and requirement of processor functional blocks.
CO2	Demonstrate the specialty of RISC processor Architecture.
CO3	Make use of I/O hardware interface of a processor based automation for consumer application with peripherals.
CO4	Construct I/O software interface of a processor with peripherals.
CO5	Utilize PIC and Arm Microcontrollers for Controlling DC/ AC appliances

COs and POs Mapping:

COs	PO1	PO2	PO3
CO1	**-**	**-**	2
CO2	**1**	**-**	3
CO3	**-**	**-**	1
CO4	**-**	**-**	-
CO5	**1**	**-**	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Typeof assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	65	60	60

	Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Steve Furber, 'ARM system on chip architecture', Addision Wesley,2010.
2. Andrew N. Sloss, Dominic Symes, Chris Wright, John Rayfield 'ARM System Developer's Guide Designing and Optimizing System Software', Elsevier 2007.
3. Muhammad Ali Mazidi, Rolin D. Mckinlay, Danny Causey ' PIC Microcontroller
4. and Embedded Systems using Assembly and C for PIC18', Pearson Education 2008.

Reference Books:

1. John Iovine, 'PIC Microcontroller Project Book ', McGraw Hill 2000
2. William Hohl, ' ARMAssebly Language' Fundamentals and Techniques,2009.
3. Rajkamal,"Microcontrollers Architecture, Programming, Interfacing,& System Design,Pearson,2012
4. ARM Architecture Reference Manual, LPC213x User Manual

Web Links and Video Lectures (E-Resources):

1. Advanced ARM Cortex Processors: www.Nuvoton .com

Suggested Skill Activities:

1. Real-World Applications and Case Studies:
   - Assign projects that involve designing embedded systems using PIC/ARM for specific applications (e.g., robotics control, industrial automation).

Course Code:	**24ES105**	**Course Title:**	**VLSI Design and Reconfigurable Architecture**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- Sequential system design, synchronous and Asynchronous circuits.
- Basic concepts of CMOS and to introduce the IC fabrication methods
- Reconfigurable Processor technologies and to provide an insight and architecture significance of SOC in real time application.
- Basics of analog VLSI design and its importance.

- Programming of Programmable device using Hardware description Language.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Blended Mode of Learning
3. Project based Learning
4. Experiential Learning
5. NPTEL and Other Videos
6. Smart Class Room
7. Flipped Class

UNIT I –Introduction to Advanced Digital System Design	**[9 hours]**
Modeling of Clocked Synchronous Sequential Network (CSSN), Design of CSSN, Design of Asynchronous Sequential Circuits (ASC), Designing Vending Machine Controller, Races in ASC, Static and Dynamic Hazards, Essential Hazards, Designing Hazard free circuits	

UNIT II – CMOS Basics & IC Fabrication	**[9 hours]**
Moore's Law-MOSFET Scaling - MOS Transistor Model-Determination of pull up / pull down ratios CMOS based combinational logic & sequential design- Dynamic CMOS –Transmission Gates-BiCMOS- Low power VLSI – CMOS IC Fabrications - Stick Diagrams, Design Rules and Layout.	

UNIT III – ASIC and Reconfigurable Processor and SoC Design	**[9 hours]**
Introduction to ASIC, ASIC design flow- programmable ASICs- Introduction to reconfigurable processor- Architecture -Reconfigurable Computing, SoC Overview, recent trends in Reconfigurable Processor & SoC, Reconfigurable processor based DC motor control.	

UNIT IV – Analog VLSI Design	[9 hours]
Introduction to analog VLSI- Design of CMOS 2stage-3 stage Op-Amp –High Speed and High frequency op-amps-Super MOS- Analog primitive cells- Introduction to FPAA.	

UNIT V – VHDL Programming	[9 hours]
Overview of digital design with VHDL, structural, data flow and behavioural modeling concepts-logic synthesis-simulation-Design examples, Ripple carry Adders, Carry Look ahead adders, Multiplier, ALU, Shift Registers, Test Bench.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Incorporate synchronous and asynchronous switching logics, with clocked circuits design
CO2	Deliver insight into developing CMOS design techniques and IC fabrication methods.
CO3	Explain the need of reconfigurable computing, hardware-software design and operation of SoC processor.
CO4	Design and development of reprogrammable analog devices and its usage for Embedded applications.
CO5	Illustrate and develop HDL computational processes with improved design strategies.

COs and POs Mapping:

CO'S	PO1	PO2	PO3
CO1	**-**	**-**	-
CO2	**2**	**-**	2
CO3	**-**	**-**	3
CO4	**2**	**-**	2
CO5	**-**	**1**	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Mark	Reduced	Total	Final marks

		s	Marks		
Continuous Internal Examination (CIE)	CIE – I	100	50	10 0	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
Total					100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. Donald G. Givone, "Digital principles and Design", Tata McGraw Hill 2002.

2. Charles H. Roth Jr., "Fundamentals of Logic design", Thomson Learning, 2004.

3. Nurmi, Jari (Ed.) "Processor Design System-On-Chip Computing for ASICs and FPGAs" Springer, 2007. 4. Joao Cardoso, Michael Hübner, "Reconfigurable Computing: From FPGAs to Hardware/Software Codesign" Springer, 2011.

5. Pierre-Emmanuel Gaillardon, Reconfigurable Logic: Architecture, Tools, and Applications, 1st Edition, CRC Press , 2015

6. Mohamed Ismail ,TerriFiez, "Analog VLSI Signal and information Processing", McGraw Hill International Editions,1994.

7. William J. Dally / Curtis Harting / Tor M. Aamodt," Digital Design Using VHDL:A Systems Approach, Cambridge Univerity Press,2015.

8. ZainalatsedinNavabi, 'VHDL Analysis and Modelling of Digital Systems', 2n Edition, Tata McGraw Hill, 1998.

Suggested Skill Activities:

1. Develop a reconfigurable computing, hardware-software design and operation of SoC processor.

Course Code:	**24ES131**	**Course Title:**	**Embedded System Laboratory – I**
Credits:	**2**	**L – T – P**	**0-0-4**

Course objectives:

To impart knowledge on the

- To involve the students to Practice on Workbench /Software Tools/ Hardware Processor Boards with the supporting Peripherals.
- To teach the concepts of algorithm development & programming on software tools and Digital processors with peripheral interfaces.
- To encourage students to practice in open source software/packages/tools
- To train though hands-on practices in commercial and licensed Hardware-software suites
- Practicing through the subdivisions covered within experiments listed below to expose the students into the revising the concepts acquired from theory subjects.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. NPTEL and Other Videos
3. Smart Classroom
4. Flipped Class

Laboratory Component **[60 hours]**

S.No.	**Name of the Experiment**
1	Programming with 8 bit Microcontrollers # Assembly programming
2	Programming with 8 bit Microcontrollers # C programming
3	I/O Programming with 8bit Microcontrollers I/O Interfacing :Serial port programming/LCD/Sensor Interfacing /PWM Generation/Motor Control
4	Programming with PIC Microcontrollers: Assembly Cprogramming
5	I/O Programming with PIC Microcontrollers I/O Interfacing : PWM Generation/ Motor Control/ADC/DAC/ LCD/Sensor Interfacing

Course outcomes: On completion of the course, the student will have the ability to:

CO1	Experiment with the embedded processors of CISC and RISC architecture/ computational processors with peripheral interface.
CO2	Analyze the microcontroller-based process control with the conventional control impact.
CO3	Experiment with the programming logic of Processor based on software suites (simulators, emulators)
CO4	Apply I/O software interface of a processor with peripherals for transferring information/data.
CO5	Analyze the influence of recent interfacing trends and use of commercial embedded processors.

COs and POs Mapping:

CO'S	PO1	PO2	PO3
CO1	2	1	2
CO2	-	-	1
CO3	2	3	1
CO4	2	-	2
CO5	-	-	1
CO	2	2	1.4

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Typeof assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	60
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Lab Exam	100	40	40	40
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 13 marks question (either or).
- One 16 marks question (either or) will be from any one of the five units.
- All the sixteen questions have to be answered.

REFERENCE BOOKS

1. Mohamammad Ali Mazidi&Mazidi '8051 Microcontroller and Embedded Systems', Pearson Education

2. Mohammad Ali Mazidi, Rolind Mckinley and Danny Causey,'PIC Microcontroller and Embedded

Systems' Pearson Education.
3. Simon Monk, "Make Action-with Arduino and Raspberry Pi,SPD,2016.
4. Wesley J.Chun, "Core Python Applications Programming,3rded,Pearson,2016
5. Kraig Mitzner, 'Complete PCB Design using ORCAD Capture and Layout', Elsevier
6. Vinay K.Ingle, John G.Proakis,"DSP-A Matlab Based Approach", Cengage Learning, 2010.
7. Taan S.Elali, "Discrete Systems and Digital Signal Processing with Matlab", CRC Press 2009.
8. Jovitha Jerome, "Virtual Instrumentation using Lab view" PHI, 2010.
9. Woon-Seng Gan, Sen M. Kuo, 'Embedded Signal Processing with the Micro Signal Architecture', John Wiley & Sons, Inc., Hoboken, New Jersey 2007
10. Dogan Ibrahim, 'Advanced PIC microcontroller projects in C',Elsevier2008
11. Perry Lea, "Internet of things for architects," Packt, 2018.

Skill Assessment:

1. Do a project to control traffic light using PIC microcontroller.
2. Write an detailed report on comparison between PIC Microcontroller and 8 bit microcontroller.

Course Code:	**24ES132**	**Course Title:**	**PROGRAMMING AND ALGORITHMS LABORATORY**
Credits:	**2**	**L – T – P**	**0-0-4**

Course objectives:

- To develop an algorithm & programming on software tools and Digital processors with peripheral interfaces.
- To expertise in open source software / packages /tools.
- To do hands-on in commercial and licensed Hardware-software suites.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Interactive Simulations
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

LIST OF EXPERIMENTS

1. Implementation of basic programming concepts like conditionals and loops
2. Implementation of function and operator overloading
3. Creation of classes and objects.
4. Implementation of constructors and destructors
5. Implementation of array of objects and dynamic objects.
6. Implementation of inheritance and its types
7. Implementation of polymorphism and its types.
8. Implementation of various sorting algorithms.
9. Application of Stack
10. Implementation of queue using array.
11. Implementation of Linked Lists: Singly linked, doubly linked and Circular lists and applications.

Course outcomes: On completion of the course, the student will have the ability to:

CO1	Implement various object oriented concepts through simple programs.
CO2	Implement different data structures using C++
CO3	Apply the different data structures for implementing solutions to practical problems
CO4	Demonstrate searching algorithms
CO5	Demonstrate sorting algorithms

COs and POs Mapping:

CO/PO	PO1	PO2	PO3
CO1	3	-	2
CO2	3	-	2
CO3	3	-	2
CO4	3	-	2
CO5	3	-	2
CO	3	-	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Typeof assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	60
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Lab Exam	100	40	40	40
				Total	100

Course Code:	24ES201	Course Title:	Real Time Operating System
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To explore the fundamental interaction of OS with a computer and User computation.
- To explain the fundamental concepts of how process are created and controlled with OS.
- To study on programming logic of modeling Process based on range of OS features
- To compare types and Functionalities in commercial OS, application development using RTOS
- To develop real time application with RTOS.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Interactive Simulations
3. Lab experiment videos
4. Blended Mode of Learning
5. Project based Learning
6. Experiential Learning
7. NPTEL and Other Videos
8. Smart Class Room
9. Flipped Class

UNIT I – Review of Operating Systems	[9 hours]
Basic Principles - Operating System structures – System Calls – Files – Processes – Design and Implementation of processes – Communication between processes – Introduction to Distributed operating system – Embedded operating systems	

UNIT II – Overview of RTOS	[9 hours]
RTOS Task and Task state –Multithreaded Preemptive scheduler- Process Synchronization- Message queues– Mail boxes -pipes – Critical section – Semaphores – Classical synchronization problem – Deadlocks	

UNIT III – Realtime Models and Languages	[9 hours]
Event Based – Process Based and Graph based Models – Real Time Languages – RTOS Tasks – RT scheduling - Interrupt processing – Synchronization – Control Blocks – Memory Requirements.	

UNIT IV – Realtime Kernel	[9 hours]
Principles – Design issues – Polled Loop Systems – RTOS Porting to a Target – Comparison and Basic study of various RTOS like – VX works – Linux supportive RTOS – C Executive.	

UNIT V –Application Development	[9 hours]
Discussions on Basics of Linux supportive RTOS – uCOS-C Executive for development of RTOS Application – Case study	

Course outcomes: On completion of the course, the student will have the ability to:

CO1	Outline Operating System structures and types
CO2	Insight into scheduling, disciplining of various processes execution.
CO3	Illustrate knowledge on various RTOS support modelling
CO4	Demonstrate commercial RTOS Suite features to work on real time processes design.
CO5	Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in RTOS and embedded automation design.

COs and POs Mapping:

COs	PO1	PO2	PO3

CO1	2	2	2
CO2	2	3	2
CO3	1	2	1
CO4	2	3	2
CO5	2	3	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Typeof assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final marks</th></tr>
<tr><td rowspan="6">Continuous Internal Examination (CIE) - Theory</td><td>CIE – I</td><td>100</td><td rowspan="2">50</td><td rowspan="6">100</td><td rowspan="6">40</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>MCQ</td><td>20</td><td>10</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td>Model Lab Exam</td><td>25</td><td>25</td></tr>
<tr><td>End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>65</td><td>60</td><td>60</td></tr>
<tr><td colspan="5">Total</td><td>100</td></tr>
</table>

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in RTOS and embedded automation design.

Reference Books:

1. Raj Kamal, "Embedded Systems- Architecture, Programming and Design" Tata McGraw Hill,2006.

Web Links and Video Lectures (E-Resources):

1. Real Time Operating System: https://archive.nptel.ac.in/courses/106/105/106105172/

Suggested Skill Activities:

1. RTOS Task Creation and Management:
   - Task students with creating tasks in an RTOS environment (e.g., FreeRTOS, VxWorks).
   - Assign different priorities to tasks and observe how the RTOS scheduler manages task execution based on priority levels.

- Discuss the concepts of preemption, context switching, and task scheduling algorithms (e.g., priority scheduling, round-robin).

2. Real-World Applications and Case Studies:
    - Assign projects that involve designing embedded systems using RTOS for specific applications (e.g., robotics control, industrial automation).
    - Encourage students to integrate sensor inputs, actuator controls, and communication interfaces within an RTOS framework.

Course Code:	**24ES202**	**Course Title:**	**Advanced Digital System Design**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To infer the modelling of clocked synchronous sequential networks.
- To interpret and design the asynchronous sequential circuit in various modes.
- To diagnose the faults and test the system using defined algorithms.
- To identify the need of EPROM technology to realize the sequential circuits.
- To utilize the VHDL principle for describing the combinational circuits.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – Sequential Circuit Design	**[9 hours]**
Analysis of Clocked Synchronous Sequential Networks (CSSN) Modeling of CSSN – State Stable Assignment and Reduction – Design of CSSN – Design of Iterative Circuits – ASM Chart – ASM Realization.	

UNIT II – Asynchronous Sequential Circuit Design	[9 hours]
Analysis of Asynchronous Sequential Circuit (ASC) – Flow Table Reduction – Races in ASC – State Assignment – Problem and the Transition Table – Design of ASC – Static and Dynamic Hazards – Essential Hazards – Data Synchronizers – Designing Vending Machine Controller – Mixed Operating Mode Asynchronous Circuits.	

UNIT III – Fault Diagnosis And Testability Algorithms	[9 hours]
Fault Table Method – Path Sensitization Method – Boolean Difference Method – Kohavi Algorithm – Tolerance Techniques – The Compact Algorithm – Practical PLA's – Fault in PLA – Test Generation – Masking Cycle – DFT Schemes – Built-in Self Test.	

UNIT IV – Synchronous Design Using Programmable Devices	[9 hours]
EPROM to Realize a Sequential Circuit – Programmable Logic Devices – Designing a Synchronous Sequential Circuit using a GAL – EPROM – Realization State machine using PLD – FPGA – Xilinx FPGA – Xilinx 2000 - Xilinx 3000.	

UNIT V – System Design Using VHDL	[9 hours]
VHDL Description of Combinational Circuits – Arrays – VHDL Operators – Compilation and Simulation of VHDL Code – Modelling using VHDL – Flip Flops – Registers – Counters – Sequential Machine – Combinational Logic Circuits - VHDL Code for – Serial Adder, Binary Multiplier – Binary Divider – complete Sequential Systems – Design of a Simple Microprocessor.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Apply the design procedure of clocked synchronous and asynchronous sequential circuits for developing simple digital system.
CO2	Analyze the clocked synchronous sequential circuits and asynchronous sequential circuits in digital system.
CO3	Interpret the basic and advanced concepts in testing the digital circuits for real world applications.
CO4	Apply the EPROM techniques to design synchronous sequential circuit using programmable devices.
CO5	Infer the basics of programming the VHDL for digital circuit design.

COs and POs Mapping:

CO's	**PO1**	**PO2**	PO3

CO1	3	2	-
CO2	-	3	-
CO3	3	-	-
CO4	2	2	-
CO5	-	-	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Typeof assessment**	**Max Mar ks**	**Reduce d Marks**	**Tot al**	**Fina l mar ks**
Continuous Internal Examination (CIE)	CIE – I	100	50	10 0	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Donald G. Givone, “Digital principles and Design”, 1st Edition, Tata McGraw Hill, 2017.
2. Charles H. Roth Jr., “Digital System Design using VHDL”, 2nd Edition, Cengage Learning, 2007.

Reference Books:

1. Parag K Lala, “Digital System design using PLD” 1st Edition BS Publications, 2003.
2. Skahill. K, “VHDL for Programmable Logic” Pearson Education, 2010.
3. Robert K Dueck, “Digital Design with CPLD applications and VHDL”, Thomson Asia, 2004.

Web Links and Video Lectures (E-Resources):

1. Digital VLSI Testing: https://archive.nptel.ac.in/courses/117/105/117105137/
2. Digital electronic and System design: https://onlinecourses.nptel.ac.in/noc21_ee39/preview

Suggested Skill Activities:

1. Real-World Applications and Projects:
   - Assign projects related to real-world signal processing applications, such as audio processing, video compression, or wireless communication systems.
2. Design Reviews and Presentations:
   - Organize design reviews where students present their projects to peers and instructors.

- Emphasize clear explanation of design choices, challenges faced, and solutions implemented.

Course Code:	24ES203	Course Title:	EMBEDDEDCONTROLFORELECTRICDRIVES
Credits:	3	L – T – P	3-0- 0

Course objectives:

To impart knowledge on the

- Toprovide thecontrolconcept for electricaldrives
- Toemphasisthe needforembedded systemfor controlling theelectricaldrives
- Toprovideknowledgeaboutvariousembeddedsystembasedcontrolstrategyforelectricaldrives
- ToImparttheknowledgeofoptimizationandmachinelearningtechniquesusedforelectrical drives
- Tofamiliarizethehighperformancecomputingfor electricaldrives.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Interactive Simulations
3. Lab experiment videos
4. Blended Mode of Learning
5. Project based Learning
6. Experiential Learning
7. NPTEL and Other Videos
8. Smart Class Room
9. Flipped Class

UNIT I – INTRODUCTIONELECTRICAL DRIVES	[9 hours]
Electricdriveanditsclassifications,Four-quadrantdrive,Dependenceofloadtorqueonvariousfactors,Dynamicsofmotor-loadcombination-SolidStateControlledDrives-Machinelearningandoptimization techniques forelectricaldrives-IoTforElectricaldrivesapplications.	
UNIT II – OVERVIEWOF EMBEDDED PROCESSOR	**[9 hours]**
Embedded Processor architecture-RTOS – Hardware/software co-design-Programming with SoC processors.	
UNIT III – INDUCTION MOTOR CONTROL	**[9 hours]**
Types- Speed control methods-PWM techniques- VSI fed three-phase induction motor- Fuzzy logicBasedspeedcontrolforthreephaseinductionmotor-FPGAbasedthreephaseinductionmotorcontrol.	
UNIT IV – BLDC MOTORCONTROL	**[9 hours]**
Overview of BLDC Motor -Speed control methods -PWM techniques- ARM processor based BDLCmotorcontrol-ANN forBLDCMotorcontrolandoperation.	
UNIT V – SRMMOTOR CONTROL	**[9 hours]**
Overview of SRM Motor -Speed control methods -PWM techniques- FPGA based SRM motor control-DNNforSRMMotorcontrolandoperation.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Interpret the significance of embedded control of electrical drives
CO2	Deliverinsightintovarious controlstrategyforelectricaldrives
CO3	DevelopingknowledgeonMachinelearningandoptimizationtechniquesformotorcontrol
CO4	DevelopembeddedsystemsolutionforrealtimeapplicationsuchasElectricvehiclesandUAVs.
CO5	Improved Employability and entrepreneurship capacity due to knowledge up gradation onrecenttrendsinembedded systemskillsrequiredformotorcontrolstrategy

COs and POs Mapping:

COS	PO1	PO2	PO3

CO1	1	-	2
CO2	1	1	3
CO3	2	-	-
CO4	1	2	3
CO5	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Typeof assessment</th><th>Max Marks</th><th>Reduce d Marks</th><th>Tota l</th><th>Final marks</th></tr>
<tr><td rowspan="5">Continuous Internal Examination (CIE)</td><td>CIE – I</td><td>100</td><td rowspan="2">50</td><td rowspan="5">10 0</td><td rowspan="5">40</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>MCQ</td><td>20</td><td>10</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td>End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>60</td><td>60</td><td>60</td></tr>
<tr><td colspan="5">Total</td><td>100</td></tr>
</table>

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1.R.Krishnan,“ElectricMotorDrives—Modeling,AnalysisandControl”,Prentice-Hall ofIndiaPvt.Ltd.,NewDelhi,2010.

2.VedamSubramanyam,“ElectricDrives—ConceptsandApplications”,TataMcGraw-Hillpublishingcompany Ltd.,NewDelhi,2002

Reference Books:

1. K.Venkataratnam,SpecialElectricalMachines,UniversitiesPress,2014
2. SteveFurber,‘ARMsystemonchiparchitecture’,AddisionWesley,2010
3. RonSassandAnderewG.Schmidt,“EmbeddedSystemdesignwithplatformFPGAs:PrinciplesandPractices”,Elsevier,2010.
4. Steve Kilts, "Advanced FPGA Design: Architecture , Implementation, and Optimization"Willey,2007

Web Links and Video Lectures (E-Resources):

1. A Basic Course on Electric drive :https://onlinecourses.nptel.ac.in/noc24_ee125/preview
2. Basic Electrical drives: https://onlinecourses.nptel.ac.in/noc24_ee112/preview
3. Digital drive Circuits: https://onlinecourses.nptel.ac.in/noc24_ee147/preview

Suggested Skill Activities:

1. List the different speed control of machines, and prepare their rating chart.
2. Design the embedded based electrical drive.
3. Develop FPGA based three phase AC motor drive
4. Develop IOT based solutions for engineering applications.
5. Design ARM processor for BLDC motor control.

Course Code:	**24ES204**	**Course Title:**	**IoT for Smart Systems**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- Internet of Things and its role in real time applications.
- Infrastructure required for IoT
- Communication techniques for IoT.
- Embedded processor and sensors required for IoT
- Different platforms and Attributes for IoT.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

10. Chalk and Talk
11. NPTEL and Other Videos
12. Smart Classroom
13. Flipped Class

UNIT I –I Introduction to Internet of Things	**[9 hours]**
Overview, Hardware and software requirements for IOT, Sensor and actuators, Technology drivers, Business drivers, Typical IoT applications, Trends and implications.	

UNIT II – IOT Architecture	[9 hours]
IoT reference model and architecture -Node Structure - Sensing, Processing, Communication, Powering, Networking - Topologies, Layer/Stack architecture, IoT standards, Cloud computing for IoT, Bluetooth, Bluetooth Low Energy beacons.	

UNIT III – Protocol and Wireless Technologies For IOT	[9 hours]
PROTOCOLS: NFC, SCADA and RFID, Zigbee MIPI, M-PHY, UniPro, SPMI, SPI, M-PCIe GSM, CDMA, LTE, GPRS, small cell. Wireless technologies for IoT: WiFi (IEEE 802.11), Bluetooth/ Bluetooth Smart, ZigBee/ZigBee Smart, UWB (IEEE 802.15.4), 6LoWPAN, Proprietary Systems-Recent trends.	

UNIT IV – IOT Processors	[9 hours]
Services/Attributes: Big-Data Analytics for IOT, Dependability, Interoperability, Security, Maintainability. Embedded processors for IOT: Introduction to Python programming -Building IOT with RASPERRY PI and Arduino.	

UNIT V – Case Studies	[9 hours]
Industrial IoT, Home Automation, smart cities, Smart Grid, connected vehicles, electric vehicle charging, Environment, Agriculture, Productivity Applications, IOT Defense.	

Course outcomes: On completion of the course, the student will have the ability to:

CO1	Explain the basic concepts and architecture of the Internet of Things.
CO2	Apply the IoT model to design basic IoT systems
CO3	Develop IoT applications using standards like MIPI, M-PHY, UniPro, SPMI, SPI, M-PCIe, and small cell technologies.
CO4	Develop IoT solutions using embedded processors such as Raspberry Pi and Arduino.
CO5	Implement IoT solutions for smart applications

COs and POs Mapping:

CO'S	1	2	3
CO1	2	1	-
CO2	3	2	1
CO3	3	2	1
CO4	3	2	1

CO5	3	2	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Typeof assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final marks</th></tr>
<tr><td rowspan="5">Continuous Internal Examination (CIE) - Theory</td><td>CIE – I</td><td>100</td><td rowspan="2">50</td><td rowspan="5">100</td><td rowspan="5">40</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>MCQ</td><td>20</td><td>10</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td>End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>60</td><td>60</td><td>60</td></tr>
<tr><td colspan="5">Total</td><td>100</td></tr>
</table>

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the sixteen questions have to be answered.

TEXT BOOKS

1. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017
2. Samuel Greengard, The Internet of Things, The MIT Press, 2015

REFERENCE BOOKS

1. Arshdeep Bahga and VijaiMadisetti : A Hands-on Approach “Internet of Things”,Universities Press 2015.
2. Oliver Hersent, David Boswarthick and Omar Elloumi “The Internet of Things”, Wiley,2016.
3. Adrian McEwen and Hakim Cassimally “Designing the Internet of Things” Wiley,2014.
4. Ovidiu Vermesan and Peter Friess (Editors), “Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems”, River Publishers Series in Communication, 2013.

WEB LINKS AND VIDEO LECTURES (E-RESOURCES):

1. Introduction and Definition of IOT: https://youtu.be/IZOKa0Bh83o?si=9BJ023QXTEp8-26m
2. Design of IOT: https://youtu.be/urUBLmXFKl0?si=mAcwX69fnPz0T0TG
3. IOT Protocols: https://youtu.be/TrFaCBV7joY?si=jl8jLARS57xxAmKb
4. Case study- Healthcare: https://youtu.be/VeMDQHyBSaA?si=LfTyMi1PRH_1y28Q

5.Case Study: https://youtu.be/6cklshRSUmk?si=b3KzmOLxJEbSCjTk

Course Code:	**24ES251**	**Course Title:**	**Embedded System Laboratory – II**
Credits:	**2**	**L – T – P**	**0-0-4**

Course objectives:

To impart knowledge on the

- To involve the students to Practice on Workbench /Software Tools/ Hardware Processor Boards with the supporting Peripherals.
- To teach the concepts of algorithm development & programming on software tools and Digital processors with peripheral interfaces.
- To encourage students to practice in open source softwares/packages/tools
- To train though hands-on practices in commercial and licensed Hardware-software suites
- Practicing through the subdivisions covered with in experiments listed below to expose the students into the revising the concepts acquired from theory subjects.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. NPTEL and Other Videos
3. Smart Classroom
4. Flipped Class

Laboratory Component **[60 hours]**

S.No.	Name of the Experiment
1	Programming ARM processor: ARM7 / ARM9/ARM Cortex Study on In-circuit Emulators, cross compilers, debuggers
2	I/O Programming with ARM processor: ARM7 / ARM9/ARM Cortex Microcontrollers I/O Interfacing: Timers/Interrupts/Serial port programming/PWM Generation/ Motor Control/ADC/DAC/ LCD/ RTC Interfacing/ Sensor Interfacing
3	Programming with Rasberry Pi Microcontroller Board: Study on incircuit Emulators, cross compilers, debuggers
4	I/O Programming with Arduino ,Rasberry Pi Microcontroller Boards I/O Interfacing: Timers/ Interrupts/ Serial port programming/PWM Generation/ Motor Control/ADC/DAC/ LCD/ RTC Interfacing/ Sensor Interfacing/IoT Applications
5	Programming with DSP processors
6	Study of one type of Real Time Operating Systems (RTOS)

Course outcomes: On completion of the course, the student will have the ability to:

CO1	Experiment and demonstrate with simulators, in programming processor boards , processor interfacing/ designing digital controllers
CO2	Design & simulate Arithmetic ,Logic programs, Filters, Signal analysis with simulators/experiments ,in programming processor boards, processor interfacing/ Tools.
CO3	Develop real time solution for embedded applications.
CO4	Analyze Program and compile in various tools &soft ware domains.
CO5	Analyze the influence of recent interfacing trends and use of commercial embedded processors.

COs and POs Mapping:

CO'S	1	2	3
CO1	1	3	1
CO2	-	1	2
CO3	1	-	3
CO4	2	2	3
CO5	3	2	3
CO	1.75	2	2.4

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Typeof assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	60
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Lab Exam	100	40	40	40
				Total	100

<u>End semester Examination: (QP PATTERN)</u>

- Each unit consists of two 2 marks questions and one 13 marks question (either or).
- One 16 marks question (either or) will be from any one of the five units.
- All the sixteen questions have to be answered.

REFERENCE BOOKS

1. Mohamammad Ali Mazidi&Mazidi ‘8051Microcontroller and Embedded Systems’, Pearson Education
2. Mohammad Ali Mazidi, Rolind Mckinley and Danny Causey, ‘PIC Microcontroller and Embedded Systems’ Pearson Education
3. Simon Monk, ”Make Action-with Arduino and Raspberry Pi,SPD,2016.
4. Wesley J.Chun, ”Core Python Applications Programming,3rded,Pearson,2016
5. Kraig Mitzner,‘Complete PCB Design using ORCAD Capture and Layout’, Elsevier
6. Vinay K. Ingle, John G.Proakis, ”DSP-A Matlab Based Approach”, CengageLearning,2010.
7. Taan S. Elali, ”Discrete Systems and Digital Signal Processing with Matlab”,CRCPress2009.
8. Jovitha Jerome, ”Virtual Instrumentation using Lab view” PHI, 2010.
9. Woon- Seng Gan, Sen M. Kuo, ‘Embedded Signal Processing with the Micro Signal Architecture’, John Wiley & Sons, Inc., Hoboken, New Jersey 2007
10. Dogan Ibrahim,‘ Advanced PIC microcontroller projects in C’,Elsevier2008

Skill Assessment:

1. Do a project: Home automation using Raspberry Pi Microcontroller
2. Write an detailed report on comparison between Arduino and Raspberry Pi Microcontroller.

Course Code:	**24ES252**	**Course Title:**	**EMBEDDED PROGRAMMING LABORATORY**
Credits:	**2**	**L – T – P**	**0-0-4**

Course objectives: • To practice on Freeware soft wares/ Platforms. • To develop an algorithm & programming on Software & Modelling tools and PLC/SCADA/PCB • To expertise in GUI Simulators and Linux programming. • To do hands-on in Programming & Simulation in Python Simulators. • To practicing through Programming with wired/wireless Communication Protocols.
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Interactive Simulations 2. Lab experiment videos 3. Blended Mode of Learning 4. Project based Learning 5. Experiential Learning 6. NPTEL and Other Videos 7. Smart Class Room 8. Flipped Class

DOMAIN	EXPERIMENT DETAILS	EQUIPMENT/ SUPPORTS REQUIRED
1.	Programming in Freeware soft wares/ Platforms	Programming Compilers & Platforms on freeware
2.	Software & Modelling tools Study on MEMS Tools Study on process Controller modelling PLC/SCADA/PCB one type CAD Tool	Personal Computers, Software & programming/modelling tools
3.	Programming & Simulation in GUI Simulators /Tools/others Graphical User interface simulations &modelling of instrumentation & controllers	Simulation Tools as LabVIEW /others
4.	Programming & Simulation in Python Simulators/Tools/others.	Programming in Python Platform

5.	Programming with wired/wireless Communication Protocols / Network Simulators	Learning Communication Protocols & Support Software Tools for BUS & network communication
6.	Linux programming Tool chain	PC with Linux OS

Course outcomes: On completion of the course, the student will have the ability to:

CO1	Optimize the code for Freeware soft wares/ Platforms.
CO2	Develop solution for Software & Modelling tools and PLC/SCADA/PCB.
CO3	Develop a model using GUI Simulators for instrumentation & controllers and Graphical User interface.
CO4	Propose a solution for wired/wireless Communication Protocols using Network Simulators.
CO5	Develop programming concepts to knowledge upgradation on Python Simulators.

COs and POs Mapping:

CO/PO	PO1	PO2	PO3
CO1	3	-	2
CO2	3	-	2
CO3	3	-	2
CO4	3	-	2
CO5	3	-	2
CO	3	-	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Typeof Assessment**	**Max Marks**	**Reduce d Marks**	**Tota l**	**Final mark s**
Continuous Internal Examination (CIE)	Model Exam	100	60	60	60
End Semester Examination (ESE)	Practical Exam	100	40	40	40
				Total	100

Course Code:	24ES301	Course Title:	Software For Embedded Systems
Credits:	3	L – T – P	3-0-0

Course objectives:

To impart knowledge on the

- To expose the students to the fundamentals of embedded Programming.
- To Introduce the GNU C Programming Tool Chain in Linux.
- To study the basic concepts of embedded C.
- To teach the basics of Python Programming
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Interactive Simulations
4. Lab experiment videos
5. Blended Mode of Learning
6. Project based Learning
7. Experiential Learning
8. NPTEL and Other Videos
9. Smart Class Room
10. Flipped Class

UNIT I - Basic C Programming	[9 hours]
Typical C Program Development Environment - Introduction to C Programming - Structured Program Development in C - Data Types and Operators - C Program Control - C Functions - Introduction to Arrays.	

UNIT II – Embedded C	[9 hours]
Adding Structure to ‘C’ Code: Object oriented programming with C, Header files for Project and Port, Examples. Meeting Real-time constraints: Creating hardware delays - Need for timeout mechanism - Creating loop timeouts - Creating hardware timeouts.	

UNIT III – C Programming Tool-Chain In Linux	[9 hours]
C preprocessor - Stages of Compilation - Introduction to GCC - Debugging with GDB - The Make utility - GNU Configure and Build System - GNU Binary utilities - Profiling - using gprof - Introduction to GNU C Library.	

UNIT IV – Python Programming	[9 hours]
Introduction - Parts of Python Programming Language - Control Flow Statements - Functions - Strings - Lists - Dictionaries - Tuples and Sets.	

UNIT V –Modules, Packages And Libraries In Python	[9 hours]
Python Modules and Packages - Creating Modules and Packages - Practical Example - Libraries for Python - Library for Mathematical functionalities and Tools - Numerical Plotting Library - GUI Libraries for Python - Imaging Libraries for Python - Networking Libraries.	

Course outcomes: On completion of the course, the student will have the ability to:

CO1	Demonstrate C programming and its salient features for embedded systems
CO2	Deliver insight into various programming languages/software compatible to embedded process development with improved design & programming skills.
CO3	Develop knowledge on C programming in Linux environment.
CO4	Possess ability to write python programming for Embedded applications.
CO5	Have improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded programming skills.

COs and POs Mapping:

COs	PO1	PO2	PO3
CO1	-	-	2
CO2	1	-	1
CO3	-	2	-
CO4	1	-	1
CO5	-	-	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Typeof assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

<u>End semester Examination: (QP PATTERN)</u>

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. A Cyber-Physical Systems Approach,. Second Edition, MIT Press, 2017.

Reference Books:

1. Fabrizio Romano, "Learn Python Programming", Second Edition, Packt Publishing, 2018.

Web Links and Video Lectures (E-Resources):

Embedded Systems Design:https://onlinecourses.nptel.ac.in/noc20_cs14/preview

PROFESSIONAL ELECTIVE – I

Course Code:	24ES205	Course Title:	Wireless And Mobile Communication
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To study the Channel planning for Wireless Systems
- To study the Mobile Radio Propagation and Equalization and Diversity
- To study the Equalization and Diversity
- To provide insight about wideband code division based access.
- To study the Wireless multiple access and IP

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. NPTEL and Other Videos
3. Smart Classroom
4. Flipped Class

UNIT I –I The Cellular Concept	[9 hours]
System Design Fundamentals: Introduction, Frequency Reuse, Channel Assignment Strategies, Handoff Strategies-Prioritizing Handoffs, Practical Handoff Considerations, Interference and system capacity –Co channel Interference and system capacity, Channel planning for Wireless Systems, Adjacent Channel interference, Power Control for Reducing interference, Trunking and Grade of Service, Improving Coverage & Capacity in Cellular Systems-Cell Splitting, Sectoring.	

UNIT II – Mobile Radio Propagation: Large-Scale Path Loss	[9 hours]
Introduction to Radio Wave Propagation, Free Space Propagation Model, Relating Power to Electric Field, Diffraction-Fresnel Zone Geometry, Knife edge Diffraction Model, Multiple knife-edge Diffraction, Scattering, Outdoor Propagation Models-Longley-Ryce Model, Okumura Model, Hata Model, Indoor Propagation Models-Partition losses, Partition losses between Floors, Log-distance path loss model, Ericsson Multiple Breakpoint Model, Attenuation Factor Model, Signal penetration into buildings, Ray Tracing and Site Specific Modelling.	

UNIT III – Mobile Radio Propagation	[9 hours]
Small –Scale Fading and Multipath: Small Scale Multipath propagation-Factors influencing small scale fading, Doppler shift, Impulse Response Model of a multipath channel-Relationship between Bandwidth and Received power, Small-Scale Frequency Domain Channels Sounding, Parameters of Mobile Multipath Channels-Time Dispersion Parameters, Coherence Bandwidth, Doppler Spread and Coherence Time, Types of Small-Scale Fading-Fading effects Due to Multipath Time	

Delay Spread, Flat fading, Frequency selective fading, Fading effects Due to Doppler Spread-Fast fading, slow fading, Fundamentals of Equalization, Training A Generic Adaptive Equalizer, Equalizers in a communication Receiver, Linear Equalizers, Nonlinear Equalization

UNIT IV – Wideband Code Division Multiple Access	**[9 hours]**
CDMA system overview -air interface –physical and logical channel–speech coding, multiplexing and channel coding –spreading and modulation: frame structure, spreading codes-uplink-downlink – 33 physical layer procedures: cell search and synchronization-establishing a connection-power controlhandover-overload control.	

UNIT V – IP Mobility Framework	**[9 hours]**
Challenges of IP Mobility -Address Management -Dynamic Host Configuration Protocol and Domain Name Server Interfaces –Security –Mobility-Based AAA Protocol -IP Mobility Architecture Framework -x Access Network -IPv6 Challenges for IP Mobility.	

Course outcomes: On completion of the course, the student will have the ability to:

CO1	Understand Cellular communication concepts
CO2	Explain the mobile radio propagation
CO3	Perceive the wireless network different type of MAC protocols
CO4	Analyse the Equalization and Diversity
CO5	Build the Wireless multiple access and IP

COs and POs Mapping:

CO'S	PO1	PO2	PO3
CO1	**3**	**3**	**2**
CO2	**3**	**3**	**2**
CO3	**3**	**3**	**2**
CO4	**1**	**-**	**-**
CO5	**1**	**-**	**-**
CO	**3**	**3**	**2**

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Typeof assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal	CIE – I	100	50	10	40

Examination (CIE) - Theory	CIE – II	100		0	
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 13 marks question (either or).
- One 16 marks question (either or) will be from any one of the five units.
- All the sixteen questions have to be answered.

REFERENCE BOOKS

1. Wireless Communications, Principles, Practice –Theodore, S. Rappaport, 2nd Ed., 2002, PHI.
2. Wireless Communications Andrea Goldsmith, 2005 Cambridge University Press.
3. Principles of Wireless Networks –KavehPahLaven and P. Krishna Murthy, 2002, PE
4. Mobile Cellular Communication –GottapuSasibhushana Rao, Pearson Education, 2012.
5. Wireless Digital Communications –KamiloFeher, 1999, PHI.
6. Wireless Communication and Networking –William Stallings, 2003,

Course Code:	**24ES206**	**Course Title:**	**VIRTUAL INSTRUMENTATION**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- Difference between Conventional and graphical programming.
- Basics of Lab VIEW and programming concepts.
- Real time and virtual instrument.
- Signals acquire process in digital domain.
- Concepts of data acquisition with LabVIEW.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Interactive Simulations
3. Lab experiment videos
4. Blended Mode of Learning
5. Project based Learning
6. Experiential Learning
7. NPTEL and Other Videos
8. Smart Classroom
9. Flipped Class

UNIT I – I FUNDAMENTALS OF VIRTUAL INSTRUMENTATION	**[9 hours]**
Fundamental Concepts of Virtual Instrumentation (VI) and Graphical Programming - Virtual instruments and Traditional instruments, Hardware and Software in virtual instrumentation, Data Flow Programming - Data Types – Customization of VI Properties - VI Documentation**.**	

UNIT II – PROGRAMMING STRUCTURES	**[9 hours]**
Software Environment - Modular programming - Formula Nodes - Loops - Shift Registers - Local and Global Variables – Case and Sequence Structures - Arrays and Clusters - Graphs and Charts – State Machines - String and File I/O.	

UNIT III – DATA ACQUISITION AND INTERFACING STANDARDS	**[10 hours]**
PC based data acquisition – DAQ hardware and software architecture – DAQ hardware configuration, sampling methods and grounding techniques, analog I/O, digital I/O, counter/timer - Communication: Interfacing of external instruments to a PC - RS232 - RS485 - GPIB – System Interface Buses: USBPCI, PXI; Introduction to bus protocols of MOD bus and CAN bus - Industrial Ethernet.	

UNIT IV – ADVANCED PROGRAMMING	**[10 hours]**
Introduction, Definition of State Machine, A Simple State Machine, Event Structures. File Input / Output: Introduction, File Formats, File I/O Functions, Path Functions, Sample VIs to Demonstrate File WRITE and READ Function String Handling: Introduction, String Functions,	

Lab VIEW String Formats, Typical examples Use of analysis tools and application of VI: Fourier transforms, Power spectrum, Simulation of systems using VI: Development of Control system, Image acquisition and processing.

UNIT V – CASE STUDIES	**[7 hours]**
Temperature Monitoring System using PC based Data Acquisition System - Machine vision, Motion control, Configuration of Real-Time I/O Hardware in MAX - Host & Target VI – Prioritization of Tasks – Timed Programming Structures in Lab VIEW – Real-Time Application Deployment using my RIO – Run-time Interaction with Deployed Applications – Running Web Services in my RIO.	

Course outcomes: On completion of the course, the student will have the ability to:

CO1	Infer and interpret the fundamentals of Virtual Instrumentation and data Acquisition.
CO2	Explain the difference between the traditional and virtual instrumentation.
CO3	Illustrate the theoretical concepts to realize practical systems.
CO4	Analyze and evaluate the performance of Virtual Instrumentation Systems
CO5	Build a VI system to solve real time problems using data acquisition

COs and POs Mapping:

COs	PO1	PO2	PO3
CO1	-	2	1
CO2	-	-	2
CO3	1	3	3
CO4	2	2	3
CO5	3	3	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of Assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		

	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

TEXTBOOKS

1. Gary Johnson and Richard Jennings, ―Lab VIEW Graphical Programming, McGraw Hill Inc., Fourth Edition, 2006
2. Lisa K Wells, "Lab view for Everyone", Graphical programming made even easier, Prentice Hall of India.
3. LabVIEW programming, data acquisition and analysis, Beyon Jeffery Y, National instrument Virtual instrument series

REFERENCE BOOKS

1. Jovitha Jerome, ―Virtual Instrumentation using Lab VIEW", PHI Learning Pvt. Ltd., 2010.
2. Sanjay Gupta and Joseph John, "Virtual Instrumentation Using Lab VIEW", Tata McGraw Hill, 2008.
3. Rick Bitter, Taqi Mohiuddin and Matt Nawrocki, "Lab VIEW Advanced Programming Techniques", CRC Press, 2009.
4. Clyde F Coombs, ―Electronic Instruments Handbook, McGraw Hill Inc., Third Edition, 1999.

WEB LINKS AND VIDEO LECTURES (E-RESOURCES):

1. Virtual Instrumentation and Sensors: https://youtu.be/zlfCJ_wZA4Q?si=oNXQ-fSmQnTi6_dq
2. Data Acquisition systems: https://youtu.be/I_9Pwyxhe40?si=AMiwDjvq2A0-6Ioe
3. Interfacing Standards and design process: https://youtu.be/T5jWYrnUWTc?si=vBbm3wOmpUbAlcjM
4. LabVIEW Programming: https://youtu.be/mBSB9qCfl54?si=sGjEZRO4vNsi--c-

Course Code:	**24ES207**	**Course Title:**	**Embedded Processor Development**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:
To impart knowledge on the • To learn about basic concepts of embedded system • To learn about ARM architecture • To learn C language and assembly programming. • To learn Object orientation for programming and C++. • To learn software modelling fundamentals.
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. Blended Mode of Learning 3. Project based Learning 4. Experiential Learning 5. NPTEL and Other Videos 6. Smart Class Room 7. Flipped Class

UNIT I – Embedded Concepts	**[9 hours]**
Introduction to embedded systems, Application Areas, Categories of embedded systems, Overview of embedded system architecture, Specialties of embedded systems, recent trends in embeddedsystems, Architecture of embedded systems, Hardware architecture, Software architecture,Application Software, Communication Software, Development and debugging Tools	

UNIT II – Arm Architecture and Overview of Cortex	**[9 hours]**
Background of ARM Architecture, Architecture Versions, Processor Naming, Instruction SetDevelopment, Thumb-2 and Instruction Set Architecture. Overview of Cortex-M3.Cortex-M3 Basics: Registers, General Purpose Registers, Stack Pointer, Link Register, ProgramCounter, Special Registers, Operation Mode, Exceptions and Interrupts, Vector.Tables, Stack Memory Operations, Reset Sequence. Instruction Sets: Assembly Basics, InstructionList, Instruction Descriptions. Cortex-M3 Implementation Overview: Pipeline, Block Diagram, BusInterfaces on Cortex-M3, I-Code Bus, D-Code Bus, System Bus, External PPB and DAP Bus.	

UNIT III – CORTEX-M3/M4 Programming	**[9 hours]**
Overview, Typical Development Flow, Using C, CMSIS (Cortex Microcontroller Software	

Interface Standard), Using Assembly Exception Programming: Using Interrupts, Exception/Interrupt Handlers, Software Interrupts, Vector Table Relocation. Memory Protection Unit and other Cortex-M3 features: MPU Registers, Setting Up the MPU, Power Management, Multiprocessor Communication

UNIT IV – Unified Modeling Language	**[9 hours]**
Connecting the object model with the use case model – Key strategies for object identification – UML basics. Object state behaviour – UML state charts – Role of scenarios in the definition of behaviour – Timing diagrams – Sequence diagrams – Event hierarchies – types and strategies of operations – Architectural design in UML concurrency design – threads in UML.	

UNIT V – Embedded Software Development Tools and RTOS	**[9 hours]**
The compilation process – libraries – porting kernels – C extensions for embedded systems – emulation and debugging techniques – RTOS - system design using RTOS	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Demonstrate about basic concepts of embedded system
CO2	Build ARM architecture
CO3	Understand C language and assembly programming.
CO4	Build and compile Object orientation for programming and C++.
CO5	Create software modelling

COs and POs Mapping:

CO'S	1	2	3
CO1	2	3	1
CO2	3	-	3
CO3	-	-	2
CO4	-	-	3

CO5	2	-	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Typeof assessment	Max Marks	Reduce d Marks	Tota l	Final mark s
Continuous Internal Examination (CIE)	CIE – I	100	50	10 0	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. The Definitive Guide to the ARM Cortex-M3, Joseph Yiu, econd Edition, Elsevier Inc. 2010.
2. Embedded/Real Time Systems Concepts, Design and Programming Black Book,Prasad, KVK.
3. David Seal “ARM Architecture Reference Manual”, 2001 Addison Wesley, England; Morgan Kaufmann Publishers
4. Andrew N Sloss, Dominic Symes, C0hris Wright, “ARM System Developer's Guide -Designing and Optimizing System Software”, 2006, Elsevier.
5. Steve Furber, “ARM System-on-Chip Architecture”, 2ndEdition, Pearson Education.
6. Cortex-M series-ARM Reference Manual .
7. Cortex-M3 Technical Reference Manual (TRM).
8. STM32L152xx ARM Cortex M3 Microcontroller Reference Manual.
9. ARM Company Ltd. “ARM Architecture Reference Manual–RM DDI 0100E”.
10. ARM v7-M Architecture Reference Manual (ARM v7-M ARM).
11. Ajay Deshmukh, “Microcontroller -Theory & Applications”, Tata McGraw Hill.
12. Arnold. S. Berger, “Embedded Systems Design -An introduction to Processes, Tools and Techniques”, Easwer Press.

13. David E. Simon, "An Embedded Software Primer", Pearson Education, 2003.

Course Code:	**24ES208**	**Course Title:**	**Automotive Embedded System**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To expose the students to the fundamentals and building of Electronic Engine Control systems.
- To teach on functional components and circuits for vehicles.
- To discuss on programmable controllers for vehicles management systems.
- To teach logics of automation & commercial techniques for vehicle communication.
- To introduce the embedded systems concepts for E-vehicle system development.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Blended Mode of Learning
3. Project based Learning
4. Experiential Learning
5. NPTEL and Other Videos
6. Smart Class Room
7. Flipped Class

UNIT I – Basic of Electronic Engine Control Systems	**[9 hours]**
Overview of Automotive systems, fuel economy, air-fuel ratio, emission limits and vehicle performance; Automotive microcontrollers- Electronic control Unit- Hardware & software selection and 37 requirements for Automotive applications – open source ECU- RTOS - Concept for Engine management-Standards; Introduction to AUTOSAR and Introduction to Society SAE-Functional safety ISO 26262- Simulation and modeling of automotive system components..	

UNIT II – Sensors and Actuators for Automotives	[9 hours]
Review of sensors- sensors interface to the ECU, conventional sensors and actuators, Modern sensor and actuators - LIDAR sensor- smart sensors- MEMS/NEMS sensors and actuators for automotive applications.	

UNIT III – Vehicle Management Systems	[9 hours]
Electronic Engine Control-engine mapping, air/fuel ratio spark timing control strategy, fuel control, electronic ignition- Adaptive cruise control - speed control-anti-locking braking system-electronic suspension - electronic steering, Automatic wiper control- body control system; Vehicle system schematic for interfacing with EMS, ECU. Energy Management system for electric vehicles- Battery management system , power management system-electrically assisted power steering system Adaptive lighting system- Safety and Collision Avoidance.	

UNIT IV – Onboard Diagnostics and Telematics	[9 hours]
On board diagnosis of vehicles -System diagnostic standards and regulation requirements Vehicle communication protocols Bluetooth, CAN, LIN, FLEXRAY, MOST, KWP2000 and recent trends in vehicle communications- Navigation- Connected Cars technology – Tracking- Security for data communication- dashboard display and Virtual Instrumentation, multimedia electronics- Role of IOT in Automotive systems	

UNIT V – Electric Vehicles	[9 hours]
Electric vehicles –Components- Plug in Electrical vehicle- Charging station – Aggregators- Fuel cells/Solar powered vehicles- Autonomous vehicles.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Insight into the significance of the role of embedded system for automotive applications.
CO2	Illustrate the need, selection of sensors and actuators and interfacing with ECU
CO3	Develop the Embedded concepts for vehicle management and control systems.
CO4	Demonstrate the need of Electrical vehicle and able to apply the embedded system technology for various aspects of EVs
CO5	Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design and its application in automotive systems.

COs and POs Mapping:

CO'S	1	2	3
CO1	**-**	**2**	1
CO2	**2**	**3**	2
CO3	**3**	**3**	3
CO4	**3**	**3**	3
CO5	**3**	**3**	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Typeof assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. D P Kothari and I.J Nagarath, "Basic Electrical and Electronics Engineering," McGraw Hill Education (India)Private Limited, Second Edition, 2020
2. A.K.Sawhney and PuneetSawhney,"A Course in Electrical & Electronic Measurements & Instrumentation,"DhanpatRai and Co, 2015.

Reference Books:

1. William B. Ribbens ,"Understanding Automotive Electronics", Elseiver,2012
2. Ali Emedi, Mehrdedehsani, John M Miller , "Vehicular Electric power system- land, Sea, Air and Space Vehicles" Marcel Decker, 2004.

3. L.Vlacic,M.Parent,F.Harahima,"Intelligent VehiclTechnologies",SAE International,2001.
4. Jack Erjavec,JeffArias,"Alternate Fuel Technology-Electric ,Hybrid& Fuel Cell Vehicles",Cengage ,2012.
5. Electronic Engine Control technology – Ronald K Jurgen Chilton's guide to Fuel Injection – Ford.
6. Automotive Electricals / Electronics System and Components, Tom Denton, 3 rd Edition, 2004.
7. Uwe Kiencke, Lars Nielsen, "Automotive Control Systems: For Engine, Driveline, and Vehicle", Springer; 1 edition, March 30, 2000.
8. Automotive Electricals Electronics System and Components, Robert Bosch Gmbh, 4 th Edition, 2004.
9. Automotive Hand Book, Robert Bosch, Bently Publishers, 1997.
10. Jurgen, R., Automotive Electronics Hand Book.

PROFESSIONAL ELECTIVE - II

Course Code:	**24ES212**	**Course Title:**	**Intelligent Control and Automation**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To Impart the knowledge of various optimization techniques and hybrid schemes.
- To introduce the concept, Analysis and implementation of ANN and Fuzzy logic
- controllers.
- To Emphasis the need for Genetic algorithm and its role for automation.
- To provide the basics of automation and its requirements
- To demonstrate the role of Intelligent controller in automation applications.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Blended Mode of Learning
3. Project based Learning
4. Experiential Learning
5. NPTEL and Other Videos
6. Smart Class Room
7. Flipped Class

UNIT I – Artificial Neural Network & Fuzzy Logic	[9 hours]
ARTIFICIAL NEURAL NETWORK: Learning with ANNs, single-layer networks, multi-layerperceptrons, Back propagation algorithm (BPA) ANNs for identification, ANNs for control,Adaptive neuro controller. Fuzzy Logic Control: Introduction, fuzzy sets, fuzzy logic, fuzzy logiccontroller design, Fuzzy Modelling & identification, Adaptive Fuzzy Control Design.	

UNIT II – Genetic Algorithm	[9 hours]
Basic concept of Genetic algorithm and detail algorithmic steps- Hybrid genetic algorithm - Solution for typical control problems using genetic algorithm. Concept on some other searchtechniques like Tabu search, Ant-colony search and Particle Swarm Optimization.	

UNIT III – Hybrid Control Schemes	[9 hours]
Fuzzification and rule base using ANN–Neuro fuzzy systems-ANFIS–Optimization of membershipfunction and rule base using Genetic Algorithm and Particle Swarm Optimization.	

UNIT IV – Automation	[9 hours]
Introduction to Automation - Automation in Production System, Principles and Strategies ofAutomation, Basic Elements of an Automated System, Advanced Automation Functions, Levels ofAutomations- Industrial Automation -computer vision for automation- PLC and SCADA basedAutomation- IoT for automation- Industry 4.0.	

UNIT V – Intelligent Controller for Automation Application	[9 hours]
Applications of Intelligent controllers in Industrial Monitoring, optimization and control-SmartAppliances- Automation concept for Electrical vehicle- Intelligent controller and Automation forPower System.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Demonstrate the basic architectures of NN and Fuzzy logics
CO2	Design and implement GA algorithms and know their limitations.

CO3	Explain and evaluate hybrid control schemes and PSO
CO4	Interpret the significance of Automation concepts.
CO5	Develop the intelligent controller for automation applications.

COs and POs Mapping:

CO'S	1	2	3
CO1	**1**	**1**	**1**
CO2	**2**	**2**	**3**
CO3	**3**	**2**	**2**
CO4	**3**	**2**	**2**
CO5	**3**	**-**	**3**

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Typeof assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. Laurene V.Fausett, "Fundamentals of Neural Networks, Architecture, Algorithms,and Applications", Pearson Education, 2008.
2. Timothy J.Ross, "Fuzzy Logic with Engineering Applications", Wiley, Third Edition,2010.

3. David E.Goldberg, “Genetic Algorithms in Search, Optimization, and MachineLearning”, Pearson Education, 2009.
4. W.T.Miller, R.S.Sutton and P.J.Webrose, “Neural Networks for Control”, MIT Press,1996.
5. Srinivas Medida, Pocket Guide on Industrial Automation for Engineers andTechnicians, IDC Technologies.
6. ChanchalDey and Sunit Kumar Sen, Industrial Automation Technologies, 1st Edition,CRC Press, 2022.

Course Code:	**24ES213**	**Course Title:**	**Unmanned Aerial Vehicle**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To make the students to understand the basic concepts and components of UAV systems.
- To teach the UAV design concepts.
- To provide an insight about the hardware structure for UAVs.
- To emphasis the communication protocol requirements and control strategy for UAVs.
- To highlight the need and the role of UAVs for real time applications and development of realtime UAVs.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Blended Mode of Learning
3. Project based Learning
4. Experiential Learning
5. NPTEL and Other Videos
6. Smart Class Room
7. Flipped Class

UNIT I – Introduction to UAV	**[9 hours]**
Overview and background - History of UAV –classification – societal impact and future outlook Unmanned Aerial System (UAS) components --models and prototypes – System Composition – applications.	

UNIT II – The Design of UAV Systems	[9 hours]
Introduction to Design and Selection of the System- Aerodynamics and Airframe Configurations- Characteristics of Aircraft Types- Design Standards-Regulatories and regulations - Design for Stealth-controlsurfaces-specifications.	

UNIT III – Hardwares for UAV s	[9 hours]
Real time Embedded processors for UAVs - sensors-servos-accelerometer –gyros-actuators- power supply- integration, installation, configuration, and testing –MEMS/NEMS sensors and actuators for UAVs- Autopilot – AGL.	

UNIT IV – Communication Payloads and Controls	[9 hours]
Payloads-Telemetry-tracking-Aerial photography-controls-PID feedback-radio control frequency range–modems-memory system-simulation-ground test-analysis-trouble shooting	

UNIT V – The Development of UAV Systems	[9 hours]
Waypoints navigation-ground control software- System Ground Testing- System In-flight Testing- Mini,Micro and Nano UAVs- Case study: Agriculture- Health- Surveying- Disaster Management and Defense.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Identify different hardware for UAV.
CO2	Determine preliminary design requirements for an unmanned aerial vehicle.
CO3	Design UAV system.
CO4	Identify and Integrate various systems of unmanned aerial vehicle.
CO5	Design micro aerial vehicle systems by considering practical limitations.

COs and POs Mapping:

COs	**POs**					
	1	**2**	**3**	**4**	**5**	**6**
CO1	**1**	**3**	**2**	**-**	**-**	**2**
CO2	**3**	**3**	**3**	**-**	**-**	**2**

CO3	**3**	**2**	**3**	**3**	**3**	**3**
CO4	**-**	**-**	**2**	**3**	**3**	**2**
CO5	**3**	**-**	**3**	**3**	**3**	**3**

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Typeof assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. Reg Austin “Unmanned Aircraft Systems UAV design, development and deployment”, Wiley,2010.
2. Paul G Fahlstrom, Thomas J Gleason, “Introduction to UAV Systems”, UAV Systems, Inc, 1998
3. Dr. Armand J. Chaput, “Design of Unmanned Air Vehicle Systems”, Lockheed Martin AeronauticsCompany, 2001
4. Kimon P. Valavanis, “Advances in Unmanned Aerial Vehicles: State of the Art and the Road toAutonomy”, Springer, 2007
5. Robert C. Nelson, Flight Stability and Automatic Control, McGraw-Hill, Inc, 1998.

Course Code:	**24ES214**	**Course Title:**	**DSP Based SystemDesign**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the • To understand various representation methods of DSP system • To provide insight about different DSP algorithms • To familiarize the various architectures of DSP system • To perform analysis of DSP architectures and to learn the implementation of DSP system in programmable hardware • To learn the details of DSP system interfacing with other peripherals
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. Blended Mode of Learning 3. Project based Learning 4. Experiential Learning 5. NPTEL and Other Videos 6. Smart Class Room 7. Flipped Class

UNIT I – Representation of DSP System	**[9 hours]**
Single Core and Multicore, Architectural requirement of DSPs - high throughput, low cost, low power, small code size, embedded applications. Representation of digital signal processing systems – blockdiagrams, signal flow graphs, data-flow graphs, dependence graphs. Techniques for enhancingcomputational throughput - parallelism and pipelining.	

UNIT II – DSP Algorithms	**[9 hours]**
DSP algorithms - Convolution, Correlation, FIR/IIR filters, FFT, adaptive filters, sampling rateconverters, DCT, Decimator, Expander and Filter Banks. DSP applications. Computational characteristics of DSP algorithms and applications, Numerical representation of signals-word lengtheffect and its impact, Carry free adders, Multiplier.	

UNIT III –System Architecture	**[9 hours]**
Introduction, Basic Architectural Features, DSP Computational Building Blocks, Bus Architecture andMemory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Features for External Interfacing. VLIW architecture. Basic performance issue in	

pipelining,Simple implementation of MIPS, Instruction Level Parallelism, Dynamic Scheduling, DynamicHardware Prediction, Memory hierarchy.Study of Fixed point and floating point DSP architectures

UNIT IV –Architecture Analysis on Programmable Hardware	**[9 hours]**
Analysis of basic DSP Architectures on programmable hardwares. Algorithms for FIR, IIR, Latticefilter structures, architectures for real and complex fast Fourier transforms, 1D/2D Convolutions,Winograd minimal filtering algorithm. FPGA: Architecture, different sub-systems, design flow for DSPsystem design, mapping of DSP algorithms onto FPGA.	

UNIT V – System Interfacing	**[9 hours]**
Examples of digital signal processing algorithms suitable for parallel architectures such as GPUs and MultiGPUs. Interfacing: Introduction, Synchronous Serial Interface CODE, A CODEC Interface Circuit,ADC interface.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Evaluate the DSP system using various methods.
CO2	Design algorithm suitable for different DSP applications.
CO3	Explain various architectures of DSP system.
CO4	Implement DSP system in programmable hardware.
CO5	Build interfacing of DSP system with various peripherals.

COs and POs Mapping:

CO'S	**1**	**2**	**3**
CO1	**-**	**3**	**-**
CO2	**3**	**3**	**3**
CO3	**-**	**3**	**-**
CO4	**3**	**-**	**3**
CO5	**2**	**-**	**3**

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Typeof assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. Sen M Kuo, Woon Seng S Gan, Digital Signal Processors
2. Digital Signal Processing and Application with C6713 and C6416 DSK, RulphChassaing, Worcester Polytechnic Institute, A Wiley Interscience Publication
3. Architectures for Digital Signal Processing, Peter Pirsch John Weily, 2007
4. DSP Processor and Fundamentals: Architecture and Features. Phil Lapsley, JBier, AmitSohan, Edward A Lee; Wiley IEEE Press
5. K. K. Parhi - VLSI Digital Signal Processing Systems - Wiley – 1999.
6. RulphChassaing, Digital signal processing and applications with C6713 and C6416 DSK, Wiley, 2005
7. Keshab K Parhi, VLSI Digital Signal Processing Systems:Design and Implementation, studentEdition, Wiley, 1999.
8. Nasser Kehtarnavaz, Digital Signal Processing System Design: LabVIEW-Based HybridProgramming, Academic Press, 2008

Course Code:	**24ES215**	**Course Title:**	**Machine Learning and Deep Learning**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- Understanding about the learning problem and algorithms
- Providing insight about neural networks
- Introducing the machine learning fundamentals and significance
- Enabling the students to acquire knowledge about pattern recognition.
- Motivating the students to apply deep learning algorithms for solving real life problems.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Blended Mode of Learning
3. Project based Learning
4. Experiential Learning
5. NPTEL and Other Videos
6. Smart Class Room
7. Flipped Class

UNIT I – Learning Problems and Algorithms	**[9 hours]**
Various paradigms of learning problems, Supervised, Semi-supervised and Unsupervised algorithms	

UNIT II – Neural Networks	**[9 hours]**
Differences between Biological and Artificial Neural Networks - Typical Architecture, CommonActivation Functions, Multi-layer neural network, Linear Separability, Hebb Net, Perceptron, Adaline,Standard Back propagation Training Algorithms for Pattern Association - Hebb rule and Delta rule,Hetero associative, Auto associative, Kohonen Self Organising Maps, Examples of Feature Maps,Learning Vector Quantization, Gradient descent, Boltzmann Machine Learning.	

UNIT III –Machine Learning - Fundamentals & Feature Selections &Classifications	**[9 hours]**
Classifying Samples: The confusion matrix, Accuracy, Precision, Recall, F1- Score, the curse ofdimensionality, training, testing, validation, cross validation, overfitting, under-fitting the data, earlystopping, regularization, bias and variance. Feature Selection, normalization, dimensionalityreduction,Classifiers: KNN, SVM, Decision trees, Naïve Bayes, Binary classification, multi class classification,clustering.	

UNIT IV –Deep Learning: Convolutional Neural Networks	[9 hours]
Feed forward networks, Activation functions, back propagation in CNN, optimizers, batchnormalization, convolution layers, pooling layers, fully connected layers, dropout, Examples of CNNs.	

UNIT V – Deep Learning: RNNS, Autoencoders and GANS	[9 hours]
State, Structure of RNN Cell, LSTM and GRU, Time distributed layers, Generating Text,Autoencoders: Convolutional Autoencoders, Denoising autoencoders, Variational autoencoders,GANs: The discriminator, generator, DCGANs	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Illustrate the categorization of machine learning algorithms.
CO2	Compare and contrast the types of neural network architectures, activation functions
CO3	Acquaint with the pattern association using neural networks
CO4	Elaborate various terminologies related with pattern recognition and architectures of convolutional neural networks
CO5	Construct different feature selection and classification techniques and advanced neural network architectures such as RNN, Autoencoders, and GANs

COs and POs Mapping:

CO'S	1	2	3
CO1	1	3	1
CO2	2	3	2
CO3	3	-	3
CO4	2	3	3
CO5	3	3	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Typeof assessment	Max Marks	Reduced Marks	Total	Final mark

					s
Continuous Internal Examination (CIE)	CIE – I	100	50	10 0	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. J. S. R. Jang, C. T. Sun, E. Mizutani, Neuro Fuzzy and Soft Computing - A ComputationalApproach to Learning and Machine Intelligence, 2012, PHI learning
2. Deep Learning, Ian Good fellow, YoshuaBengio and Aaron Courville, MIT Press, ISBN: 9780262035613, 2016.
3. The Elements of Statistical Learning. Trevor Hastie, Robert Tibshirani and Jerome Friedman.Second Edition. 2009.
4. Pattern Recognition and Machine Learning. Christopher Bishop. Springer. 2006.
5. Understanding Machine Learning. Shai Shalev-Shwartz and Shai Ben-David. CambridgeUniversity Press. 2017

AUDIT COURSES - I

Course Code:	**24AC101**	**Course Title:**	**English for Research Paper Writing**
Credits:	**2**	**L – T – P**	**2-0-0**

Course objectives: To impart knowledge on the • Teach how to improve writing skills and level of readability. • Tell about what to write in each section. • Summarize the skills needed when writing a Title. • Infer the skills needed when writing the Conclusion. • Ensure the quality of paper at very first-time submission
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. Interactive Simulations 3. Blended Mode of Learning 4. Project based Learning 5. NPTEL and Other Videos 6. Smart Class Room 7. Flipped Class

UNIT I – Introduction to Research Paper Writing	**[6 hours]**
Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.	

UNIT II – Presentation Skills	**[6 hours]**
Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction	

UNIT III –Title Writing Skills	**[6 hours]**
Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check	

UNIT IV – Result Writing Skills	**[6 hours]**
Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions	

UNIT V –Verification Skills	[6 hours]
Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first-time submission.	

Course outcomes: On completion of the course, the student will have the ability to:

CO1	Understand that how to improve your writing skills and level of readability
CO2	Learn about what to write in each section
CO3	Understand the skills needed when writing a Title
CO4	Understand the skills needed when writing the Conclusion
CO5	Ensure the good quality of paper at very first-time submission

COs and POs Mapping:

COs	PO1	PO2	PO3
CO1	2	2	2
CO2	2	3	2
CO3	1	2	1
CO4	2	3	2
CO5	2	3	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Typeof assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	65	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011
2. Day R How to Write and Publish a Scientific Paper, Cambridge University Press 2006

Reference Books:

1. Goldbort R Writing for Science, Yale University Press (available on Google Books) 2006

Web Links and Video Lectures (E-Resources):

1. English for Research Paper Writing: https://onlinecourses.swayam2.ac.in/ntr24_ed15/preview

Course Code:	**24AC102**	**Course Title:**	**Disaster Management**
Credits:	**2**	**L – T – P**	**2-0-0**

Course objectives:
To impart knowledge on the • Summarize basics of disaster. • Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response. • Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives. • Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations. • Develop the strengths and weaknesses of disaster management approaches
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. Interactive Simulations 3. Blended Mode of Learning 4. Project based Learning 5. NPTEL and Other Videos 6. Smart Class Room 7. Flipped Class

UNIT I – Introduction	[6 hours]
Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.	

UNIT II – Repercussions of Disasters and Hazards	[6 hours]
Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.	

UNIT III –Disaster Prone Areas in India	[6 hours]
Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics	

UNIT IV – Disaster Preparedness and Management	[6 hours]
Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.	

UNIT V –Risk Assessment	[6 hours]
Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival	

Course outcomes: On completion of the course, the student will have the ability to:

CO1	Summarize basics of disaster
CO2	Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
CO3	Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
CO4	Describe the standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
CO5	Develop the strengths of disaster management approaches

COs and POs Mapping:

COs	PO1	PO2	PO3
CO1	2	2	2
CO2	2	3	2
CO3	1	2	1
CO4	2	3	2
CO5	2	3	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Typeof assessment</th><th>Max Mar ks</th><th>Reduce d Marks</th><th>Tot al</th><th>Fin al mar ks</th></tr>
<tr><td rowspan="6">Continuous Internal Examination (CIE) - Theory</td><td>CIE – I</td><td>100</td><td rowspan="2">50</td><td rowspan="6">10 0</td><td rowspan="6">40</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>MCQ</td><td>20</td><td>10</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td>Model Lab Exam</td><td>25</td><td>25</td></tr>
<tr><td>End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>65</td><td>60</td><td>60</td></tr>
<tr><td colspan="5">Total</td><td>100</td></tr>
</table>

<u>End semester Examination: (QP PATTERN)</u>

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Goel S. L., Disaster Administration And Management Text And Case Studies”,Deep& Deep Publication Pvt. Ltd., New Delhi,2009.
2. NishithaRai, Singh AK, “Disaster Management in India: Perspectives, issues and strategies “’NewRoyal book Company,2007.

Reference Books:

1. Sahni, PardeepEt.Al. ,” Disaster Mitigation Experiences And Reflections”, Prentice Hall OfIndia, New Delhi,2001.

Web Links and Video Lectures (E-Resources):

1. Disaster Management: https://onlinecourses.swayam2.ac.in/cec19_hs20/preview

Course Code:	**24AC103**	**Course Title:**	**Constitution of India**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- Understand the premises informing the twin themes of liberty and freedom from a civil right perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional
- Role and entitlement to civil and economic rights as well as the emergence nation hood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the BolshevikRevolutionin1917and its impact on the initial drafting of the Indian Constitution.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Blended Mode of Learning
3. Project based Learning
4. Experiential Learning
5. NPTEL and Other Videos
6. Smart Class Room
7. Flipped Class

UNIT I – History of Making of the Indian Constitution	**[6 hours]**
History, Drafting Committee, (Composition &Working) - Preamble, Salient Features	

UNIT II – Contours of Constitutional Rights and Duties	**[6 hours]**
Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles ofState Policy, Fundamental Duties.	

UNIT III – Organs of Governance	[6 hours]
Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.	

UNIT IV –Local Administration	[6 hours]
District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat.Elected officials and their roles, CEO ZilaPachayat: Position and role. Block level: Organizational Hierarchy(Different departments), Village level:Roleof Elected and Appointed officials, Importance of grass root democracy.	

UNIT V – Election Commission	[6 hours]
Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
CO2	Discuss the intellectual origins of the framework
CO3	Discuss the intellectual origins of conceptualization of social reforms leading to revolution in India.
CO4	Discuss the circumstances surrounding the foundation of the Congress Socialist Party[CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
CO5	Discuss the passage of the Hindu Code Bill of 1956.

COs and POs Mapping:

CO'S	1	2	3
CO1	-	1	-
CO2	-	1	-
CO3	-	1	-
CO4	-	1	-
CO5	-	1	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Typeof assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. The Constitution of India,1950(Bare Act),Government Publication.
2. Dr.S.N.Busi, Dr.B.R.Ambedkar framing of Indian Constitution,1stEdition, 2015.
3. M.P. Jain, Indian Constitution Law, 7thEdn., Lexis Nexis,2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Item 01:18 – Annexure XVI

ROHINI COLLEGE OF ENGINEERING AND TECHNOLOGY

(AUTONOMOUS)

(Anjugramam-Kanyakumari Main Road, Palkulam,Variyoor P.O.-629 401, K.K.Dist.)

Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai

Accredited with A+ Grade by NAAC

Department of Mechanical Engineering

(M.E Industrial Safety Engineering)

Curriculum & Syllabus

(*2024-2025 Admitted Students Onwards*)

Proceedings of the 1st Academic Council [29.06.2024]

Vision Statement of RCET

To be an academic institute of continuous excellence towards education and research in rural regime and provide service to nation in terms of nurturing potentially higher social, ethical and engineering companion graduands.

Mission Statement of RCET

To foster and promote technically competent graduands by imparting the state of art engineering education in rural regime.

To enunciate research assisted scientific learning by dissemination of knowledge towards science, agriculture, industry and national security.

Vision of the Department

To inculcate competence in the field of mechanical engineering for the students by providing quality education and learning opportunities to become ethically strong engineers for the development of society.

Mission of the Department

To provide fundamentals and technical skills in Mechanical Engineering through effective teaching-learning methodologies.

To provide an ambience for research through collaborations with industry and academia.

To inculcate the students' leadership quality through employability skills with ethical values.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1	Graduates will apply the knowledge of Mechanical Engineering concepts and innovative methods to solve real-world engineering problems.
PEO2	Graduates will have the required qualities for a successful carrier in Mechanical Engineering and related fields.
PEO3	Graduates will exhibit professional skills with ethical values and teamwork.

PROGRAMME OUTCOMES (POs)

PO #	**Programme Outcomes**
PO1	An ability to independently carry out research/investigation and development work to solve practical problems
PO2	An ability to write and present a substantial technical report/document
PO3	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the Industrial Safety Engineering. The mastery should be at a level higher than the requirements in the appropriate bachelor program

CREDIT INFO		
Sl.No	Category	Credits
1	**FOUNDATION COURSES (FC)**	4
2	**PROGRAM CORE COURSES (PCC)**	29
3	**RESEARCH METHODOLOGY AND IPR COURSES (RMC)**	2
4	**PROFESSIONAL ELECTIVES (PEC)**	15
5	**EMPLOYABILITY ENHANCEMENT COURSES (EEC)**	22
6	**OPEN ELECTIVES (OEC)**	3
Total Credits		75

FOUNDATION COURSES (FC)							
Sl.no	Course Code	Course Title	Course Type	L	T	P	Credit
1.	24IS101	Probability and Statistical Methods	FC	**4**	**0**	**0**	**4**

PROGRAM CORE COURSES (PCC)							
Sl.no	Course Code	Course Title	Course Type	L	T	P	Credit
1	24IS102	Principles of Safety Management	PCC	3	0	0	3
2.	24IS103	Environmental Safety	PCC	3	0	0	3
3.	24IS104	Occupational Health and Industrial Hygiene	PCC	3	0	0	3
4.	24IS105	Industrial Safety, Health and Environment Acts	PCC	3	0	0	3
5.	24IS201	Fire Engineering and Explosion Control	PCC	3	0	0	3
6.	24IS202	System Simulation and Hazard Analysis	PCC	4	0	0	4
7.	24IS203	Electrical Safety	PCC	3	0	0	3
8.	24IS204	Safety in Process Industries	PCC	3	0	0	3
9.	24IS231	Industrial Safety and Simulation Laboratory	PCC	0	0	2	1
10.	24IS301	Reliability Engineering	PCC	3	0	0	3

RESEARCH METHODOLOGY AND IPR COURSES (RMC)							
Sl.no	Course Code	Course Title	Course Type	L	T	P	Credit
1.	24RM101	Research Methodology and IPR	RMC	2	0	0	2

PROFESSIONAL ELECTIVES-1 (PEC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1.	24IS111	Plant Layout and Material Handling	PEC	3	0	0	3
2.	24IS112	Work Study and Ergonomics	PEC	3	0	0	3
3.	24IS113	Human Factors in Engineering	PEC	3	0	0	3

4.	24IS114	Maintainability Engineering	PEC	3	0	0	3
5.	24IS115	Optimization Techniques	PEC	3	0	0	3
EMPLOYABILITY ENHANCEMENT COURSES (EEC)							
1.	24IS151	Safety Audit	EEC	0	0	2	1
2.	24IS251	Technical Seminar - I	EEC	0	0	2	1
3.	24IS351	Project Work I	EEC	0	0	12	6
4.	24IS352	Industrial Safety Assessment – Internship	EEC	0	0	4	2
5.	24IS451	Project Work II	EEC	0	0	24	12
PROFESSIONAL ELECTIVES-II & III (PEC)							
1.	24IS211	Transport Safety	PEC	3	0	0	3
2.	24IS212	Fireworks Safety	PEC	3	0	0	3
3.	24IS213	Safety in Construction	PEC	3	0	0	3
4.	24IS214	Nuclear Engineering and Safety	PEC	3	0	0	3
5.	24IS215	Safety in Textile Industry	PEC	3	0	0	3
6.	24IS216	Safety in Mines	PEC	3	0	0	3
7.	24IS217	Dock Safety	PEC	3	0	0	3
PROFESSIONAL ELECTIVES- IV & V (PEC)							
1.	24IS311	Safety in Engineering Industry	PEC	3	0	0	3
2.	24IS312	Quality Engineering in Production Systems	PEC	3	0	0	3
3.	24IS313	ISO 45001 and ISO 14000	PEC	3	0	0	3
4.	24IS314	Artificial Intelligence and Expert Systems	PEC	3	0	0	3
5.	24IS315	Design of Experiments	PEC	3	0	0	3
6.	24IS316	Data Analytics	PEC	3	0	0	3

OPEN ELECTIVES (OEC)

S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1.	24CI 341	Integrated Water Resources Management	OEC	3	0	0	3
2.	24CI 342	Water, Sanitation and Health	OEC	3	0	0	3
3.	24CI 343	Principles of Sustainable Development	OEC	3	0	0	3
4.	24CI 344	Environmental Impact Assessment	OEC	3	0	0	3
5.	24CP 311	Block chain Technologies	OEC	3	0	0	3
6.	24CP 310	Deep Learning	OEC	3	0	0	3
7.	24CI 345	Sustainable Management	OEC	3	0	0	3
8.	24IS 341	Micro and Small Business Management	OEC	3	0	0	3
9.	24IS 343	Intellectual Property Rights	OEC	3	0	0	3
10.	24IS 344	Ethical Management	OEC	3	0	0	3
11.	24EM 341	IoT for Smart Systems	OEC	3	0	0	3
12.	24EM 342	Smart Grid	OEC	3	0	0	3
13.	24CP 301	Security Practices	OEC	3	0	0	3
14.	24CP 206	Cloud Computing Technologies	OEC	3	0	0	3
15.	24TE 344	Design Thinking	OEC	3	0	0	3
16.	24CP 341	Principles of Multimedia	OEC	3	0	0	3
17.	24CP 342	Big Data Analytics	OEC	3	0	0	3
18.	24CM 341	Medical Robotics	OEC	3	0	0	3

19.	24EM 343	Embedded Automation	OEC	3	0	0	3
20.	24CI 346	Environmental Sustainability	OEC	3	0	0	3
21.	24TE 345	Textile Reinforced Composites	OEC	3	0	0	3

 # denotes no credit

Recommended Courses for I SEMESTER

S. No.	Course Code	Course Title	Course Category	L	T	P	C
FOUNDATION COURSES							
1.	24IS101	Probability and Statistical Methods	FC	4	0	0	4
PROFESSIONAL CORE COURSES							
2.	24IS102	Principles of Safety Management	PCC	3	0	0	3
3.	24IS103	Environmental Safety	PCC	3	0	0	3
4.	24IS104	Occupational Health and Industrial Hygiene	PCC	3	0	0	3
5.	24IS105	Industrial Safety, Health and Environment Acts	PCC	3	0	0	3
RESEARCH METHODOLGY AND IPR COURSES							
6.	24RM101	Research Methodology and IPR	RMC	2	0	0	2
PROFESSIONAL ELECTIVE COURSES							
7.	24IS11X	Professional Elective - I	PEC	3	0	0	3
AUDIT COURSES							
8.	24AC2XX	Audit Course – I*	AC	2	0	0	0
EMPLOYABILITY ENHANCEMENT COURSES							
9.	24IS151	Safety Audit	EEC	0	0	2	1
		Total		**23**	**0**	**2**	**22**

Recommended Courses for II SEMESTER

S. No.	Course Code	Course Title	Course Category	L	T	P	C
PROFESSIONAL CORE COURSES							
1.	24IS201	Fire Engineering and Explosion	PCC	3	0	0	3
2.	24IS202	System Simulation and Hazard Analysis	PCC	4	0	0	4
3.	24IS203	Electrical Safety	PCC	3	0	0	3
4.	24IS204	Safety in Process Industries	PCC	3	0	0	3
5.	24IS231	Industrial Safety and Simulation Laboratory	PCC	0	0	2	1
PROFESSIONAL ELECTIVE COURSES							
6.	24IS21X	Professional Elective - II	PEC	3	0	0	3
7.	24IS21X	Professional Elective- III	PEC	3	0	0	3
AUDIT COURSES							
8.	24AC2XX	Audit Course - II*	AC	2	0	0	0
EMPLOYABILITY ENHANCEMENT COURSES							
9.	24IS251	Technical Seminar - I	EEC	0	0	2	1
		Total		**21**	**0**	**4**	**21**

Course Code:	**24IS101**	**Course Title:**	**Probability and Statistical Methods**
Credits:	**4**	**L – T – P**	**4-0-0**

Course objectives:

To impart knowledge on the

- To provide students with basic concepts of probability theory.
- To provide the most appropriate estimator of the parameter in statistical inference.
- To decide whether to accept or reject a specific value of a parameters.
- To avoid or at least to minimize, the problems of estimating the effects of the independent variable by experimental designs.
- To learn methods for analyzing time series data to extract meaningful statistical characteristic of data.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Blended Mode of Learning
3. Project based Learning
4. NPTEL and Other Videos
5. Smart Class Room
6. Flipped Class

UNIT I – Probability and Random Variables	**[12 hours]**
Probability – Axioms of probability – Conditional probability – Baye's theorem - Random variables – Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a random variable.	
UNIT II – ESTIMATION THEORY	**[12 hours]**
Principle of least squares – Regression – Multiple and partial correlations – Estimation of parameters – Maximum likelihood estimates – Method of moments	

UNIT III – TESTING OF HYPOTHESIS	**[12 hours]**
Sampling distributions – Small and large samples and problems – Tests based on Normal, t - distribution, Chi - square, Goodness of fit and F – distributions	
UNIT IV – DESIGN OF EXPERIMENTS	**[12 hours]**
Analysis of variance – Completely randomized design – Randomized block design – Latin square design – 22 Factorial designs.	
UNIT V – TIME SERIES	**[12 hours]**
Characteristics and representation – Moving averages – Exponential smoothing – Auto regressive processes.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Apply the ideas of probability and random variables in solving engineering problems.	K3
CO2	Obtain the regression line using the method of least square and also to calculate the partial and multiple correlation coefficient for the given set of data points.	K3
CO3	Apply the various statistical methods in hypothesis testing for mean and variances of large and small samples.	K3
CO4	Apply various ANOVA techniques like CRD, RBD, and LSD etc. to obtain the variances.	K3
CO5	Apply various time series models to predict the forecast level using exponential smoothing techniques.	K3

COs and POs Mapping:

COs	POs		
	1	2	3
CO1	3	2	2
CO2	3	2	2
CO3	2	2	2
CO4	2	1	2
CO5	3	2	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Anderson, O.D, "Time Series Analysis: Theory and Practice", North - Holland, Amsterdam, 1982.
2. Devore, J. L., "Probability and Statistics for Engineering and Sciences", 9th Edition, Cengage Learning, 2016.

Reference Books:

1. Gupta S.C. and KapoorV.K.," Fundamentals of MathematicalStatistics", 12th Edition, Sultan and Sons, New Delhi, 2020.
2. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers, 9th Edition, Pearson Education, Asia, 2016.
3. Montgomery D.C and Johnson, L.A, "Forecasting and Time Series", 6th Edition, McGraw Hill, 1990.

Web Links and Video Lectures (E-Resources):

1. Statistical methods for scientist and Engineers : http://digimat.in/nptel/courses/video/111105077/L01.html
2. Introduction to probability and Statistics: http://acl.digimat.in/nptel/courses/video/111106112/L10.html
3. Probability and Statistics: http://acl.digimat.in/nptel/courses/video/111105090/L24.html

Suggested Skill Activities:

- Creating frequency tables.
- Creating dot plots.
- Reading dot plots & frequency tables.
- Create histograms.
- Read histograms.

Course Code:	**24IS102**	**Course Title:**	**Principles of Safety Management**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To achieve an understanding of principles of safety management.
- To enable the students to learn about various functions and activities of safety department.
- To enable students to conduct safety audit and write audit reports effectively in auditing situations.
- To have knowledge about sources of information for safety promotion and training.
- To familiarize students with evaluation of safety performance.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Experiential Learning
3. NPTEL and Other Videos
4. Smart Class Room
5. Flipped Class

UNIT I – CONCEPTS AND TECHNIQUES	**[9 hours]**
History of Safety movement –Evolution of modern safety concept- general concepts of management – planning for safety for optimization of productivity -productivity, quality and safety-line and staff functions for safety-budgeting for safety-safety policy. Incident Recall Technique (IRT), disaster control, job safety analysis, safety survey, safety inspection, safety sampling, evaluation of performance of supervisors on safety.	
UNIT II – SAFETY AUDIT	**[9 hours]**
Components of safety audit, types of audit, audit methodology, non-conformity reporting (NCR), audit checklist and report – review of inspection, remarks by government agencies, consultants, experts – perusal of accident and safety records, formats – implementation of audit indication -	

liaison with departments to ensure co-ordination – check list – identification of unsafe acts of workers and unsafe conditions in the shop floor.	
UNIT III – ACCIDENT INVESTIGATION AND REPORTING	**[9 hours]**
Concept of an accident, reportable and non reportable accidents, reporting to statutory authorities – principles of accident prevention – accident investigation and analysis – records for accidents, departmental accident reports, documentation of accidents – unsafe act and condition – domino sequence – supervisory role – role of safety committee –cost of accident.	
UNIT IV – SAFETY PERFORMANCE MONITORING	**[9 hours]**
ANSI (Z16.1) Recommended practices for compiling and measuring work injury experience – permanent total disabilities, permanent partial disabilities, temporary total disabilities - Calculation of accident indices, frequency rate, severity rate, frequency severity incidence, incident rate, accident rate, safety "t" score, safety activity rate – problems.	
UNIT V – SAFETY EDUCATION AND TRAINING	**[9 hours]**
Importance of training-identification of training needs-training methods – programmes, seminars, conferences, competitions – method of promoting safe practice - motivation – communication - role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – Domestic Safety and Training.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	To understand the functions and activities of safety engineering department.	K2
CO2	To carry out a safety audit and prepare a report for the audit	K2
CO3	To plan an accident investigation report.	K3
CO4	To identify the safety performance of an organization from accident records.	K3
CO5	To identify various agencies, support institutions and government organizations involved in safety training and promotion.	K3

COs and POs Mapping:

COs	POs		
	1	2	3
CO1	3	-	2
CO2	-	-	3
CO3	-	-	-
CO4	-	-	-
CO5	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. "Accident Prevention Manual for Industrial Operations", N.S.C.Chicago, 13th Edition 2009.
2. Blake R.B., "Industrial Safety" Prentice Hall, Inc., New Jersey,. 3rd Edition 2000.

Reference Books:

1. Dan Petersen, "Techniques of Safety Management", McGraw-Hill Company, Tokyo, 1981.
2. Heinrich H.W. "Industrial Accident Prevention" McGraw-Hill Company, New York, 1980
3. John Ridley, "Safety at Work", Butterworth and Co., London, 1983
4. Lees, F.P., "Loss Prevention in Process Industries" Butterworth publications, London, 2nd edition, 1990.
5. Relevant Indian Standards and Specifications, BIS, New Delhi.
6. "Safety and Good House Keeping", N.P.C., New Delhi, 1985.

Web Links and Video Lectures (E-Resources):

1. Industrial safety Engineering:
http://acl.digimat.in/nptel/courses/video/110105094/L51.html
2. Industrial safety Engineering
:http://acl.digimat.in/nptel/courses/video/110105094/L18.html
3. Introduction to safety and risk management
:https://www.youtube.com/watch?v=GeKBDv2lSfM

Suggested Skill Activities:

- Prepare a report about the risk of workplace incidents, injuries, and fatalities through data-driven measurements and improvements.
- Visit the people from different parts of the organization to make safety a shared responsibility and prepare the report.

Course Code:	**24IS103**	**Course Title:**	**ENVIRONMENTAL SAFETY**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To provide in depth knowledge in Principles of Environmental safety and its applications in various fields.
- To give understanding of air and water pollution and their control.
- To expose the students to the basis in hazardous waste management.
- To design emission measurement devices.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Blended Mode of Learning
3. NPTEL and Other Videos
4. Smart Class Room
5. Flipped Class

UNIT I – AIR POLLUTION	**[9 hours]**
Classification and properties of air pollutants – Pollution sources – Effects of air pollutants on human beings, Animals, Plants and Materials - automobile pollution-hazards of air pollution-concept of clean coal combustion technology - ultra violet radiation, infrared radiation, radiation from sun-hazards due to depletion of ozone - deforestation-ozone holes-automobile exhausts-chemical factory stack emissions-CFC.	
UNIT II – WATER POLLUTION	**[9 hours]**

Classification of water pollutants-health hazards-sampling and analysis of water-water treatment - different industrial effluents and their treatment and disposal -advanced wastewater treatment - effluent quality standards and laws- chemical industries, tannery, textile effluents-common treatment.	
UNIT III – HAZARDOUS WASTE MANAGEMENT	**[9 hours]**
Hazardous waste management in India-waste identification, characterization and classification-technological options for collection, treatment and disposal of hazardous waste-selection charts for the treatment of different hazardous wastes-methods of collection and disposal of solid wastes-health hazards-toxic and radioactive wastes-incineration and verification - hazards due to bio-process- dilution-standards and restrictions – recycling and reuse.	
UNIT IV – ENVIRONMENTAL MEASUREMENT AND CONTROL	**[9 hours]**
Sampling and analysis – dust monitor – gas analyzer, particle size analyzer – lux meter-pH meter – gas chromatograph – atomic absorption spectrometer. Gravitational settling chambers-cyclone separators-scrubbers-electrostatic precipitator - bag filter – maintenance - control of gaseous emission by adsorption, absorption and combustion methods- Pollution Control Board-laws	
UNIT V – POLLUTION CONTROL IN PROCESS INDUSTRIES	**[9 hours]**
Pollution control in process industries - cement, paper, petroleum-petroleum products-textile-tanneries-thermal power plants – dying and pigment industries - eco-friendly energy.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Illustrate and familiarize the basic concepts scope of environmental safety.	K2
CO2	Explain the standards of professional conduct that are published by professional safety organizations and/or certification bodies.	K2
CO3	Experiment the ways in which environmental health problems have arisen due to air and water pollution.	K3
CO4	Develop the role of hazardous waste management and use of critical thinking to identify and assess environmental health risks.	K3
CO5	Identify the concepts of measurement of emissions and design emission measurement devices.	K3

COs and POs Mapping:

COs	POs		
	1	**2**	**3**
CO1	3	-	2
CO2	-	-	3
CO3	-	-	-
CO4	-	-	-
CO5	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. E. C Wolfe, Race to Save to Save Planet, Wadsworth Publishing Co., Belmont, CA 2006.
2. G. T Miller, Environmental Science: Working with the Earth, 11th Edition, Wadsworth Publishing Co., Belmont, CA, 2006

Reference Books:

1. M.J Hammer,., and M.J Hammer,., Jr., Water and Wastewater Technology, Pearson Prentice Hall, 2006
2. Rao, CS, "Environmental pollution engineering:, Wiley Eastern Limited, New Delhi, 1st January 2018.
3. S. P. Mahajan, "Pollution control in process industries", Tata McGraw Hill Publishing Company, New Delhi, 2006.
4. Varma and Braner, "Air pollution equipment", Springer Publishers, Second Edition.

Web Links and Video Lectures (E-Resources):

1. Safety, Health, Report: https://www.youtube.com/watch?v=KoDiuL6NqgQ

2. Health, Safety and Environmental Management in Petroleum and Offshore Engineering : http://digimat.in/nptel/courses/video/114106017/L06.html

Suggested Skill Activities:

1. Access the Wisdom of Local Community
2. Make Classroom Own Paint
3. Visit the Local Recycling Center
4. Write Found Object Short Stories
5. Collect Weather Data

Course Code:	**24IS104**	**Course Title:**	**Occupational Health and Industrial Hygiene**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To understand the basic knowledge on anatomy of human organs and its basic functions.
- To enable the students to learn about various functions and activities of occupational health services.
- To enable students to compare the hazards with the permissible levels.
- To have knowledge about types of hazards arising out of physical, chemical and biological agents.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Blended Mode of Learning
3. NPTEL and Other Videos
4. Smart Class Room
5. Flipped Class

UNIT I – PHYSICAL HAZARDS	**[9 hours]**
Noise, compensation aspects, noise exposure regulation, properties of sound, occupational damage, risk factors, sound measuring instruments, octave band analyzer, noise networks, noise surveys, noise control program, industrial audiometry, hearing conservation programs- vibration, types, effects, instruments, surveying procedure, permissible exposure limit. Ionizing radiation, types, effects, monitoring instruments, control programs, OSHA standard- non-ionizing radiations, effects, types, radar hazards, microwaves and radio-waves, lasers, TLV- cold environments, hypothermia, wind chill index, control measures- hot environments, thermal comfort, heat stress indices, acclimatization, estimation and control.	

UNIT II – CHEMICAL HAZARDS	[9 hours]
Recognition of chemical hazards-dust, fumes, mist, vapour, fog, gases, types, concentration, Exposure vs. dose, TLV - Methods of Evaluation, process or operation description, Field Survey, Sampling methodology, Industrial Hygiene calculations, Comparison with OSHAS Standard. Air Sampling instruments, Types, Measurement Procedures, Instruments Procedures, Gas and Vapour monitors, dust sample collection devices, personal sampling Methods of Control - Engineering Control, Design maintenance considerations, design specifications - General Control Methods - training and education	
UNIT III – BIOLOGICAL AND ERGONOMICAL HAZARDS	**[9 hours]**
Classification of Biohazardous agents – examples, bacterial agents, rickettsial and chlamydial agents, viral agents, fungal, parasitic agents, infectious diseases – Covid SARS - Biohazard control program, employee health program-laboratory safety program-animal care and handling-biological safety cabinets - building design. Work Related Musculoskeletal Disorders –carpal tunnel syndrome CTS- Tendon pain-disorders of the neck- back injuries.	
UNIT IV – OCCUPATIONAL HEALTH AND TOXICOLOGY	**[9 hours]**
Concept and spectrum of health - functional units and activities of occupational health services, pre-employment and post-employment medical examinations - occupational related diseases, levels of prevention of diseases, notifiable occupational diseases such as silicosis, asbestosis, pneumoconiosis, siderosis, anthracosis, aluminosis and anthrax, lead-nickel, chromium and manganese toxicity, gas poisoning (such as CO, ammonia, coal and dust etc) their effects and prevention – cardio pulmonary resuscitation, audiometric tests, eye tests, vital function tests. Industrial toxicology, local, systemic and chronic effects, temporary and cumulative effects, carcinogens entry into human systems.	
UNIT V – OCCUPATIONAL PHYSIOLOGY	**[9 hours]**
Man as a system component – allocation of functions – efficiency – occupational work capacity – aerobic and anaerobic work – evaluation of physiological requirements of jobs – parameters of measurements – categorization of job heaviness – work organization – stress – strain – fatigue – rest pauses – shift work – personal hygiene.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	To Compare the various physiological functions.	K2
CO2	To Demonstrate the various test methods for periodical monitoring of health.	K2
CO3	To Identify the functions and activities of Occupational health services.	K3
CO4	To identify various types of hazards arising out of physical, chemical and biological agents in a process.	K3
CO5	To identify notifiable occupational diseases arising out of Occupation and suggest methods for the prevention of such diseases.	K3

COs and POs Mapping:

COs	**POs**		
	1	**2**	**3**
CO1	3	-	2
CO2	3	-	2
CO3	-	-	3
CO4	-	-	-
CO5	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final marks</th></tr>
<tr><td rowspan="5">Continuous Internal Examination (CIE)</td><td>CIE – I</td><td>100</td><td rowspan="2">50</td><td rowspan="5">100</td><td rowspan="5">40</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>MCQ</td><td>20</td><td>10</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td>End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>60</td><td>60</td><td>60</td></tr>
<tr><td colspan="5">Total</td><td>100</td></tr>
</table>

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Benjamin O.Alli, Fundamental Principles of Occupational Health and Safety ILO 2008.
2. Danuta Koradecka, Handbook of Occupational Health and Safety, CRC, 2010.

Reference Books:

1. E.J. McCornick, and M. S Sanders, Human Factors in Engineering and Design, Tata McGraw-Hill, 1992.
2. Encyclopedia of "Occupational Health and Safety", Vol.I and II, published by International Labour Office, Geneva, 1985
3. Hand book of "Occupational Safety and Health", National Safety Council, Chicago, 2002.
4. Lawrence Slote , Handbook of occupational safety and health, Wiley, 2001.
5. Louis J. Di Berardinis, Handbook of occupational safety and health Wiley, 1999.
6. Interim guidance "COVID-19: Occupational health and safety for health workers", WHO & ILO,2021.

Web Links and Video Lectures (E-Resources):

1. Course Introduction SAFM 3423 Industrial Hygiene : https://www.youtube.com/watch?v=y4ZdUFhwfUU
2. Occupational Hazards : https://www.youtube.com/watch?v=OPqTjnqejnQ

Suggested Skill Activities:

- Prepare a report about the risk of industrial hazards, injuries, and fatalities through data-driven measurements and improvements.
- Visit nearby industry and learn about real world industrial hazards and prepare the report.

Course Code:	**24IS105**	**Course Title:**	**Industrial Safety, Health and Environment Acts**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To provide exposure to the students about safety and health provisions related to hazardous processes as laid out in Factories act 1948.
- To familiarize students with powers of inspectorate of factories.
- To help students to learn about Environment act 1986 and rules framed under the act.
- To provide wide exposure to the students about various legislations applicable to an industrial unit.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Blended Mode of Learning
3. NPTEL and Other Videos
4. Smart Class Room
5. Flipped Class

UNIT I – FACTORIES ACT – 1948	**[9 hours]**
Statutory authorities – inspecting staff, health, safety, provisions relating to hazardous processes, welfare, working hours, employment of young persons – special provisions – penalties and procedures-Tamilnadu Factories Rules 1950 under Safety and health chapters of Factories Act 1948. Forms, Registers and notices – Tamilnadu Safety Officer Rules 2005- with updated Amendments.	
UNIT II – ENVIRONMENT ACT – 1986	**[9 hours]**
General powers of the central government, prevention, control and abatement of environmental pollution-Biomedical waste (Management and handling Rules, 1989-The noise pollution (Regulation and control) Rules, 2000-The Batteries (Management and Handling Rules) 2001- No Objection certificate from statutory authorities like pollution control board.	

Air Act 1981 and Water Act 1974: Central and state boards for the prevention and control of air pollution-powers and functions of boards – prevention and control of air pollution and water pollution – fund – accounts and audit, penalties and procedures.	
UNIT III – MANUFACTURE, STORAGE AND IMPORT OF HAZARDOUS CHEMICAL RULES 1989 AND MAJOR ACCIDENT HAZARD CONTROL RULES AND AMENDMENT	**[9 hours]**
Definitions – duties of authorities – responsibilities of occupier – notification of major accidents – information to be furnished – preparation of offsite and onsite plans – list of hazardous and toxic chemicals – safety reports – safety data sheets. Major Accident Hazard Control Rules. Hazardous Wastes (management, handling and Transboundary Movement) Rules 2016.	
UNIT IV – OTHER ACTS AND RULES	**[9 hours]**
Indian Boiler (Amendments) Act 2007, static and mobile pressure vessel rules (SMPV), motor vehicle rules, The Mines and Minerals (Development & Regulation) Amendment Act, 2015, workman compensation act, rules – electricity act and rules – hazardous wastes (management, handling and transboundary) rules, 2008 - the building and other construction workers act 1996., Petroleum rules, Gas cylinder rules 2016, Explosives Act 1884 - Pesticides Act – E waste (management) rules 2016.	
UNIT V – INTERNATIONAL ACTS AND STANDARDS	**[9 hours]**
Occupational Safety and Health act of USA (The Williames - Steiger Act of 1970) – Health and safety work act (HASAWA 1974, UK) – ISO 14001 – ISO 45001 , European Safety and Health Legislations, American Petroleum Institute (API) Standards, Oil Industry Safety Directorate (OISD) Standards, National Fire Protection Association (NFPA) Standards, Atomic Energy Regulatory Board (AERB), American National Standards Institute(ANSI).	

Course outcomes:

On completion of the course, the student will have the ability :

CO1	To Explain out important legislations related to health, Safety and Environment.	K2
CO2	To show out requirements mentioned in factories act for the prevention of accidents.	K2
CO3	To develop the health and welfare provisions given in factories act.	K3
CO4	To organize the statutory requirements for an Industry on registration, license and its renewal.	K3
CO5	To compare onsite and offsite emergency plan.	K2

COs and POs Mapping:

COs	POs		
	1	**2**	**3**
CO1	3		2
CO2	-		3
CO3	-		-
CO4	-		-
CO5	-		-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	**2**	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. The Factories Act 1948, Madras Book Agency, Chennai, 2000
2. The Environment Act (Protection) 1986, Commercial Law Publishers (India) Pvt.Ltd., New Delhi.

Reference Books:

1. Water (Prevention and control of pollution) act 1974, Commercial Law publishers (India) Pvt.Ltd.,New Delhi.
2. Air (Prevention and control of pollution) act 1981, Commercial Law Publishers (India) Pvt.Ltd., New Delhi.
3. The Indian boilers act 1923, Commercial Law Publishers (India) Pvt.Ltd., Allahabad.
4. The Mines Act 1952, Commercial Law Publishers (India) Pvt.Ltd., Allahabad.
5. The manufacture, storage and import of hazardous chemical rules 1989, Madras Book Agency, Chennai.
6. Srinivasan S , "The Tamil Nadu Safety Officers Rules 2005" Madras Book Agency, Chennai, 28th Edition, 2017.

Web Links and Video Lectures (E-Resources):

1. Environmental Laws : https://www.youtube.com/watch?v=CTUOchYZG2k
2.Environment Protection Act 1986 : https://www.youtube.com/watch?app=desktop&v=ILeQ2E9yVDA

Suggested Skill Activities:

- Frame the safety rules for a medium scale industry as per Environmental Acts
- Prepare a report about the risk of industrial safety measures.
- Visit nearby industry and learn about real world industrial safety measures and prepare the report.

Course Code:	**24RM101**	**Course Title:**	**RESEARCH METHODOLOGY AND IPR**
Credits:	**2**	**L – T – P**	**2-0-0**

Course objectives:

To impart knowledge on the

Formulation of research problem, research methodology, ethics involved in doing research and importance of IPR protection.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Blended Mode of Learning
3. NPTEL and Other Videos
4. Smart Class Room
5. Flipped Class

UNIT I – RESEARCH DESIGN	**[9 hours]**
Overview of research process and design, Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys.	
UNIT II – DATA COLLECTION AND SOURCES	**[9 hours]**
Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data - Preparing, Exploring, examining and displaying.	
UNIT III – DATA ANALYSIS AND REPORTING	**[9 hours]**
Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation.	
UNIT IV – INTELLECTUAL PROPERTY RIGHTS	**[9 hours]**

Intellectual Property – The concept of IPR, Evolution and development of concept of IPR, IPR development process, Trade secrets, utility Models, IPR & Bio diversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.

UNIT V – PATENTS	[9 hours]
Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification, Types of patent application, process E-filling, Examination of patent, Grant of patent, Revocation, Equitable Assignments, Licences, Licensing of related patents, patent agents, Registration of patent agents.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Formulate research problem	**K6**
CO2	Analyze literature review and find research gaps to finalize research objectives	**K4**
CO3	Identify the need of ethics in research	**K3**
CO4	Identify the need of IPR of research projects for economic growth and social benefits	**K3**
CO5	Apply their research work for patent through IPR	**K3**

COs and POs Mapping:

COs	**POs**		
	1	**2**	**3**
CO1	3	-	2
CO2	-	-	3
CO3	-	-	-
CO4	-	-	-
CO5	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final marks</th></tr>
<tr><td rowspan="5">Continuous Internal Examination (CIE)</td><td>CIE – I</td><td>100</td><td rowspan="2">50</td><td rowspan="5">100</td><td rowspan="5">40</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>MCQ</td><td>20</td><td>10</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td>End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>60</td><td>60</td><td>60</td></tr>
<tr><td colspan="5" align="right">Total</td><td>100</td></tr>
</table>

Assessment Pattern

<table>
<tr><th rowspan="2">Bloom's Category</th><th colspan="2">Continuous Assessment Tests</th><th rowspan="2">Terminal Examination</th></tr>
<tr><th>1</th><th>2</th></tr>
<tr><td>Remember</td><td>10</td><td>10</td><td>10</td></tr>
<tr><td>Understand</td><td>20</td><td>30</td><td>20</td></tr>
<tr><td>Apply</td><td>30</td><td>40</td><td>40</td></tr>
<tr><td>Analyze</td><td>10</td><td>10</td><td>10</td></tr>
<tr><td>Evaluate</td><td>10</td><td>10</td><td>10</td></tr>
<tr><td>Create</td><td>20</td><td>-</td><td>10</td></tr>
</table>

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Ranjit Kumar, Research Methodology- A step by step guide for beginners, Pearson Education, Australia, 2005.
2. Ann M. Korner, Guide to Publishing a Scientific paper, Bioscript Press 2004.

Reference Books:

1. Kothari, C. R. Research Methodology - Methods and Techniques, New Age International publishers, New Delhi, 2004.
2. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students', Juta & Company, 1996.
3. Robert P. Merges, Peter S. Menell and Mark A. Lemley, "Intellectual Property in New Technological Age", Aspen Publishers, 2016.
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall , "Industrial Design", McGraw Hill, 1992.
6. Niebel , "Product Design", McGraw Hill, 1974.
7. Asimov , "Introduction to Design", Prentice Hall, 1962.

Web Links and Video Lectures (E-Resources):

1. Introduction to Intellectual Property :
https://www.youtube.com/watch?v=6BArSbZ2Gcw
2. Research Methodology and IPR Introduction :
https://www.youtube.com/watch?v=Ju4ov_ZBZn4

Suggested Skill Activities:

1. Participate Expert Session on Intellectual Property Rights
2. Participate Workshop on Research Methods Tools: Basics of R.
3. Innovation and Prototyping.

Course Code:	24IS151	Course Title:	Safety Audit
Credits:	1	L – T – P	0-0-2

Course objectives:
To impart knowledge on the ● To Inculcate the Industrial Safety Environment to the students ● To Explore the Human Capital Management and Hazardous System
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Experiential Learning

Laboratory Component: **[30 hours]**

Any 12 experiments have to be completed from the following list of experiments.

S.No.	Name of the Experiment
1	Safety Management systems.
2	Fire and Explosion prevention, protection and emergency management.
3	Work injury prevention.
4	Health hazards control.
5	Evaluating emergency plan.
6	First aid practices
7	Management of health and safety
8	Accidents and accident reporting
9	Asbestos
10	Contractors
11	Display screen equipment
12	Electrical safety
13	Emergency lighting
14	Environmental protection
15	Fire prevention and emergencies
16	Hazardous substances
17	Housekeeping and cleanliness
18	Information and communication
19	Kitchens, catering and food safety
20	Lifts and lifting equipment
21	Manual handling operations
22	Noise
23	Occupational health

24	Personal protective equipment
25	Plant rooms, machinery and equipment
26	Risk assessment requirements
27	Safety Policy
28	Safety signs and notices
29	Training
30	Use of vehicles / vehicle safety
31	Water services
32	Welfare provision
33	Working time
34	Work at heights
35	Workplace environment
36	Accident prevention
37	Identifying and correcting Regulatory Deficiencies
38	Improvement of Employee Morale
39	Identification and Elimination of Safety Hazards

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Explain the Labor turn over by existence of Safety Measures of an Employee.	K2
CO2	Identify the Fatigue Study it will lead to good production.	K3
CO3	Develop the Human Resource Management Practices.	K3
CO4	Choose the Health Consciousness to the Working Community.	K3
CO5	Demonstrate the Human Capital Management and Hazardous System	K2

COs and POs Mapping:

COs	**POs**		
	1	**2**	**3**
CO1	-	3	-
CO2	-	2	2
CO3	-	-	-
CO4	-	2	-
CO5	-	-	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	60
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Lab Exam	100	15	40	40
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

Course Code:	24IS201	Course Title:	Fire Engineering and Explosion Control
Credits:	3	L – T – P	3-0-0

Course objectives: To impart knowledge on the • To provide an in depth knowledge about the science of fire. • To understand the causes and effects of fire. • To know the various fire prevention systems and protective equipment's. • To understand the science of explosion and its prevention techniques. • To understand the various fire prevention techniques to be followed in a building.
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 6. Chalk and Talk 7. Blended Mode of Learning 8. NPTEL and Other Videos 9. Smart Class Room 10. Flipped Class

UNIT I – PHYSICS AND CHEMISTRY OF FIRE	[9 hours]
Fire properties of solid, liquid and gases - fire spread - toxicity of products of combustion - theory of combustion and explosion – vapour clouds – flash fire – jet fires – pool fires – unconfined vapour cloud explosion, shock waves - auto-ignition – boiling liquid expanding vapour explosion – case studies – Flixborough, Mexico disaster, Pasedena Texas, Piper Alpha, Peterborough and Bombay Victoria dock ship explosions.	
UNIT II – FIRE PREVENTION AND PROTECTION	**[9 hours]**
Sources of ignition – fire triangle – principles of fire extinguishing – active and passive fire protection systems – various classes of fires – A, B, C, D, E – types of fire extinguishers – fire stoppers – hydrant pipes – hoses – monitors – fire watchers – lay out of stand pipes – fire station-	

fire alarms and sirens – maintenance of fire trucks – foam generators – escape from fire rescue operations – fire drills – notice-first aid for burns.	
UNIT III – INDUSTRIAL FIRE PROTECTION SYSTEMS	**[9 hours]**
Sprinkler-hydrants-stand pipes – special fire suppression systems like deluge and emulsifier, selection criteria of the above installations, reliability, maintenance, evaluation and standards – alarm and detection systems. Other suppression systems – CO2 system, foam system, dry chemical powder (DCP) system, halon system – need for halon replacement – smoke venting. Portable extinguishers – flammable liquids – tank farms – indices of inflammability-fire fighting systems.	
UNIT IV – BUILDING FIRE SAFETY	**[9 hours]**
Objectives of fire safe building design, Fire load, fire resistant material and fire testing – structural fire protection – structural integrity – concept of egress design - exists – width calculations - fire certificates – fire safety requirements for high rise buildings – snookers	
UNIT V – EXPLOSION PROTECTING SYSTEMS	**[9 hours]**
Principles of explosion-detonation and blast waves-explosion parameters – Explosion Protection, Containment, Flame Arrestors, isolation, suppression, venting, explosion relief of large enclosure-explosion venting-inert gases, plant for generation of inert gas-rupture disc in process vessels and lines explosion, suppression system based on carbon dioxide (CO2) and halons-hazards in LPG, ammonia (NH3), sulphur dioxide (SO3), chlorine (CL2) etc.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	To Identify familiar about basic concepts of fire and explosion science.	K3
CO2	To show the different source of ignition and their prevention techniques.	K2
CO3	To choose the operation of various types of firefighting equipment's.	K3
CO4	To Explain the causes and prevention of explosion.	K2
CO5	To develop the students to effectively employ explosion protection techniques and their significances to suit the industrial requirement.	K3

COs and POs Mapping:

COs	POs		
	1	**2**	**3**
CO1	-	3	-
CO2	-	-	3
CO3	-	-	-
CO4	-	-	-
CO5	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	**2**	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. "Accident Prevention manual for industrial operations" N.S.C., Chicago, 1982.
2. "Davis Daniel et al, "Hand Book of fire technology"

Reference Books:

1. "Fire Prevention and firefighting", Loss prevention Association, India.
2. Derek, James, "Fire Prevention Hand Book", Butter Worths and Company, London, 1986.
3. Dinko Tuhtar, "Fire and explosion protection"
4. Fire fighters hazardous materials reference book Fire Prevention in Factories", an Nostrand Rein Hold, New York, 1991.
5. Gupta, R.S., "Hand Book of Fire Technology" Orient Longman, Bombay 1977.
6. Relevant Indian Acts and rules, Government of India.

Web Links and Video Lectures (E-Resources):

1. HSE for offshore Engineers :
https://ggsestc.digimat.in/nptel/courses/video/114106042/L54.html
2. Fire and Explosion Preventive Measures :
https://www.youtube.com/watch?v=PJhjs3gtfEU

Suggested Skill Activities:

1. Identifying potential fire and explosion hazards within a specific environment and create a report.
2. Participate workshop on fire hazards and submit the certificate.

Course Code:	24IS202	Course Title:	System Simulation and Hazard Analysis
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives: To impart knowledge on the • To provide knowledge on risk, hazard and their assessment techniques in Industry • To understand the principles of operation of various equipment for safety application • To know the consequences of fire, explosion and toxic release • To know the various software available for risk quantification • To conduct a risk assessment technique in Industries.
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. Blended Mode of Learning 3. NPTEL and Other Videos 4. Smart Class Room 5. Flipped Class

UNIT I – HAZARD, RISK ISSUES AND HAZARD ASSESSMENT	[9 hours]
Introduction, hazard, hazard monitoring-risk issue, group or societal risk, individual risk, voluntary and involuntary risk, social benefits Vs technological risk, approaches for establishing risk acceptance levels, Risk estimation. Hazard assessment, procedure, methodology; safety audit, checklist analysis, what-if analysis, safety review, preliminary hazard analysis(PHA), human error analysis, hazard operability studies(HAZOP),safety warning systems.	
UNIT II – COMPUTER AIDED INSTRUMENTS	**[9 hours]**
Applications of Advanced Equipments and Instruments, Thermo Calorimetry, Differential Scanning Calorimeter(DSC), Thermo Gravimetric Analyser(TGA), Accelerated Rate Calorimeter(ARC), Reactive Calorimeter(RC), Reaction System Screening Tool(RSST) - Principles of operations, Controlling parameters, Applications, advantages.	

Explosive Testing, Deflagration Test, Detonation Test, Ignition Test, Minimum ignition energy Test, Sensitiveness Test, Impact Sensitiveness Test(BAM) and Friction Sensitiveness Test (BAM), Shock Sensitiveness Test, Card Gap Test.	
UNIT III – RISK ANALYSIS QUANTIFICATION AND SOFTWARES	**[9 hours]**
Introduction to Discrete and Continuous Systems Simulation- Fault Tree Analysis and Event Tree Analysis, Logic symbols, methodology, minimal cut set ranking - fire explosion and toxicity index(FETI), various indices - Hazard analysis(HAZAN)- Failure Mode and Effect Analysis(FMEA)- Basic concepts of Reliability- Software on Risk analysis, CISCON, FETI, HAMGARS modules on Heat radiation, Pool fire, Jet, Explosion. Reliability softwares on FMEA for mechanical and electrical systems.	
UNIT IV – CONSEQUENCES ANALYSIS	**[9 hours]**
Logics of consequences analysis- Estimation- Hazard identification based on the properties of chemicals- Chemical inventory analysis- identification of hazardous processes- Estimation of source term, Gas or vapour release, liquid release, two phase release- Heat radiation effects, BLEVE, Pool fires and Jet fire- Gas/vapour dispersion- Explosion, UVCE and Flash fire, Explosion effects and confined explosion- Toxic effects- Plotting the damage distances on plot plant/layout.	
UNIT V – CREDIBILITY OF RISK ASSESSMENT TECHNIQUES	**[9 hours]**
Past accident analysis as information sources for Hazard analysis and consequences analysis of chemical accident, Mexico disaster, Flixborough, Bhopal, Seveso, Pasadena, Feyzin disaster(1966), Port Hudson disaster- convey report, hazard assessment of non-nuclear installation- Rijnmond report, risk analysis of size potentially Hazardous Industrial objects- Rasmussen masses report, Reactor safety study of Nuclear power plant	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Explain about the basic concepts in risk and hazard	K2
CO2	Develop the various instruments to bring safety in Industries	K3
CO3	Relate the risk assessment studies through the use of software	K2
CO4	Make use of a risk assessment technique to quantify the risk	K3

CO5	Illustrate hazard analysis techniques in Industry and helpful to prevent the accidents in Industry.	K2

COs and POs Mapping:

COs	POs		
	1	2	3
CO1	-	3	-
CO2	-	-	-
CO3	-	-	-
CO4	-	-	-
CO5	-	-	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Brown, D.B. System analysis and Design for safety, Prentice Hall, 1976.
2. Course Material Intensive Training Programme on Consequence Analysis, by Process Safety Centre, Indian Institute of Chemical Technology, Tarnaka and CLRI, Chennai.

Reference Books:

1. Guidelines for Hazard Evaluation Procedures, Centre for Chemical Process safety, AICHE 1992
2. Hazop and Hazom, by Trevor A Klett, Institute of Chemical Engineering.
3. ILO- Major Hazard control- A practical Manual, ILO, Geneva, 1988.
4. Loss Prevention in Process Industries-Frank P. Less Butterworth-Hein UK 1990 (Vol.I, II and III)
5. Methodologies for Risk and Safety Assessment in Chemical Process Industries, Common wealth Science Council, UK
6. Quantitative Risk assessment in Chemical Industries, Institute of Chemical Industries, Centre for Chemical process safety.

Web Links and Video Lectures (E-Resources):

1. Industrial Safety Engineering : http://acl.digimat.in/nptel/courses/video/110105094/L07.html

2. Project Management : http://acl.digimat.in/nptel/courses/video/110107430/L22.html

Suggested Skill Activities:

1. Assess the risk for a particular work area and create the report.
2. Create the report for safe Guards of a particular work area.
3. Document and present the risk and safety measures of a particular work area.

Course Code:	24IS203	Course Title:	ELECTRICAL SAFETY
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:
To impart knowledge on the • To provide knowledge on basics of electrical fire and statutory requirements for electrical safety • To understand the causes of accidents due to electrical hazards • To know the various protection systems in Industries from electrical hazards • To know the importance of earthing • To distinguish the various hazardous zones and applicable fire proof electrical devices
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. Blended Mode of Learning 3. NPTEL and Other Videos 4. Smart Class Room 5. Flipped Class

UNIT I – CONCEPTS AND STATUTORY REQUIREMENTS	[9 hours]
Introduction – electrostatics, electro magnetism, stored energy, energy radiation and electromagnetic interference – Working principles of electrical equipment-Indian electricity act and rules-statutory requirements from electrical inspectorate-international standards on electrical safety – first aid-cardio pulmonary resuscitation(CPR).	

UNIT II – ELECTRICAL HAZARDS	[9 hours]
Primary and secondary hazards-shocks, burns, scalds, falls-human safety in the use of electricity. Energy leakage-clearances and insulation-classes of insulation-voltage classifications-excess energy- current surges-Safety in handling of war equipments-over current and short circuit current-heating effects of current-electromagnetic forces-corona effect-static electricity –definition, sources, hazardous conditions, control, electrical causes of fire and explosion-ionization, spark and arc- ignition energy-national electrical safety code ANSI. Lightning, hazards, lightning arrestor, installation – earthing, specifications, earth resistance, earth pit maintenance.	
UNIT III – PROTECTION SYSTEMS	**[9 hours]**
Fuse, circuit breakers and overload relays – protection against over voltage and under voltage – safe limits of amperage – voltage –safe distance from lines-capacity and protection of conductor-joints-and connections, overload and short circuit protection-no load protection-earth fault protection. FRLS insulation-insulation and continuity test-system grounding-equipment grounding-earth leakage circuit breaker (ELCB)-cable wires-maintenance of ground-ground fault circuit interrupter-use of low voltage-electrical guards-Personal protective equipment – safety in handling hand held electrical appliances tools and medical equipments.	
UNIT IV – SELECTION, INSTALLATION, OPERATION AND MAINTENANCE	**[9 hours]**
Role of environment in selection-safety aspects in application - protection and interlock-self diagnostic features and fail safe concepts-lock out and work permit system-discharge rod and earthing devices- safety in the use of portable tools-cabling and cable joints-preventive maintenance.	
UNIT V – HAZARDOUS ZONES	**[9 hours]**
Classification of hazardous zones-intrinsically safe and explosion proof electrical apparatus-increase safe equipment-their selection for different zones-temperature classification-grouping of gases-use of barriers and isolators-equipment certifying agencies.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Demonstrate the basic concepts in electrical circuit and hazards involved in it.	K2
CO2	Identify the electrical hazards in Industries.	K3
CO3	Develop the operation of various protection systems from electrical hazards	K3
CO4	Explain the operation and maintenance from electrical hazards	K2
CO5	Identify different hazardous zones in Industries	K3

COs and POs Mapping:

COs	**POs**		
	1	**2**	**3**
CO1	-	3	-
CO2	-	-	2
CO3	-	-	-
CO4	-	-	-
CO5	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. "Accident prevention manual for industrial operations", N.S.C., Chicago, 1982.
2. Indian Electricity Act and Rules, Government of India.

Reference Books:

1. Power Engineers – Handbook of TNEB, Chennai, 1989.
2. Martin Glov Electrostatic Hazards in powder handling, Research Studies Pvt. Ltd., England, 1988.
3. Fordham Cooper, W., "Electrical Safety Engineering" Butterworth and Company, London, 1986.

Web Links and Video Lectures (E-Resources):

1. Safety in Construction : https://hits.digimat.in/nptel/courses/video/105102206/L19.html
2. Earthing / Grounding: https://www.youtube.com/watch?v=lnM3J5auQBk

Suggested Skill Activities:

1. Assess the risk regarding electrical safety for a particular work area and create the report.
2. Create the report for safe Guards of a particular work area regarding electrical safety.
3. Document and present the risk and safety measures of a particular work area.

Course Code:	24IS204	Course Title:	SAFETY IN PROCESS INDUSTRIES
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To provide knowledge on design features for a process industry and safety in the operation of various equipment in industry.
- To understand the various hazards and prevention in commissioning stage of industry.
- To recognise and identify the safe operation of equipment in process industry.
- To plan and trained for emergency planning in a process industry.
- To get fundamental knowledge on safe storage of chemicals.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Blended Mode of Learning
3. NPTEL and Other Videos
4. Smart Class Room
5. Flipped Class

UNIT I – SAFETY IN PROCESS DESIGN AND PRESSURE SYSTEM DESIGN	[9 hours]
Design process, conceptual design and detail design, assessment, inherently safer design- chemical reactor , types, batch reactors, reaction hazard evaluation, assessment, reactor safety, operating conditions, unit operations and equipments, utilities. Pressure system, pressure vessel design, standards and codes- pipe works and valves- heat exchangers- process machinery- over pressure protection, pressure relief devices and design, fire relief, vacuum and thermal relief, special situations, disposal- flare and vent systems- failures in pressure system.	
UNIT II – PLANT COMMISSIONING AND INSPECTION	**[9 hours]**

Commissioning phases and organization, pre-commissioning documents, process commissioning, commissioning problems, post commissioning documentation Plant inspection, pressure vessel, pressure piping system, non destructive testing, pressure testing, leak testing and monitoring- plant monitoring, performance monitoring, condition, vibration, corrosion, acoustic emission-pipe line inspection.	
UNIT III – PLANT OPERATIONS	**[9 hours]**
Operating discipline, operating procedure and inspection, format, emergency procedures- hand over and permit system- start up and shut down operation, refinery units- operation of fired heaters, driers, storage- operating activities and hazards- trip systems- exposure of personnel	
UNIT IV – PLANT MAINTENANCE, MODIFICATION AND EMERGENCY PLANNING	**[9 hours]**
Management of maintenance, hazards- preparation for maintenance, isolation, purging, cleaning, confined spaces, permit system- maintenance equipment- hot works- tank cleaning, repair and demolition- online repairs- maintenance of protective devices- modification of plant, problems- controls of modifications. Emergency planning, disaster planning, onsite emergency- offsite emergency, APELL	
UNIT V – STORAGES	**[9 hours]**
General consideration, petroleum product storages, storage tanks and vessel- storages layout- segregation, separating distance, secondary containment- venting and relief, atmospheric vent, pressure, vacuum valves, flame arrestors, fire relief- fire prevention and protection- LPG storages, pressure storages, layout, instrumentation, vapourizer, refrigerated storages- LNG storages, hydrogen storages, toxic storages, chlorine storages, ammonia storages, other chemical storages- underground storages- loading and unloading facilities- drum and cylinder storage- ware house, storage hazard assessment of LPG and LNG.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Show of safe design of equipment which are the essential to chemical industry and leads to design of entire process industries.	K2
CO2	Utilize the design of pressure systems	K3
CO3	Identify the problems and find innovative solutions while industries facing Problems in commissioning and maintenance stages.	K3
CO4	Develop the emergency planning for chemical industry problems	K3

CO5	Demonstrate safe storage systems.	K2

COs and POs Mapping:

COs	POs		
	1	**2**	**3**
CO1	-	-	-
CO2	-	-	2
CO3	-	-	-
CO4	-	3	-
CO5	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	**2**	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).

- All the fifteen questions have to be answered.

Text Books:

1. “Accident Prevention Manual for Industrial Operations” NSC, Chicago, 1982.
2. “Quantitative Risk Assessment in Chemical Process Industries” American Institute of Chemical Industries, Centre for Chemical Process safety.

Reference Books:

1. Carbide of Calcium Rules, Government of India.
2. Fawcett, H.h. and Wood, “Safety and Accident Prevention in Chemical Operations” Wiley inters, Second Edition.
3. GREEN, A.E., “High Risk Safety Technology”, John Wiley and Sons,. 1984.
4. Lees, F.P. “Loss Prevention in Process Industries” Butterworths and Company, 1996
5. Petroleum Act and Rules, Government of India.

Web Links and Video Lectures (E-Resources):

1. Safety Consideration in the Process of Industries : https://www.youtube.com/watch?v=OjHBgv7a1GU

2 Industrial Safety : https://www.youtube.com/watch?v=z8WuzF0Eeuk

Suggested Skill Activities:

1. Assess the risk regarding safety for a particular work area and create the report.
2. Create the report for safe Guards of a particular work area regarding safety.
3. Document and present the risk and safety measures of a particular work area.

Course Code:	24IS231	Course Title:	**Industrial Safety and Simulation Laboratory**
Credits:	**1**	**L – T – P**	**0-0-2**

Course objectives:

To impart knowledge on the

- To provide opportunity to operate the equipment to acquire practical knowledge.
- To know the various PPEs and software.
- To carry out experiments to find out the environmental parameters.
- To assess the impact of sensitivity of chemicals on explosivity.
- To run the software to assess the consequence effects of major accidents.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

2. Experiential Learning

Laboratory Component: **[30 hours]**

Any 12 experiments have to be completed from the following list of experiments.

S.No.	Name of the Experiment
1	Study of Safety Software
2	Study of Emergency Kits ,First – aid, road safety signs and signals.
3	Measurement of sound pressure level in dB for Impact, continuous and intermittent sources at various networks, peak and average values.
4	Burst strength test of packaging materials like paper bags, corrugated cartoons, wood etc.
5	Auto ignition temperature test
6	Impact test on Explosive materials like gun powder, white powder, amerce composition etc.
7	Friction test on Explosive materials like gun powder, white powder, amerce composition etc.
8	Exhaust gas measurement and analysis
9	Environmental parameter measurement (dbt, wbt etc)
10	Static charge testing on plastic, rubber, ferrous and non-ferrous materials
11	Illumination testing - by lux meter and photo meter

12	Study of personal protective equipment
13	Study of Fire extinguishers and its operation.

Course outcomes:

On completion of the course, the student will have the ability to

CO1	Compare the various equipments to bring out the safety environment in the industry.	K2
CO2	Make use of various measure on particulate matter and assess the impact of air pollution.	K3
CO3	Construct experiments to find out various environmental parameters.	K3
CO4	Develop personal protective equipment in-dependently.	K3
CO5	Demonstrate the various problems with the use of software and hence to predict the real situations on major accidents.	K2

COs and POs Mapping:

COs	**POs**					
	1	**2**	**3**	**4**	**5**	**6**
CO1	-	2	-	-	-	-
CO2	-	-	3	-	-	-
CO3	-	-	-	3	-	-
CO4	-	-	-	-	3	-
CO5	-	-	-	-	-	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	60
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Lab Exam	100	15	40	40

Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

Course Code:	24IS251	Course Title:	Technical Seminar - I
Credits:	**1**	**L – T – P**	**0-0-2**

Course objectives:

To impart knowledge on the

- To enrich the communication skills of the student through presentation of topics in recent advances in Industrial safety engineering/technology

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Experiential Learning

[30hours]

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Develop skills to read, write, comprehend and present research papers.	K3
CO2	Demonstrate on recent areas of research in industrial safety engineering in two cycles.	K2
CO3	Explain the Depth of understanding, coverage, quality of presentation material (PPT/OHP)	K2
CO4	Develop the Communication skill.	K3
CO5	Explain the advances in Industrial safety engineering/technology	K2

COs and POs Mapping:

COs	POs		
	1	2	3
CO1	3		3
CO2			
CO3			
CO4	2		2
CO5	2		2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	60
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Lab Exam	100	15	40	40
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

PROFESSIONAL ELECTIVES SEMESTER I, (ELECTIVE)

S. No.	Course Code	Course Title	Course Category	L	T	P	C
1.	24IS111	Plant Layout and Material Handling	PEC	3	0	0	3
2.	24IS112	Work Study and Ergonomics	PEC	3	0	0	3
3.	24IS113	Human Factors in Engineering	PEC	3	0	0	3
4.	24IS114	Maintainability Engineering	PEC	3	0	0	3
5.	24IS115	Optimization Techniques	PEC	3	0	0	3

Course Code:	**24IS111**	**Course Title:**	**Plant Layout And Material Handling**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To provide provided with the knowledge of the process of analyzing and developing information to produce a plant layout based on the locations and working conditions.
- To educate the students about the basic things of work conditions which includes ventilation, comfort, lighting and its effect based on various nature of work.
- To provide knowledge on effective and safe layout design of an industry.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. NPTEL and Other Videos
3. Smart Class Room
4. Field visit
5. Project based learning
6. Industrial Visit

UNIT I – Plant Location	**[9 hours]**
Selection of plant locations, territorial parameters, considerations of land, water, electricity, location for waste treatment and disposal, further expansions Safe location of chemical storages, LPG, LNG, CNG, acetylene, ammonia, chlorine, explosives and propellants	
UNIT II – Plant Layout	**[9 hours]**
Safe layout, equipment layout, safety system, fire hydrant locations, fire service rooms, facilities for safe effluent disposal and treatment tanks, site considerations, approach roads, plant railway lines, security towers. Safe layout for process industries, engineering industry, construction sites, pharmaceuticals, pesticides, fertilizers, refineries, food processing, nuclear power stations, thermal power stations, metal powders manufacturing, fireworks and match works.	
UNIT III – Working Conditions	**[9 hours]**
Principles of good ventilation, purpose, physiological and comfort level types, local and exhaust ventilation, hood and duct design, air conditioning, ventilation standards, application. Purpose of lighting, types, advantages of good illumination, glare and its effect, lighting requirements for various work, standards- Housekeeping, principles of 5S.	

UNIT IV- Manual Material Handling and Lifting Tackles	[9 hours]
Preventing common injuries, lifting by hand, team lifting and carrying, handling specific shape machines and other heavy objects – accessories for manual handling, hand tools, jacks, hand trucks, dollies and wheel barrows – storage of specific materials - problems with hazardous materials, liquids, solids – storage and handling of cryogenic liquids - shipping and receiving, stock picking, dock boards, machine and tools, steel strapping and sacking, glass and nails, pitch and glue, boxes and cartons and car loading – personal protection – ergonomic considerations. Fiber rope, types, strength and working load inspection, rope in use, rope in storage - wire rope, construction, design factors, deterioration causes, sheaves and drums, lubrication, overloading, rope fitting, inspection and replacement – slings, types, method of attachment, rated capacities, alloy chain slings, hooks and attachment, inspection	
UNIT V- Mechanical Material Handling	**[9 hours]**
Hoisting apparatus, types - cranes, types, design and construction, guards and limit devices, signals, operating rules, maintenance safety rules, inspection and inspection checklist – conveyors, precautions, types, applications. Powered industrial trucks, requirements, operating principles, operators selection and training and performance test, inspection and maintenance, electric trucks, gasoline operated trucks, LPG trucks –power elevators, types of drives, hoist way and machine room emergency procedure, requirements for the handicapped, types- Escalator, safety devices and brakes, moving walks – man lifts, construction, brakes, inspection.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Classify equipment requirements for a specific process and for various locations and working conditions.	K2
CO2	Develop an efficient material handling system.	K3
CO3	Identify the difficulties during the design and implementation of the plant layout.	K3
CO4	Plan about material handling requirements and methods	K3
CO5	Demonstrate the inspection and maintenance techniques.	K2

COs and POs Mapping:

COs	POs		
	1	2	3
CO1	2	-	-
CO2	-	-	-
CO3	2	-	-
CO4	-	-	-
CO5	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	60	100	40
	CIE – II	100			
	Skill Assessment – I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. ”Accident prevention manual for industrial operations” N.S.C., Chicago, 1982.
2. Alexandrov. M.P. ”Material handling equipment” Mir Publishers, Moscow, 1981

Reference Books:

1. APPLE M. JAMES “Plant layout and material handling”, 3rd edition, John Wiley and sons.
2. “Encyclopedia of occupational safety and health”, ILO Publication, 1985

Web Links and Video Lectures (E-Resources):

1. Plant Location: https://nptel.ac.in/courses/112107292
2. Plant Layout: https://archive.nptel.ac.in/courses/112/107/112107292/
3. Manual Material Handling and Lifting Tackles: https://archive.nptel.ac.in/courses/112/107/112107142/
4. Mechanical Material Handling: https://archive.nptel.ac.in/courses/112/107/112107143/

Suggested Skill Activities:

1. Which of the following is an important consideration in plant layout design?
2. Which of the following layout manufactures part in small or medium batches?
3. Which of the following material handling device is used in process layouts?
4. Which of the following represent a versatile means of handling different load configurations?
5. Which of the following layout produces identical products?
6. Inventories are usually kept stored on the floor near to the next scheduled machines.
7. Which of the following is carried out using product layout?

8. Which of the following system is typically characterized as fixed routes and flow rates?
9. Should an employer only consider lifting and lowering?
10. Is my employer required to provide training for manual handling?

Course Code:	24IS112	Course Title:	Work Study and Ergonomics
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To study the applications of ergonomic principles and physiology of workers
- To know the concepts of personal protective equipment and its usages
- To create the knowledge in process and equipment design in safety aspects

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. NPTEL and Other Videos
3. Smart Class Room
4. Field visit
5. Project based learning
6. Industrial Visit

UNIT I – Work Study	[9 hours]
Study of operations – work content – work procedure – breakdown – human factors – safety and method study – methods and movements at the workplace – substitution with latest devices – robotic concepts – applications in hazardous workplaces – productivity, quality and safety (PQS).	
UNIT II – Ergonomics	**[9 hours]**
Definition – applications of ergonomic principles in the shop floor – work benches – seating arrangements – layout of electrical panels- switch gears – principles of motion economy – location of controls – display locations – machine foundations – work platforms, fatigue, physical and mental strain – incidents of accident – physiology of workers.	
UNIT III – Personal Protection	**[9 hours]**
Concepts of personal protective equipment – types – selection of PPE – invisible protective barriers procurement, storage, inspection and testing – quality – standards – ergonomic considerations in personal protective equipment design.	
UNIT IV– Process and Equipment Design	**[9 hours]**

Process design – equipment – instrument – selection – concept modules – various machine tools – inbuilt safety – machine layout-machine guarding-safety devices and methods – selection, inspection, maintenance and safe usage – statutory provisions, operator training and supervision – hazards and prevention.

UNIT V- Man Machine Systems	**[9 hours]**
Job and personal risk factors – standards-selection and training-body size and posture-body dimension (static/dynamic) – adjustment range – penalties – guide lines for safe design and postures – evaluation and methods of reducing posture strain. Man-machine interface-controls -types of control-identification and selection-types of displays compatibility and stereotypes of important operations-fatigue and vigilance-measurement characteristics and strategies for enhanced performance.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Explain the work procedure in hazardous.	K2
CO2	Choose the applications in hazardous.	K3
CO3	Identify the Process of Personal protective System.	K3
CO4	Make use of human factors in design of Personal protective equipment.	K3
CO5	Explain the risk factors, guide lines for safe design of man machine systems considering human factors	K2

COs and POs Mapping:

COs	**POs**		
	1	**2**	**3**
CO1	**-**	**2**	**2**
CO2	**2**	**-**	**-**
CO3	**-**	**2**	**2**
CO4	**2**	**-**	**2**
CO5	**-**	**2**	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped,
Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	60	100	40
	CIE – II	100			
	Skill Assessment – I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. "Accident prevention manual for industrial operations" N.S.C., Chicago, 1982.
2. E.J.Mc Cormick and M.S.Sanders "Human Factors in Engineering and Design", TMH, New Delhi, 1982.

Reference Books:

1. "Work Study", National Productivity Council, New Delhi, 1995.
2. Hunter, Gomas, "Engineering Design for Safety", Mc Graw Hill Inc., 1992.
3. Introduction to Work Study", ILO, Oxford and IBH Publishing company, Bombay, 1991".
4. Mundel, Motion and Time Study, 6th Edition, Allied Publishers, Madras, 1989.
5. W.Benjamin Neibal Motion and Time Study, 9^{th} Edition 1993.

Web Links and Video Lectures (E-Resources):

1. Ergonomics: https://nptel.ac.in/courses/107103004
2. Personal Protection: https://archive.nptel.ac.in/courses/112/104/112104222/
3. Process and Equipment Design: https://archive.nptel.ac.in/courses/107/103/107103004/
4. Man Machine Systems: https://archive.nptel.ac.in/courses/112/107/112107249/

Suggested Skill Activities:

1. Have any shop workers been previously diagnosed with any of the following CTD's: Carpal tunnel, Tendonitis, Tenosynovitis, De Quervain's disease, Trigger Finger, White finger, Hand Arm Segmental Vibration Syndrome, Muscle strains, or Back ailments?
2. Have there been any worker complaints concerning ergonomic issues?
3. Do employees perform high repetition tasks? (100 reps/hour to 2000 per/day)
4. Do the employee's routine tasks require repeated heavy lifting? (>20 lbs) or occasional heavy lifting (>50 lbs)
5. Are employees using awkwardly designed tools, which cause the worker to operate the tool outside of a neutral position for an extended period of time? (> 1 hour)
6. Do employees perform tasks with an awkward head or neck position for an extended period of time? (1 to 3 hours)
7. Do employees perform tasks that require awkward back angles to be held for extended periods of time (2 to 3 hours)? i.e…hunching, bending, or squatting
8. Do employees perform tasks with an awkward elbow angle for an extended period of time (1 to 3 hours) or with extreme force application?
9. Do employees perform tasks with an awkward elbow abduction angle for an extended period of time (1 to 3 hours) or with extreme force application?
10. Do employees perform tasks with an extreme reaching distance for an extended period of time (1 to 3 hours) or with extreme force application?

Course Code:	**24IS113**	**Course Title:**	**Human Factors In Engineering**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- Studying the work procedure and understanding the relationships between the workers and working environments.
- To study the applications of ergonomic principles and physiology of workers.
- To know the concepts of personal protective equipment and its usages.
- To create the knowledge in process and equipment design in safety aspects.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. NPTEL and Other Videos
3. Smart Class Room
4. Field visit
5. Project based learning
6. Industrial Visit

UNIT I – Ergonomics and Anatomy	**[9 hours]**
Introduction to ergonomics: The focus of ergonomics, ergonomics and its areas of application in the work system, a brief history of ergonomics, attempts to humanize work, modern ergonomics, future directions for ergonomics Anatomy, Posture and Body Mechanics: Some basic body mechanics, anatomy of the sprine and pelvis related to posture, posture stability and posture adaptation, low back pain, risk factors for musculoskeletal disorders in the workplace, behavioural aspects of posture, effectiveness and cost effectiveness, research directions	
UNIT II – Human Behavior	**[9 hours]**
Individual differences, Factors contributing to personality, Fitting the man to the job, Influence of difference on safety, Method of measuring characteristics, Accident Proneness. Motivation, Complexity of Motivation, Job satisfaction. Management theories of motivation, Job enrichment theory. Frustration	

and Conflicts, Reaction to frustration, Emotion and Frustration. Attitudes- Determination of attitudes, Changing attitudes Learning, Principles of Learning, Forgetting, Motivational requirements.	
UNIT III – Anthropometry And Work Design For Standing and Seated Works	**[9 hours]**
Designing for a population of users, percentile, sources of human variability, anthropometry and its uses in ergonomics, principals of applied anthropometry in ergonomics, application of anthropometry in design, design for everyone, anthropometry and personal space, effectiveness and cost effectiveness. Fundamental aspects of standing and sitting, an ergonomics approach to work station design, design for standing workers, design for seated workers, work surface design, visual display units, guidelines for design of static work, effectiveness and cost effectiveness, research directions.	
UNIT IV– Man - Machine System And Repetitive Works and Manual Handling Task	**[9 hours]**
Applications of human factors engineering, man as a sensor, man as information processor, man as controller – Man vs Machine. Ergonomics interventions in Repetitive works, handle design, key board design- measures for preventing in work related musculoskeletal disorders (WMSDs), reduction and controlling, training anatomy and biomechanics of manual handling, prevention of manual handling injuries in the work place, design of manual handling tasks, carrying, postural stability.	
UNIT V- Human Skill and Performance and Display, Controls And Virtual Environments	**[9 hours]**
A general information-processing model of the users, cognitive system, problem solving, effectiveness. Principles for the design of visual displays- auditory displays- design of controls- combining displays and controls- virtual (synthetic) environments, research issues.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Explain the knowledge in work procedure and applications in hazardous workplaces.	K2
CO2	Develop their own safety devices and equipment to reduce the accidents possibilities.	K3
CO3	Organize human factors in design of Personal protective equipment.	K3
CO4	Identify the risk factors, guide lines for safe design of man machine systems considering human factors.	K3
CO5	Explain the knowledge in Display, Controls And Virtual Environments	K2

COs and POs Mapping:

COs	POs		
	1	2	3
CO1	-	-	-
CO2	-	-	3
CO3	2	-	-
CO4	-	-	-
CO5	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	60	100	40
	CIE – II	100			
	Skill Assessment – I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Ergonomic design for organizational effectiveness, Michael O'Neill 1st Edition 1998.
2. Introduction to Ergonomics, R.S. Bridger, Taylor and Francis 3rd Edition 2008.

Reference Books:

1. Human factors in engineering and design, MARK S.SANDERS 1992.
2. The Ergonomics manual, Dan Mc Leod, Philip Jacobs and Nancy Larson

Web Links and Video Lectures (E-Resources):

1. Ergonomics and Anatomy**:** https://archive.nptel.ac.in/courses/112/104/112104222/
2. Anthropometry**:** https://archive.nptel.ac.in/courses/107/103/107103004/
3. Man Machine Systems**:** https://archive.nptel.ac.in/courses/112/107/112107249/
4. Human Skill Performance and Display**:** https://archive.nptel.ac.in/courses/107/103/107103004/

Suggested Skill Activities:

1. What is the study of physical dimensions and abilities of the human body called?
2. Why is training an important element in the ergonomics process?
3. What are the benefits of ergonomics?
4. Why is anthropometry important in various fields such as ergonomics, nutrition assessment, and healthcare?
5. How are anthropometric measurements used to assess growth and nutritional status?
6. What are the different methods used in anthropometry to measure body dimensions accurately?
7. What are the Characteristics of a Man-Machine System?

Course Code:	24IS114	Course Title:	Maintainability Engineering
Credits:	3	L – T – P	3-0-0

Course objectives:

To impart knowledge on the

- To enable the students know about the basic concept of maintainability engineering.
- To impart knowledge on various maintenance models, maintenance policies and replacement model of various equipment.
- To provide knowledge on logistics for the effective utilization of existing resources and facilities availability of spares parts.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. NPTEL and Other Videos
3. Smart Class Room
4. Field visit
5. Project based learning
6. Industrial Visit

UNIT I – Maintenance Concept	[6 hours]
Maintenance definition – Need for maintenance – Maintenance objectives and challenges – Tero technology – Maintenance costs - Scope of maintenance department.	
UNIT II – Maintenance Models	**[12 hours]**
Proactive/Reactive maintenance – Imperfect maintenance – Maintenance policies – PM versus b/d maintenance – PM schedule and product characteristics – Inspection models-Optimizing profit/downtime – Replacement decisions.	
UNIT III – Maintenance Logistics	**[11 hours]**
Human factors – Maintenance staffing: Learning curves – Simulation – Maintenance resource requirements: Optimal size of service facility – Optimal repair effort – Maintenance planning and scheduling – Spare parts planning.	

UNIT IV – Maintenance Quality	[8 hours]
Maintenance excellence – Five Zero concept –FMECA –Root cause analysis – System effectiveness – Design for maintainability – Reliability Centered Maintenance.	
UNIT V- Total Productive Maintenance	**[8 hours]**
TPM features – Chronic and sporadic losses – Equipment defects – Six major losses – Overall Equipment Effectiveness – TPM pillars – Autonomous maintenance – TPM implementation	

Course outcomes: On completion of the course, the student will have the ability to:

CO1	Explain the various terms and terminologies about the maintenance concept.	K2
CO2	Identify the various maintenance models in various services.	K3
CO3	Identify the logistics meant for the execution of various services.	K3
CO4	Identify the various terms and terminologies about the maintenance quality.	K3
CO5	Demonstrate their knowledge in areas where the down time, over replacement are existing and could lead to improve the productivity and quality.	K2

COs and POs Mapping:

COs	POs		
	1	**2**	**3**
CO1	-	-	-
CO2	-	-	**3**
CO3	-	**2**	-
CO4	-	-	3
CO5	-	**2**	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped,
Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	60	100	40
	CIE – II	100			
	Skill Assessment – I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Andrew K.S.Jardine & Albert H.C.Tsang, "Maintenance, Replacement and Reliability", Taylor and Francis, 2006.

Reference Books:

1. Bikas Badhury & S.K.Basu, "Tero Technology: Reliability Engineering and Maintenance Management", Asian Books, 2003.

2. Seichi Nakajima, "Total Productive Maintenance", Productivity Press, 1993.

Web Links and Video Lectures (E-Resources):

1. Maintenance Models**:** https://nptel.ac.in/courses/112107292
2. Maintenance Logistics: https://nptel.ac.in/courses/112107143
3. Total Productive Maintenance: https://nptel.ac.in/courses/112107142

Suggested Skill Activities:

1. What is the purpose of a squirrel cage?
2. What is the primary maintenance model currently employed by the organization?
3. How is the effectiveness of the current maintenance model measured?
4. Are there any specific challenges or limitations associated with the current maintenance model?
5. How does the current maintenance model align with industry best practices and standards?
6. What is the primary goal of maintenance logistics in a supply chain?
7. Did the maintenance team respond promptly to your requests or issues?
8. Were there any recurring maintenance problems that were not adequately addressed?
9. Were there any unexpected delays or disruptions in the maintenance work? If yes, how were they handled?
10. What does routine preventive maintenance tasks in Autonomous Maintenance (AM) include?
11. What is the role of autonomous maintenance in Total Productive Maintenance (TPM)?

Course Code:	**24IS115**	**Course Title:**	**Optimization Techniques**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To understand the non-linear problem.
- To know about multi-objective problem.
- To create awareness of Meta heuristic algorithms.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. NPTEL and Other Videos
3. Smart Class Room
4. Field visit
5. Project based learning
6. Industrial Visit

UNIT I – Introduction	**[5 hours]**
Classification of optimization problems, concepts of design vector, Design constraints, constrains surface, objective function surface and multi-level optimization, parametric linear programming.	
UNIT II – Decision Analysis	**[10 hours]**
Decision Trees, Utility theory, Game theory, Multi Objective Optimization, MCDM- Goal Programming, Analytic Hierarchy process, ANP	
UNIT III – Non-Linear Optimization	**[15 hours]**
Unconstrained one variable and multi variable optimization, KKT Conditions, Constrained optimization, Quadratic programming, Convex programming, Separable programming, Geometric programming, Non-Convex programming	
UNIT IV– Non-Traditional Optimization -1	**[10 hours]**

Classes P and NP, Polynomial time reductions, Introduction to NP- Hard problems, Overview of Genetic algorithms, Simulated Annealing, neural network based optimization.	
UNIT V– Non-Traditional Optimization -2	**[5 hours]**
Particle Swarm optimization, Ant Colony Optimization, Optimization of Fuzzy Systems.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Explain the familiarity with some of the well-known optimization techniques and their applicability in a real setting.	K2
CO2	Utilize the process of decision making.	K3
CO3	Develop awareness on the usefulness and limitation of optimization.	K3
CO4	Develop the concepts of polynomial time and nondeterministic polynomial time	K3
CO5	Explain the concepts of Optimization techniques.	K2

COs and POs Mapping:

COs	**POs**		
	1	**2**	**3**
CO1		**2**	
CO2	**2**		
CO3			2
CO4		**2**	
CO5		**2**	

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	60	100	40
	CIE – II	100			
	Skill Assessment – I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Christos H. Papadimitriou, Kenneth Steiglitz, Combinatorial Optimization, PHI 2006

2. Fredrick S.Hillier and G.J.Liberman, "Introduction to Operations Research", McGraw Hill Inc. 1995.

Reference Books:

1. Kalymanoy Deb, “Optimization for Engineering Design”,PHI,2003

2. Ravindran – Phillips –Solberg, “Operations Research – Principles and Practice”, John Wiley India, 2006.

3. Singiresu S.Rao, “Engineering optimization – Theory and practices”, John Wiley and Sons, 1996.

Web Links and Video Lectures (E-Resources):

1. Decision Analysis**:** https://archive.nptel.ac.in/courses/110/104/110104094/
2. Geometric Programming**:** https://archive.nptel.ac.in/courses/111/107/111107104/
3. Genetic algorithms**:** https://nptel.ac.in/courses/112105235
4. Particle Swarm optimization**:** https://nptel.ac.in/courses/112103301

Suggested Skill Activities:

1. How do artificial ants and real ants differ in the context of ACO?
2. Discuss the Role of Constraints in Optimization Problems
3. Describe Linear Programming and its Applications
4. Provide an Overview of Evolutionary Algorithms for Optimization
5. What are the key components of a PSO algorithm?
6. What are some common variations or enhancements to traditional PSO algorithms
7. What are some applications where artificial ants and local search algorithms are commonly used for optimization tasks?
8. Describe a common approach employed in Derivative-Free Optimization when applicable.
9. What are the core steps in a typical genetic algorithm cycle?
10. How does optimization contribute to the interpretability and accuracy of fuzzy systems?

PROFESSIONAL ELECTIVES SEMESTER II, (ELECTIVE II & III)

S. No.	Course Code	Course Title	Course Category	L	T	P	C
1.	24IS211	Transport Safety	PEC	3	0	0	3
2.	24IS212	Fireworks Safety	PEC	3	0	0	3
3.	24IS213	Safety in Construction	PEC	3	0	0	3
4.	24IS214	Nuclear Engineering and Safety	PEC	3	0	0	3
5.	24IS215	Safety in Textile Industry	PEC	3	0	0	3
6.	24IS216	Safety in Mines	PEC	3	0	0	3
7.	24IS217	Dock Safety	PEC	3	0	0	3

Course Code:	24IS211	Course Title:	Transport Safety
Credits:	3	L – T – P	3-0-0

Course objectives:

To impart knowledge on the

- To provide the students about the various activities/steps to be followed in safe handling the hazardous goods transportation from one location to another location.
- To educate the reasons for the road accident and the roles and responsibilities of a safe Driver and the training needs of the driver.
- To inculcate the culture of safe driving and fuel conservation along with knowing of basic traffic symbols followed throughout the highways.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. NPTEL and Other Videos
3. Smart Class Room
4. Field visit
5. Project based learning
6. Industrial Visit

UNIT I –Transportation of Hazardous Goods	[9 hours]
Transport emergency card (TREM) – driver training-parking of tankers on the highways-speed of the vehicle – warning symbols – design of the tanker lorries -static electricity-responsibilities of driver – inspection and maintenance of vehicles-check list- loading and decanting procedures – communication.	
UNIT II – Road Transport	**[9 hours]**
Introduction – factors for improving safety on roads – causes of accidents due to drivers and pedestrians-design, selection, operation and maintenance of motor trucks-preventive maintenance check lists-motor vehicles act – motor vehicle insurance and surveys.	
UNIT III – Driver and Safety	**[9 hours]**
Driver safety programme – selection of drivers – driver training-tacho-graph-driving test-driver's responsibility-accident reporting and investigation procedures-fleet accident frequency-safe driving	

incentives-slogans in driver cabin-motor vehicle transport workers act- driver relaxation and rest pauses – speed and fuel conservation – emergency planning and Haz mat codes	
UNIT IV- Road Safety	**[9 hours]**
Road alignment and gradient-reconnaissance-ruling gradient-maximum rise per k.m.- factors influencing alignment like tractive resistance, tractive force, direct alignment, vertical curves-breaking characteristics of vehicle-skidding-restriction of speeds-significance of speeds- Pavement conditions – Sight distance – Safety at intersections – Traffic control lines and guide posts-guard rails and barriers – street lighting and illumination overloading-concentration of driver. Plant railway: Clearance-track-warning methods-loading and unloading-moving cars-safety practices.	
UNIT V- Shop Floor and Repair Shop Safety	**[9 hours]**
Transport precautions-safety on manual, mechanical handling equipment operations-safe driving movement of cranes-conveyors etc., servicing and maintenance equipment-grease rack operation wash rack operation-battery charging-gasoline handling-other safe practices-off the road motorized equipment.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Identify the various safety activities undertaken in transporting of hazardous goods	K3
CO2	Demonstrate the operation and maintenance of motor trucks.	K2
CO3	Explain the various safety programs for drivers	K2
CO4	Explain the various symbols which are specific to the road safety and able to reduce the accidents occurred in the roads.	K2
CO5	Apply for the safe transportation of hazardous goods, creating TREM card and safe loading and unloading procedure.	K3

COs and POs Mapping:

COs	**POs**		
	1	**2**	**3**
CO1	**2**	-	**2**
CO2	**-**	-	**2**
CO3	**2**	-	-
CO4	**2**	-	-
CO5	**-**	-	**2**

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped,
Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	60	100	40
	CIE – II	100			
	Skill Assessment – I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. "Accident prevention manual for industrial operations" N.S.C., Chicago, 1982.

2. Babkov, V.F., "Road Conditions and Traffic Safety" MIR Publications, Moscow, 1986. **Reference Books:**

3. K.W.Ogden, "Safer Roads – A guide to Road Safety Engineering"

4. Kadiyali, "Traffic Engineering and Transport Planning" Khanna Publishers, New Delhi, 1983.

5. Motor Vehicles Act, 1988, Government of India.

6. Pasricha, "Road Safety guide for drivers of heavy vehicle" Nasha Publications, Mumbai, 1999.

7. Popkes, C.A. "Traffic Control and Road Accident Prevention" Chapman and Hall Limited, 1986.

Web Links and Video Lectures (E-Resources):

1. Hazardous Goods**:** https://archive.nptel.ac.in/courses/105/106/105106056/
2. Road Transport**:** https://nptel.ac.in/courses/105101087
3. Driver and Safety**:** https://onlinecourses.nptel.ac.in/noc20_mg43/preview
4. Road Safety**:** https://archive.nptel.ac.in/courses/105/105/105105215/

Suggested Skill Activities:

1. What should you do when encountering an aggressive driver on the road?
2. What transportation services are offered and who receives them?
3. What were the barriers and challenges that affected implementation of transportation activities? Who facilitated the implementation?
4. How did community members or clients perceive the program?
5. Did community members or clients report any changes in their use of transportation? Were there changes in their knowledge of what transportation services are available?
6. What programmatic or policy changes have occurred in state or local jurisdictions as a result of the transportation program?
7. Has the program helped to improve access to healthcare, food, physical activity, or other services in the target population?

Course Code:	24IS212	Course Title:	Fireworks Safety
Credits:	3	L – T – P	3-0-0

Course objectives: To impart knowledge on the ● To study the properties of pyrotechnic chemicals ● To know about the hazards in the manufacture of various fireworks ● To understand the hazards in fireworks industries related processes ● To study the effects of static electricity ● To learn pyrotechnic material handling, transportation and user safety
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. NPTEL and Other Videos 3. Smart Class Room 4. Field visit 5. Project based learning 6. Industrial Visit

UNIT I – Properties of Fireworks Chemicals	**[9 hours]**
Fire properties – potassium nitrate (KN03), potassium chlorate (KCl03), barium nitrate (BaNO3), calcium nitrate (CaNO3), Sulphur (S), Phosphorous (P), antimony (Sb), Pyro Aluminum (A1) powder-Reactions-metal powders, Borax, ammonia (NH3) – Strontium Nitrate, Sodium Nitrate, Potassium per chloride. Fire and explosion, impact and friction sensitivity.	
UNIT II – Static Charge and Dust	**[9 hours]**
Concept-prevention-earthing-copper plates-dress materials-static charge meter lightning, Causes effects-hazards in fireworks factories-lightning arrestor: concept-installation-earth pit-maintenance resistance-legal requirements-case studies. Dust: size-desirable, non-respirable-biological barriers-hazards-personal protective equipment pollution prevention.	
UNIT III – Process Safety	**[8 hours]**
Safe-quantity, mixing-filling-fuse cutting – fuse fixing – finishing – drying at various stages-packing storage- hand tools-materials, layout: building-distances- factories act – explosive act and rules – fire prevention and control – risk related fireworks industries.	

UNIT IV– Material Handling and Transportation	[10 hours]
Manual handling – wheel barrows-trucks-bullock carts-cycles-automobiles-fuse handling – paper caps handling-nitric acid handling in snake eggs manufacture-handling the mix in this factory-material movement-godown-waste pit. Packing-magazine-design of vehicles for explosive transports loading into automobiles-transport restrictions-case studies-overhead power lines-driver habits-intermediate parking-fire extinguishers loose chemicals handling and transport.	
UNIT V- Waste Control and User Safety	**[9 hours]**
Concepts of wastes – Wastes in fireworks-Disposal-Spillages-storage of residues. Consumer anxiety hazards in display-methods in other countries-fires, burns and scalds-sales outlets-restrictions-role of fire service.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Extend the knowledge of the chemical reactions of Fireworks chemicals.	K2
CO2	Develop safe manufacture of Fireworks items	K3
CO3	Make use of process safety in fireworks industries	K3
CO4	Apply safety measures against static electricity	K3
CO5	Demonstrate safe practices for handling of fireworks in factories, transport and at user end	K2

COs and POs Mapping:

COs	POs		
	1	**2**	**3**
CO1	-	3	-
CO2	-	-	-
CO3	-	-	2
CO4	-	-	-
CO5	-	-	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped,
Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	60	100	40
	CIE – II	100			
	Skill Assessment – I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. J.A.Purkiss, "Fireworks-Fire Safety Engineering"
2. Bill of once, "Fireworks Safety manual"
3. "Goeff, "Dust Explosion prevention, Part 1"

Reference Books:

1. "Seminar on explosives", Dept.of of explosives.
2. A.Chelladurai, "Fireworks related accidents"
3. A.Chelladurai, "Fireworks principles and practice"

4. A.Chelladurai, “History of the fireworks in India” Brock, “History of fireworks”

5. K.N.Ghosh, “Principles of fireworks”, H.Khatsuria, Sivakasi, 1987.

6. “Proceedings of National seminar on Fireworks Safety-1999”, MSEC-1999.

Web Links and Video Lectures (E-Resources):

1. Fire Properties: https://archive.nptel.ac.in/courses/105/102/105102176/
2. Lightning arrestor: https://www.digimat.in/nptel/courses/video/108106138/L23.html

Suggested Skill Activities:

1. What is inside a firework?
2. How should human factors be addressed in the PHA
3. Can you describe your experience in managing and optimizing material flow within a production facility?
4. Is the phenomenon described in the video an example of charging by induction?

Course Code:	24IS213	Course Title:	Safety in Construction
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To know causes of accidents related to construction activities and human factors associated with these accident
- To understand the construction regulations and quality assurance in construction
- To have the knowledge in hazards of construction and their prevention methods
- To know the working principles of various construction machinery
- To gain knowledge in health hazards and safety in demolition work

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. NPTEL and Other Videos
3. Smart Class Room
4. Field visit
5. Project based learning
6. Industrial Visit

UNIT I –Accidents Causes and Management Systems	[9 hours]
Problems impeding safety in construction industry- causes of fatal accidents, types and causes of accidents related to various construction activities, human factors associated with these accident – construction regulations, contractual clauses – Pre contract activates, preconstruction meeting - design aids for safe construction – permits to work – quality assurance in construction - compensation – Recording of accidents and safety measures – Education and training	
UNIT II – Hazards Of Construction and Prevention	**[9 hours]**
Excavations, basement and wide excavation, trenches, shafts – scaffolding , types, causes of accidents, scaffold inspection checklist – false work – erection of structural frame work, dismantling – tunneling – blasting, pre blast and post blast inspection – confined spaces – working on contaminated sites – work over water - road works – power plant constructions – construction of high rise buildings.	
UNIT III – Working at Heights	**[9 hours]**

Fall protection in construction OSHA 3146 – OSHA requirement for working at heights, Safe access and egress – safe use of ladders- Scaffoldings , requirement for safe work platforms, stairways, gangways and ramps – fall prevention and fall protection , safety belts, safety nets, fall arrestors, controlled access zones, safety monitoring systems – working on fragile roofs, work permit systems, height pass – accident case studies.	
UNIT IV– Construction Machinery	**[9 hours]**
Selection, operation, inspection and testing of hoisting cranes, mobile cranes, tower cranes, crane inspection checklist - builder's hoist, winches, chain pulley blocks – use of conveyors - concrete mixers, concrete vibrators – safety in earth moving equipment, excavators, dozers, loaders, dumpers, motor grader, concrete pumps, welding machines, use of portable electrical tools, drills, grinding tools, manual handling scaffolding, hoisting cranes – use of conveyors and mobile cranes – manual handling.	
UNIT V- Safety in Demolition Work	**[9 hours]**
Safety in demolition work, manual, mechanical, using explosive - keys to safe demolition, pre survey inspection, method statement, site supervision, safe clearance zone, health hazards from demolition - Indian standard - trusses, girders and beams – first aid – fire hazards and preventing methods interesting experiences at the construction site against the fire accidents.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Identify the problems impeding safety in construction industries.	K3
CO2	Identify types and causes of accidents, and designing aids for safe construction.	K3
CO3	Explain the hazards during construction of power plant, road works and high rise buildings.	K2
CO4	Choose the safety procedure for working at heights during construction.	K3
CO5	Explain the knowledge in selection, operation, inspection and testing of various construction machinery.	K2

COs and POs Mapping:

COs	**POs**		
	1	**2**	**3**
CO1	**2**	**-**	**-**
CO2	**-**	**-**	**-**
CO3	**-**	**3**	**-**
CO4	**-**	**-**	**-**
CO5	**-**	**-**	**2**

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final marks</th></tr>
<tr><td rowspan="4">Continuous Internal Examination (CIE)</td><td>CIE – I</td><td>100</td><td rowspan="2">60</td><td rowspan="4">100</td><td rowspan="4">40</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>Skill Assessment – I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td>End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>60</td><td>60</td><td>60</td></tr>
<tr><td colspan="5">Total</td><td>100</td></tr>
</table>

Assessment Pattern

<table>
<tr><th rowspan="2">Bloom's Category</th><th colspan="2">Continuous Assessment Tests</th><th rowspan="2">Terminal Examination</th></tr>
<tr><th>1</th><th>2</th></tr>
<tr><td>**Remember**</td><td>20</td><td>20</td><td>20</td></tr>
<tr><td>**Understand**</td><td>20</td><td>60</td><td>40</td></tr>
<tr><td>**Apply**</td><td>60</td><td>20</td><td>40</td></tr>
<tr><td>**Analyze**</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>**Evaluate**</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>**Create**</td><td>0</td><td>0</td><td>0</td></tr>
</table>

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Handbook of OSHA Construction safety and health charles D. Reese and James V. Edison
2. Hudson, R.,"Construction hazard and Safety Hand book, Butter Worth's, 1985.

Reference Books:

1. Jnathea D.Sime, "Safety in the Build Environment", London, 1988.

2. V.J.Davies and K.Thomasin “Construction Safety Hand Book” Thomas

Telford Ltd., London, 1990.

Web Links and Video Lectures (E-Resources):

1. Construction Machinery: https://archive.nptel.ac.in/courses/105/103/105103206/
2. Accidents Causes: https://archive.nptel.ac.in/courses/110/105/110105094/
3. Hazardous Goods: https://archive.nptel.ac.in/courses/105/106/105106056/

Suggested Skill Activities:

1. What have I done today to make my job site safer?
2. Are the employees working here today using the safety equipment that they have been provided?
3. Have I talked to any workers in the past two days to learn another thing about safety on this job?
4. Has anything changed on the job site since yesterday that introduces a new hazard that wasn't here yesterday?
5. Have I walked the job site today looking for unsafe behavior or equipment?
6. Have I talked to my boss lately about safety issues on this job site?
7. When was the last time I checked the OSHA regulations to make sure there are no new requirements that affect my employer's job sites?
8. Do employees feel that they can come to me about safety concerns so that they don't "drop a dime" on my employer with OSHA?
9. Have I done what I promised others that I would do to take care of potential safety hazards on this job site?

Course Code:	**24IS214**	**Course Title:**	**Nuclear Engineering and Safety**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To know about nuclear energy and fission fusion process.
- To gain knowledge in reactor types, design considerations and their operational problems.
- To know the current status of India in nuclear energy.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. NPTEL and Other Videos
3. Smart Class Room
4. Field visit
5. Project based learning
6. Industrial Visit

UNIT I – Introduction	**[9 hours]**
Binding energy – fission process – radio activity – alpha, beta and gamma rays radioactive decay – decay schemes – effects of radiation – neutron interaction – cross section – reaction rate – neutron moderation – multiplication – scattering – collision – fast fission – resonance escape – thermal utilization – criticality.	
UNIT II – Reactor Control	**[9 hours]**
Control requirements in design considerations – means of control – control and shut down rods – their operation and operational problems – control rod worth – control instrumentation and monitoring – online central data processing system.	
UNIT III – Reactor Types	**[9 hours]**
Boiling water reactors – radioactivity of steam system – direct cycle and dual cycle power plants pressurized water reactors and pressurized heavy water reactors – fast breeder reactors and their role in power generation in the Indian context – conversion and breeding – doubling time – liquid metal coolants – nuclear power plants in India.	
UNIT IV – Safety of Nuclear Reactors	**[9 hours]**

Safety design principles – engineered safety features – site related factors – safety related systems – heat transport systems – reactor control and protection system – fire protection system – quality assurance in
plant components – operational safety – safety regulation process – public awareness and emergency preparedness. Accident Case studies- Three Mile island and Chernobyl accident.

UNIT V- Radiation Control	**[9 hours]**
Radiation shielding – radiation dose – dose measurements – units of exposure – exposure limits – barriers for control of radioactivity release – control of radiation exposure to plant personnel – health physics surveillance – waste management and disposal practices – environmental releases.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Demonstrate nuclear fission and fusion process and their utilization.	K2
CO2	Explain the reactors Control requirements.	K2
CO3	Explain the types of reactors	K2
CO4	Explain the safety design principles and safety regulation process	K2
CO5	Explain the Control system requirements for radiation.	K2

COs and POs Mapping:

COs	**POs**		
	1	**2**	**3**
CO1	**2**		**2**
CO2	**2**		**2**
CO3	**2**		
CO4	**2**		2
CO5	**2**		2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped,
Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	60	100	40
	CIE – II	100			
	Skill Assessment – I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	40	30
Understand	80	60	70
Apply	0	0	0
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. "Loss prevention in the process Industries" Frank P.Lees Butterworth-Hein-UK, 1990.
2. Loffness, R.L., "Nuclear Power Plant" Van Nostrand Publications, 1979.

Reference Books:

1. M.M.E.L.Wakil, "Nuclear Energy Conversion", International Text Book Co.

2. R.L.Murray, “Introduction to Nuclear Engineering”, Prentice Hall.

3. Sri Ram K, “Basic Nuclear Engineering” Wiley Eastern Ltd., New Delhi, 1990.

4. Sterman U.S.’”Thermal and Nuclear Power Stations”, MIR Publications, Moscow, 1986.

Web Links and Video Lectures (E-Resources):

1. Reactor Control: https://archive.nptel.ac.in/courses/103/106/103106101/
2. Reactor Types: https://archive.nptel.ac.in/courses/103/106/103106117/
3. Safety of Nuclear Reactors: https://nptel.ac.in/courses/112107142
4. Radiation Control: https://archive.nptel.ac.in/courses/112/107/112107256/

Suggested Skill Activities:

1. What is nuclear engineering, and how do you see its role in the energy sector evolving in the future?
2. What is the role of a nuclear reactor coolant in a nuclear power plant?
3. Explain the types of Nuclear reactor?
4. What is the recertification process for the Waste Isolation Pilot Plant?
5. The radiation dose may be reduced by?

Course Code:	24IS215	Course Title:	Safety in Textile Industry
Credits:	3	L – T – P	3-0-0

Course objectives:

To impart knowledge on the

- To provide the student about the basic knowledge about the textile industries and its products by using various machineries.
- To enforce the knowledge on textile processing and various processes in making the yarn from cotton or synthetic fibres.
- To understand the various hazards of processing textile fibres by using various activities.
- To inculcate the knowledge on health and welfare activities specific to the Textile industries as per the Factories Act.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Blended Mode of Learning
3. NPTEL and Other Videos
4. Smart Class Room
5. Flipped Class

UNIT I – Introduction	**[9 hours]**
Introduction to process flow charts of i) short staple spinning, ii) long staple spinning, iii) viscose rayon and synthetic fibre, manufacturer, iv) spun and filament yarn to fabric manufacture, v) jute spinning and jute fabric manufacture-accident hazard, guarding of machinery and safety precautions in opening, carding, combing, drawing, flyer frames and ring frames, doubles, rotor spinning, winding, warping, softening/spinning specific to jute	
UNIT II – Textile Hazards I	**[9 hours]**
Accident hazards i)sizing processes- cooking vessels, transports of size, hazards due to steam ii) Loom shed – shuttle looms and shuttless looms iii) knitting machines iv) non-wovens.	

UNIT III – Textile Hazards II	[9 hours]
Scouring, bleaching, dyeing, punting, mechanical finishing operations and effluents in textile processes.	
UNIT IV – Health and Welfare	**[9 hours]**
Health hazards in textile industry related to dust, fly and noise generated-control measures-relevant occupational diseases, personal protective equipment-health and welfare measures specific to textile industry, Special precautions for specific hazardous work environments.	
UNIT V – Safety Status	**[9 hours]**
Relevant provision of factories act and rules and other statues applicable to textile industry – effluent treatment and waste disposal in textile industry.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Demonstrate the overall picture about the textile industries and its operations.	K2
CO2	Make use of the various concepts underlying in the processes involved in processing of fibres to yarn.	K3
CO3	Demonstrate various hazards in the textile industry and will be able to apply the control measures to mitigate the risk emanating from the hazard.	K2
CO4	Develop capability to handle the various health and welfare activities as per the Factories act and could implement statutory requirements.	K3
CO5	Apply his own arrangement in designing various methods meant for mitigating the risk and able to guide his subordinates in executing the work safely.	K3

COs and POs Mapping:

COs	POs		
	1	**2**	**3**
CO1	-	-	-
CO2	-	-	-
CO3	-	-	2
CO4	-	-	-

CO5	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final marks</th></tr>
<tr><td rowspan="5">Continuous Internal Examination (CIE)</td><td>CIE – I</td><td>100</td><td rowspan="2">50</td><td rowspan="5">100</td><td rowspan="5">40</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>MCQ</td><td>20</td><td>10</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td>End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>60</td><td>60</td><td>60</td></tr>
<tr><td colspan="5">Total</td><td>100</td></tr>
</table>

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. 100 Textile fires – analysis, findings and recommendations LPA
2. Groover and Henry DS, "Hand book of textile testing and quality control"

Reference Books:

1. "Quality tolerances for water for textile industry", BIS
2. Shenai, V.A. "A technology of textile processing", Vol.I, Textile Fibres
3. Little, A.H.,"Water supplies and the treatment and disposal of effluent"
4. "Safety in Textile Industry" Thane Belapur Industries Association, Mumbai.

Web Links and Video Lectures (E-Resources):

1. **Safety and Risk Analytics**

: http://ec2-52-32-140-135.us-west-2.compute.amazonaws.com/nptel/courses/video/110105160/L01.html

2. Industrial Safety Engineering :

http://www.digimat.in/nptel/courses/video/110105094/L54.html

Suggested Skill Activities:

1. Assess the risk for a particular work area and create the report.
2. Create the report for safe Guards of a particular work area.
3. Document and present the risk and safety measures of a particular work area.
4. Visit nearby textile industry and learn the safety measures.

Course Code:	**24IS216**	**Course Title:**	**Safety in Mines**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To provide in depth knowledge on Safety of mine s of various types.
- To study, know and understand about the types of mines and various risk involved in the mining operations.
- To get exposed to various types of accidents happened in mines and how to manage during accidents.
- To analyse the nature of mining activities and developing a safety system to reduce the risk and also to implement the Emergency preparedness in the working environment of mines and to plan for the disaster management.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Blended Mode of Learning
3. NPTEL and Other Videos
4. Smart Class Room
5. Flipped Class

UNIT I – Opencast Mines	**[9 hours]**
Causes and prevention of accident from: Heavy machinery, belt and bucket conveyors, drilling, hand tools-pneumatic systems, pumping, water, dust, electrical systems, fire prevention. Garage safety – accident reporting system-working condition-safe transportation – handling of explosives.	
UNIT II – Underground Mines	**[9 hours]**
Fall of roof and sides-effect of gases-fire and explosions-water flooding-warning sensors-gas detectors-occupational hazards-working conditions-winding and transportation	
UNIT III – Tunnelling	**[9 hours]**

Hazards from: ground collapse, inundation and collapse of tunnel face, falls from platforms and danger from falling bodies. Atmospheric pollution (gases and dusts) – trapping –transport-noise-electrical hazards-noise and vibration from: pneumatic tools and other machines – ventilation and lighting – personal protective equipment.	
UNIT IV – Risk Assessment	**[9 hours]**
Basic concepts of risk-reliability and hazard potential-elements of risk assessment – statistical methods – control charts-appraisal of advanced techniques-fault tree analysis-failure mode and effect analysis – quantitative structure-activity relationship analysis-fuzzy model for risk assessment.	
UNIT V – Accident Analysis and Management	**[9 hours]**
Accidents classification and analysis-fatal, serious, minor and reportable accidents – safety audits-recent development of safety engineering approaches for mines-frequency rates-accident occurrence- investigation-measures for improving safety in mines-cost of accident-emergency preparedness – disaster management.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Explain the various operations carried out in a dock.	K2
CO2	Identify the different acts and rules for safe dock operations.	K3
CO3	Make use of the operation of various types of material handling equipments.	K3
CO4	Choose to response at the time of emergency in a dock.	K3
CO5	Explain the various problems associated with the use of lifting equipments and in the storage yards.	K2

COs and POs Mapping:

COs	**POs**		
	1	**2**	**3**
CO1	-	3	-
CO2	-	-	-
CO3	-	2	-
CO4	-	-	-
CO5	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final marks</th></tr>
<tr><td rowspan="5">Continuous Internal Examination (CIE)</td><td>CIE – I</td><td>100</td><td rowspan="2">50</td><td rowspan="5">100</td><td rowspan="5">40</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>MCQ</td><td>20</td><td>10</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td>End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>60</td><td>60</td><td>60</td></tr>
<tr><td colspan="5">Total</td><td>100</td></tr>
</table>

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. DGMS Circulars-Ministry of Labour, Government of India press, OR Lovely Prakashan - DHANBAD, 2002.

Reference Books:

1. Kejiriwal, B.K. Safety in Mines, Gyan Prakashan, Dhanbad, 2001.
2. “Mine Health and Safety Management”, Michael Karmis ed., SME, Littleton, Co.2001.

Web Links and Video Lectures (E-Resources):

1. Industrial Safety Engineering : http://www.digimat.in/nptel/courses/video/110105094/L54.html
2. Port and Harbour Structures : http://www.digimat.in/nptel/courses/video/114106025/L14.html

Suggested Skill Activities:

1. Assess the risk for a particular work area and create the report.
2. Create the report for safe Guards of a particular work area.
3. Document and present the risk and safety measures of a particular work area.

Course Code:	24IS217	Course Title:	Dock Safety
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:
To impart knowledge on the • To understand safety legislation related to dock activities in India. • To understand the causes and effects of accidents during dock activities. • To know the various material handling equipment and lifting appliances in dock. • To know the safe working on board the ship and storage in the yards.
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. Blended Mode of Learning 3. NPTEL and Other Videos 4. Smart Class Room 5. Flipped Class

UNIT I – History of Safety Legislation	**[9 hours]**
History of dock safety statues in India-background of present dock safety statues- dock workers (safety, health and welfare) act 1986 and the rules and regulations framed there under, other statues like marking of heavy packages act 1951 and the rules framed there under - manufacture, storage and import of hazardous chemicals. Rules 1989 framed under the environment (protection) act, 1989 – few cases laws to interpret the terms used in the dock safety statues. Responsibility of different agencies for safety, health and welfare involved in dock work – responsibilities of port authorities – dock labour board – owner of ship master, agent of ship – owner of lifting appliances and loose gear etc. – employers of dock workers like stevedores – clearing and forwarding agents – competent persons and dock worker. Forums for promoting safety and health in ports – Safe Committees and Advisory Committees. Their functions, training of dock workers.	

UNIT II – Working On Board the Ship	**[9 hours]**
Types of cargo ships – working on board ships – Safety in handling of hatch beams – hatch covers including its marking, Mechanical operated hatch covers of different types and its safety features – safety in chipping and painting operations on board ships – safe means of accesses – safety in storage etc. – illumination of decks and in holds – hazards in working inside the hold of the ship and on decks – safety precautions needed – safety in use of transport equipment - internal combustible engines like fort-lift trucks-pay loaders etc. Working with electricity and electrical management – Storage – types, hazardous cargo	
UNIT III – Lifting Appliances	**[9 hours]**
Different types of lifting appliances – construction, maintenance and use, various methods of rigging of derricks, safety in the use of container handling/lifting appliances like portainers, transtainer, top lift trucks and other containers – testing and examination of lifting appliances – portainers – transtainers – toplift trucks – derricks in different rigging etc. Use and care of synthetic and natural fiber ropes – wire rope chains, different types of slings and loose gears.	
UNIT IV – Transport Equipment	**[9 hours]**
The different types of equipment for transporting containers and safety in their use-safety in the use of self-loading container vehicles, container side lifter, fork lift truck, dock railways, conveyors and cranes. Safe use of special lift trucks inside containers – Testing, examination and inspection of containers – carriage of dangerous goods in containers and maintenance and certification of containers for safe operation. Handling of different types of cargo – stacking and unstacking both on board the ship and ashore – loading and unloading of cargo identification of berths/walking for transfer operation of specific chemical from ship to shore and vice versa – restriction of loading and unloading operations.	
UNIT V – Emergency Action Plan and Dock Workers (SHW) Regulations 1990	**[9 hours]**
Emergency action Plans for fire and explosions - collapse of lifting appliances and buildings, sheds etc., - gas leakages and precautions concerning spillage of dangerous goods etc., - Preparation of on- site emergency plan and safety report. Dock workers (SHW) rules and regulations 1990-related to lifting appliances, Container handling, loading and unloading, handling of hatch coverings and beams, Cargo handling, conveyors, dock railways, forklift.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Identify the various operations carried out in a dock.	K3
CO2	Explain the different acts and rules for safe dock operations.	K2
CO3	Identify the operation of various types of material handling equipment's.	K3
CO4	Develop to response at the time of emergency in a dock.	K3
CO5	Explain the various problems associated with the use of lifting equipment's and in the storage yards.	K2

COs and POs Mapping:

COs	**POs**		
	1	**2**	**3**
CO1	-	-	-
CO2	-	3	-
CO3	-	-	-
CO4	-	-	-
CO5	-	-	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final marks</th></tr>
<tr><td rowspan="5">Continuous Internal Examination (CIE)</td><td>CIE – I</td><td>100</td><td rowspan="2">50</td><td rowspan="5">100</td><td rowspan="5">40</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>MCQ</td><td>20</td><td>10</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td>End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>60</td><td>60</td><td>60</td></tr>
<tr><td colspan="5">Total</td><td>100</td></tr>
</table>

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. "Dock Safety" Thane Belapur Industries Association, Mumbai.
2. Bindra SR "Course in Dock and Harbour Engineering"

Reference Books:

1. Safety and Health in Dock work, IInd Edition, ILO, 1992.
2. Srinivasan "Harbour, Dock and Tunnel Engineering"
3. Taylor D.A., ""Introduction to Marine Engineering".

Web Links and Video Lectures (E-Resources):

1. Port and Harbour Structures :
http://www.digimat.in/nptel/courses/video/114106025/L04.html
2. Port and Harbour Structures :
http://www.digimat.in/nptel/courses/video/114106025/L14.html

Suggested Skill Activities:

1. Assess the risk for a particular work area and create the report.
2. Create the report for safe Guards of a particular work area.
3. Document and present the risk and safety measures of a particular work area.

AUDIT COURSES SEMESTER I & II,

S. No.	Course Code	Course Title	Course Category	L	T	P	C
AUDIT COURSES							
1.	24AC201	English for Research Paper Writing	PEC	2	0	0	0
2.	24AC202	Disaster Management	PEC	2	0	0	0
3.	24AC203	Constitution of India	PEC	2	0	0	0

Course Code:	**24AC201**	**Course Title:**	**ENGLISH FOR RESEARCH PAPER WRITING**
Credits:	**0**	**L – T – P**	**2-0-0**

Course objectives:

To impart knowledge on the

- To analyze the basic energy generation cycles.
- To detail about the concept of cogeneration, its types and probable areas of applications.
- To study the significance of waste heat recovery systems and carry out its economic analysis.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – INTRODUCTION TO RESEARCH PAPER WRITING	**[6 hours]**
Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.	
UNIT II – PRESENTATION SKILLS	**[6 hours]**
Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction	
UNIT III – TITLE WRITING SKILLS	**[6 hours]**
Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check	

UNIT IV - RESULT WRITING SKILLS	[6 hours]
Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions.	
UNIT V – VERIFICATION SKILLS	**[6 hours]**
Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selection of appropriate energy storage technology, Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification and comparison of energy management strategies, implementation issues.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1		
CO2		
CO3		
CO4		
CO5		

COs and POs Mapping:

COs	POs		
	1	2	3
CO1	2	1	-
CO2	2	1	-
CO3	-	1	-
CO4	2	-	-
CO5	2	1	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal	CIE – I	100	50	100	40

Examination (CIE)	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011
2. Day R How to Write and Publish a Scientific Paper, Cambridge University Press 2006

Reference Books:

1. Goldbort R Writing for Science, Yale University Press (available on Google Books) 2006
2. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book 1998.

Course Code:	**24AC202**	**Course Title:**	**DISASTER MANAGEMENT**
Credits:	**0**	**L – T – P**	**2-0-0**

Course objectives:

To impart knowledge on the

- To analyze the basic energy generation cycles.
- To detail about the concept of cogeneration, its types and probable areas of applications.
- To study the significance of waste heat recovery systems and carry out its economic analysis.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – INTRODUCTION TO RESEARCH PAPER WRITING	**[6 hours]**
Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.	
UNIT II – REPERCUSSIONS OF DISASTERS AND HAZARDS	**[6 hours]**
Economic Damage, Loss of Human and Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.	
UNIT III – DISASTER PRONE AREAS IN INDIA	**[6 hours]**
Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics	

UNIT IV - DISASTER PREPAREDNESS AND MANAGEMENT	[6 hours]
Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.	

UNIT V – RISK ASSESSMENT	[6 hours]
Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1		
CO2		
CO3		
CO4		
CO5		

COs and POs Mapping:

COs	POs		
	1	2	3
CO1	2	1	-
CO2	2	1	-
CO3	-	1	-
CO4	2	-	-
CO5	2	1	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal	CIE – I	100	50	100	40
	CIE – II	100			

Examination (CIE)	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**Terminal Examination**
	1	**2**	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Goel S. L., Disaster Administration And Management Text And Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi,2009.

Reference Books:

1. NishithaRai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company,2007.
2. Sahni, PardeepEt.Al. ," Disaster Mitigation Experiences And Reflections", Prentice Hall OfIndia, New Delhi, 2001.

Course Code:	**24AC203**	**Course Title:**	**CONSTITUTION OF INDIA**
Credits:	**0**	**L – T – P**	**2-0-0**

Course objectives:

To impart knowledge on the

- To analyze the basic energy generation cycles.
- To detail about the concept of cogeneration, its types and probable areas of applications.
- To study the significance of waste heat recovery systems and carry out its economic analysis.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – HISTORY OF MAKING OF THE INDIAN CONSTITUTION	**[3 hours]**
History, Drafting Committee, (Composition & Working)	
UNIT II – PHILOSOPHY OF THE INDIAN CONSTITUTION	**[3 hours]**
Preamble, Salient Features	
UNIT III – CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES	**[6 hours]**
Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.	
UNIT IV - ORGANS OF GOVERNANCE	**[6 hours]**

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

UNIT V – LOCAL ADMINISTRATION	**[6 hours]**
District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy(Different departments), Village level:Role of Elected and Appointed officials, Importance of grass root democracy.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1		
CO2		
CO3		
CO4		
CO5		

COs and POs Mapping:

COs	**POs**		
	1	**2**	**3**
CO1	**2**	**1**	-
CO2	**2**	**1**	-
CO3	**-**	**1**	-
CO4	**2**	**-**	-
CO5	**2**	**1**	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
	CIE – I	100	50		
	CIE – II	100			

Continuous Internal Examination (CIE)	MCQ	20	10	100	40
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. The Constitution of India,1950(Bare Act),Government Publication.
2. Dr.S.N.Busi, Dr.B. R.Ambedkar framing of Indian Constitution,1st Edition, 2015.

Reference Books:

1. M.P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis,2014.
2. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

ROHINI COLLEGE OF ENGINEERING AND TECHNOLOGY

(AUTONOMOUS)

(Anjugramam-Kanyakumari Main Road, Palkulam,Variyoor P.O.-629 401, K.K.Dist.)

Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai

Accredited with A+ Grade by NAAC

Department of Mechanical Engineering

(M.E Thermal Engineering)

Curriculum & Syllabus

(*2024-2025 Admitted Students Onwards*)

Vision Statement of RCET

To be an academic institute of continuous excellence towards education and research in rural regime and provide service to nation in terms of nurturing potentially higher social, ethical and engineering companion graduands.

Mission Statement of RCET

To foster and promote technically competent graduands by imparting the state of art engineering education in rural regime.

To enunciate research assisted scientific learning by dissemination of knowledge towards science, agriculture, industry and national security.

Vision of the Department

To inculcate competence in the field of mechanical engineering for the students by providing quality education and learning opportunities to become ethically strong engineers for the development of society.

Mission of the Department

To provide fundamentals and technical skills in Mechanical Engineering through effective teaching-learning methodologies.

To provide an ambience for research through collaborations with industry and academia.

To inculcate the students' leadership quality through employability skills with ethical values.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1	Graduates will apply the knowledge of Mechanical Engineering concepts and innovative methods to solve real-world engineering problems.
PEO2	Graduates will have the required qualities for a successful carrier in Mechanical Engineering and related fields.
PEO3	Graduates will exhibit professional skills with ethical values and teamwork.

PROGRAMME OUTCOMES (POs)

On successful completion of the programme,

PO1	An ability to independently carry out research /investigation and development work to solve practical problems.
PO2	An ability to write and present a substantial technical report/document.
PO3	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the Thermal Engineering. The mastery should be at a level higher than the requirements in the appropriate bachelor program.

CREDIT INFO		
Sl.No	**Category**	**Credits**
1	Fundamental Courses (FC)	8
2	Research Methodology Courses (RMC)	2
3	Audit Courses (AC)	-
4	Professional Core Courses (PCC)	24
5	Professional Electives (PEC)	18
6	Open Electives (OEC)	3
7	Employability Enhancement Courses (EEC)	20
Total Credits		**75**

Fundamental Courses (FC)							
Sl.No	**Course Code**	**Course Title**	**Course Type**	**L**	**T**	**P**	**Credit**
1	24TE101	Advanced Numerical Methods	FC	4	0	0	4
2	24TE102	Advanced Heat Transfer	FC	4	0	0	4
Research Methodology Courses (RMC)							
Sl.No	**Course Code**	**Course Title**	**Course Type**	**L**	**T**	**P**	**Credit**
1	24RM101	Research Methodology and IPR	RMC	2	0	0	2
Audit Courses (AC)							
Sl.No	**Course Code**	**Course Title**	**Course Type**	**L**	**T**	**P**	**Credit**
1.	24AC201	English for Research Paper Writing	2	0	0	0	-
2.	24AC202	Disaster Management	2	0	0	0	-
3.	24AC203	Constitution of India	2	0	0	0	-
Professional Core Courses (PCC)							
Sl.No	**Course Code**	**Course Title**	**Course Type**	**L**	**T**	**P**	**Credit**
1.	24TE103	Advanced Thermodynamics	PCC	3	1	0	4
2.	24TE104	Advanced Fluid Mechanics	PCC	3	0	0	3
3.	24TE131	Thermal Engineering Laboratory	PCC	0	0	4	2
4.	24TE201	Instrumentation for Thermal Engineering	PCC	3	0	0	3
5.	24TE202	Internal Combustion Engine Design	PCC	3	0	0	3
6.	24TE203	Fuels, Combustion and Emission Control	PCC	4	0	0	4
7.	24TE231	Thermal Systems Simulation Laboratory	PCC	0	0	4	2
8.	24TE301	Design and Optimization of Thermal Energy Systems	PCC	3	0	0	3
Professional Electives Courses (PEC)							
Sl.No	**Course Code**	**Course Title**	**Course Type**	**L**	**T**	**P**	**Credit**
1.	24TE111	Aircraft and Jet Propulsion	PEC	3	0	0	3
2.	24TE112	Hydrogen and Fuel Cell Technologies	PEC	3	0	0	3
3.	24TE113	Energy Resources	PEC	3	0	0	3
4.	24TE114	Advanced Internal Combustion Engines	PEC	3	0	0	3
5.	24TE115	Cryogenic Engineering	PEC	3	0	0	3
6.	24TE116	Refrigeration Systems	PEC	3	0	0	3
7.	24TE117	Electronic Engine Management Systems	PEC	3	0	0	3

8.	24TE118	Cogeneration and Waste Heat Recovery Systems	PEC	3	0	0	3
Open Electives Courses (OEC)							
Sl.No	**Course Code**	**Course Title**	**Course Type**	**L**	**T**	**P**	**Credit**
1.	24CI341	Integrated Water Resources Management	OEC	3	0	0	3
2.	24CI342	Water, Sanitation and Health	OEC	3	0	0	3
3.	24CI343	Principles of Sustainable Development	OEC	3	0	0	3
4.	24CI344	Environmental Impact Assessment	OEC	3	0	0	3
5.	24CP311	Block-chain Technologies	OEC	3	0	0	3
6.	24CP310	Deep Learning	OEC	3	0	0	3
7.	24CI345	Sustainable Management	OEC	3	0	0	3
8.	24IS 341	Micro and Small Business Management	OEC	3	0	0	3
9.	24IS 343	Intellectual Property Rights	OEC	3	0	0	3
10.	24IS 344	Ethical Management	OEC	3	0	0	3
11.	24EM341	IoT for Smart Systems	OEC	3	0	0	3
12.	24EM342	Machine Learning and Deep Learning	OEC	3	0	0	3
13.	24CP 301	Renewable Energy Technology	OEC	3	0	0	3
14.	24CP 206	Smart Grid	OEC	3	0	0	3
15.	24TE 344	Security Practices	OEC	3	0	0	3
16.	24CP 341	Cloud Computing Technologies	OEC	3	0	0	3
17.	24CP 342	Design Thinking	OEC	3	0	0	3
18.	24CM341	Principles of Multimedia	OEC	3	0	0	3
19.	24EM343	Big Data Analytics	OEC	3	0	0	3
20.	24CI 346	Internet of Things and Cloud	OEC	3	0	0	3
21.	24TE 345	Medical Robotics	OEC	3	0	0	3
22.	24TE 346	Embedded Automation	OEC	3	0	0	3
23.	24CI 341	Environmental Sustainability	OEC	3	0	0	3
24.	24CI 342	Textile Reinforced Composites	OEC	3	0	0	3
25.	24CI 343	Nano-composite Materials	OEC	3	0	0	3
Employability Enhancement Courses (EEC)							
Sl.No	**Course Code**	**Course Title**	**Course Type**	**L**	**T**	**P**	**Credit**
1.	24TE251	Technical Seminar – I	EEC	0	0	2	1
2.	24TE351	Technical Seminar – II	EEC	0	0	2	1
3.	24TE352	Project Work - I	EEC	0	0	12	6
4.	24TE451	Project Work - II	EEC	0	0	24	12

Recommended Courses for I SEMESTER

S. No.	Course Code	Course Title	Course Category	L	T	P	C
FUNDAMENTAL COURSES							
1.	24TE101	Advanced Numerical Methods	FC	4	0	0	4
2.	24TE102	Advanced Heat Transfer	FC	4	0	0	4
PROFESSIONAL CORE COURSES							
3.	24TE103	Advanced Thermodynamics	PCC	3	1	0	4
4.	24TE104	Advanced Fluid Mechanics	PCC	3	0	0	3
RESEARCH METHODOLOGY AND IPR COURSES							
5.	24RM101	Research Methodology and IPR	RMC	2	0	0	2
PROFESSIONAL ELECTIVE COURSES							
6.	24TE11X	Professional Elective - I	PEC	3	0	0	3
7.	24TE11X	Professional Elective - II	PEC	3	0	0	3
AUDIT COURSES							
8.	24AC2XX	Audit Course I*	AC	2	0	0	0
PROFESSIONAL CORE COURSES							
9.	24TE131	Thermal Engineering Laboratory	PCC	0	0	4	2
		TOTAL		24	1	4	25

Recommended Courses for II SEMESTER

S. No.	Course Code	Course Title	Course Category	L	T	P	C
PROFESSIONAL CORE COURSES							
1.	24TE201	Instrumentation for Thermal Engineering	PCC	3	0	0	3
2.	24TE202	Internal Combustion Engine Design	PCC	3	0	0	3
3.	24TE203	Fuels, Combustion and Emission	PCC	4	0	0	4
PROFESSIONAL ELECTIVE COURSES							
4.	24TE21X	Professional Elective - III	PEC	3	0	0	3
5.	24TE21X	Professional Elective – IV	PEC	3	0	0	3
6.	24TE21X	Professional Elective - V	PEC	3	0	0	3
AUDIT COURSES							
7.	24AC2XX	Audit Course II*	AC	2	0	0	0
PROFESSIONAL CORE COURSES							
8.	24TE231	Thermal Systems Simulation Laboratory	PCC	0	0	4	2
EMPLOYABILITY ENHANCEMENT COURSES							
9.	24TE251	Technical Seminar – I	EEC	0	0	2	1
		TOTAL		21	0	6	22

Course Code:	**24TE101**	**Course Title:**	**Advanced Numerical Methods**
Credits:	**4**	**L – T – P**	**4-0-0**

Course objectives:

To impart knowledge on the

- To study various numerical techniques to solve linear and non-linear algebraic and transcendental equations.
- To compare ordinary differential equations by finite difference and collocation methods.
- To establish finite difference methods to solve Parabolic and hyperbolic equations.
- To establish finite difference method to solve elliptic partial differential equations.
- To provide basic knowledge in finite elements method in solving partial differential equations.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – Algebraic Equations	**[12 hours]**
Systems of linear equations : Gauss elimination method – Pivoting techniques – Thomas algorithm for tri diagonal system – Jacobi, Gauss Seidel, SOR iteration methods – Conditions for convergence - Systems of nonlinear equations : Fixed point iterations, Newton's method, Eigenvalue problems : Power method and Given's method.	
UNIT II – Ordinary Differential Equations	**[12 hours]**
Runge - Kutta methods for system of IVPs – Numerical stability of Runge - Kutta method – Adams - Bashforth multistep method, Shooting method, BVP: Finite difference method, Collocation method and orthogonal collocation method.	

UNIT III – Finite Difference Method for Time Dependent Partial Differential Equations	[12 hours]
Parabolic equations: Explicit and implicit finite difference methods – Weighted average approximation - Dirichlet's and Neumann conditions – Two dimensional parabolic equations – ADI method: First order hyperbolic equations – Method of numerical integration along characteristics – Wave equation: Explicit scheme – Stability.	
UNIT IV – Finite Difference Methods for Elliptic Equations	**[12 hours]**
Laplace and Poisson's equations in a rectangular region: Five point finite difference schemes, Leibmann's iterative methods, Dirichlet's and Neumann conditions – Laplace equation in polar coordinates: Finite difference schemes – Approximation of derivatives near a curved boundary while using a square mesh.	
UNIT V – Finite Element Method	**[12 hours]**
Basics of finite element method: Weak formulation, Weighted residual method – Shape functions for linear and triangular element – Finite element method for two point boundary value problems, Laplace and Poisson equations.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Solve an algebraic or transcendental equation, linear system of equations and differential equations using an appropriate numerical method.	**K3**
CO2	Solving the initial boundary value problems and boundary value problems using finite difference and finite element methods.	**K3**
CO3	Solving parabolic and hyperbolic partial differential equations by finite difference methods.	**K3**
CO4	Compute solution of elliptic partial differential equations by finite difference methods.	**K3**
CO5	Selection of appropriate numerical methods to solve various types of problems in engineering and science in consideration with the minimum number of mathematical operations involved, accuracy requirements and available computational resources.	**K3**

COs and POs Mapping:

COs	POs		
	1	2	3
CO1	3	2	1
CO2	3	3	2
CO3	3	2	1
CO4	3	3	2
CO5	3	2	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. Burden, R.L., and Faires, J.D., “Numerical Analysis – Theory and Applications”, 9th Edition, Cengage Learning, New Delhi, 2016.
2. Gupta S.K., “Numerical Methods for Engineers”,4th Edition, New Age Publishers, 2019.
3. Jain M. K., Iyengar S. R., Kanchi M. B., Jain, “Computational Methods for Partial Differential Equations”, New Age Publishers ,1993.
4. Sastry, S.S., “Introductory Methods of Numerical Analysis”, 5th Edition, PHI Learning, 2015.
5. Saumyen Guha and Rajesh Srivastava, “Numerical methods for Engineering and Science”, Oxford Higher Education, New Delhi, 2010.
6. Smith, G. D., "Numerical Solutions of Partial Differential Equations: Finite Difference Methods", Clarendon Press, 1985.

Web Links and Video Lectures (E-Resources):

1. Runge - Kutta methods for system of IVPs:
   https://onlinecourses.nptel.ac.in/noc21_ge26/preview
2. Weighted average approximation:
   https://onlinecourses.nptel.ac.in/noc24_cs97/preview
3. Two dimensional parabolic equations:
   https://onlinecourses.nptel.ac.in/noc22_ma72/preview
4. Dirichlet's and Neumann conditions:
   https://onlinecourses.nptel.ac.in/noc20_ee04/preview

Suggested Skill Activities:

1. List some common methods for tridiagonal systems.
2. Problem solving in computational fluid dynamics for one dimension.
3. Problem solving in computational fluid dynamics for two dimension.
4. Solving heat transfer problems using finite element method.

Course Code:	24TE102	Course Title:	Advanced Heat Transfer
Credits:	4	L – T – P	4-0-0

Course objectives: To impart knowledge on the • To impart knowledge on conduction heat transfer associated with radiation. • To impart knowledge on the turbulent forced convective heat transfer. • To impart knowledge on the significance of Phase Change Heat Transfer and Mass • Transfer. • To teach the heat exchanger design aspects including compact heat exchangers. • To impart knowledge on Mass transfer as an engineering phenomenon.
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. Lab experiment videos 3. Blended Mode of Learning 4. Project based Learning 5. Experiential Learning 6. NPTEL and Other Videos 7. Smart Class Room 8. Flipped Class

UNIT I – Conduction and Radiation Heat Transfer	**[12 hours]**
One dimensional energy equations and boundary condition - three-dimensional heat conduction equations - extended surface heat transfer- various pin profiles- pin optimization - transient conduction-- conduction with moving boundaries - radiation in gases and vapour. Gas radiation and radiation heat transfer in enclosures containing absorbing and emitting media – interaction of radiation with conduction and convection	
UNIT II – Turbulent Forced Convective Heat Transfer	**[12 hours]**
Momentum and energy equations - turbulent boundary layer heat transfer - mixing length concept - turbulence model – k Є model - analogy between heat and momentum transfer – Reynolds, Colburn, Prandtl turbulent flow in a tube - high speed flows.	

UNIT III – Phase Change Heat Transfer and Heat Exchanger	[12 hours]
Condensation on bank of tubes - boiling – pool and flow boiling - heat Transfer Enhancement Techniques.	
UNIT IV – Heat Exchangers	**[12 hours]**
Heat Exchanger – Є- NTU approach and design procedure – compact heat exchangers – Plate heat exchangers– Mini and Micro Channel heat exchangers, Heat transfer correlations for specific cases.	
UNIT V – Mass Transfer	**[12 hours]**
Mass transfer - vaporization of droplets - combined heat and mass transfers applications – Cooling Towers, Evaporative condensers, solar pond, Cooling and dehumidification systems – porous media heat transfer	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Apply the problems on heat transfer associated with conduction and convection and radiation through vapours and gases.	**K3**
CO2	Solve the problems on turbulent heat transfer and also solve high speed flow problems.	**K3**
CO3	Apply the problems on phase change heat transfer.	**K3**
CO4	Estimate the performance of compact heat exchangers and also understand the use of correlations to predict heat transfer from specific devices	**K2**
CO5	Illustrate and predict the mass transfer associated with heat transfer in engineering systems	**K3**

COs and POs Mapping:

COs	POs		
	1	**2**	**3**
CO1	2	1	3
CO2	2	2	3
CO3	2	1	3
CO4	2	2	3
CO5	2	2	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	**2**	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. Ghoshdastidar. P.S., Heat Transfer, Oxford University Press, 2004.
2. Holman.J.P., Heat Transfer, Tata Mc Graw Hill, 2002.
3. Incropera F.P. and DeWitt. D.P., Fundamentals of Heat & Mass Transfer, John Wiley & Sons, 2002.
4. Nag.P.K., Heat Transfer, Tata McGraw-Hill, 2002.
5. Ozisik. M.N., Heat Transfer – A Basic Approach, McGraw-Hill Co., 1985.
6. Yadav, R., Heat and Mass Transfer, Central Publishing House, 1995.
7. Yunus A.Cengal., Heat and Mass Transfer – A practical Approach, 3rd edition, Tata McGraw - Hill, 2007.

Web Links and Video Lectures (E-Resources):

1. Conduction and Radiation Heat Transfer: https://onlinecourses.nptel.ac.in/noc20_ch12/preview
2. Turbulent Forced Convective Heat Transfer: https://onlinecourses.nptel.ac.in/noc20_ch12/preview
3. Phase Change Heat Transfer and Heat Exchanger: https://onlinecourses.nptel.ac.in/noc20_ch12/preview
4. Heat Exchangers: https://onlinecourses.nptel.ac.in/noc20_ch12/preview
5. Mass Transfer: https://onlinecourses.nptel.ac.in/noc20_ch12/preview

Suggested Skill Activities:

1. Analyzing Multi-dimensional Transient heat conduction problems using a software.
2. Analyzing One-dimensional Transient heat conduction problems using a software.
3. Analysis of fin heat conduction problems.
4. Compare between shell and tube heat exchanger and parallel flow heat exchanger.

Course Code:	**24TE103**	**Course Title:**	**Advanced Thermodynamics**
Credits:	**4**	**L – T – P**	**3-1-0**

Course objectives:

To impart knowledge on the

- To achieve an understanding of basic principle and scope of thermodynamics.
- To predict the availability and irreversibility associated with the thermodynamic processes.
- To analyse the properties of ideal and real gas mixtures and to understand the basic concepts of thermal systems

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – Thermodynamic Property Relations	**[12 hours]**
Thermodynamic Potentials, Maxwell relations, Generalised relations for changes in Entropy, Internal Energy and Enthalpy, Generalised Relations for Cp and Cv, Clausius Clapeyron Equation, Joule Thomson Coefficient, Bridgeman Tables for Thermodynamic Relations.	
UNIT II – Real Gas Behavior and Multi-Component Systems	**[12 hours]**
Equations of State (mention three equations), Fugacity, Compressibility, Principle of Corresponding States, and use of generalised charts for enthalpy and entropy departure, fugacity coefficient, Lee-Kesler generalised three parameter tables. Fundamental property relations for systems of variable composition, partial molar properties, Real gas mixtures, Ideal solution of real gases and liquids, Equilibrium in multi-phase systems, Gibb's phase rule for non-reactive components.	

UNIT III – Availability Analysis	[12 hours]
Introduction, Reversible work, Availability, Irreversibility and Second - Law Efficiency for a closed System and Steady-State Control Volume. Availability Analysis of Simple Cycles. Chemical availability of closed and control volume. Fuel Chemical availability, Evaluation of the availability of hydrocarbon fuels.	
UNIT IV – Fuel - Air Cycles and Their Analysis	**[12 hours]**
Ideal Models of Engine Processes, Fuel–Air Cycle Analysis – SI Engine Cycle Simulation, CI Engine Cycle Simulation, Results of Cycle Calculations, Availability Analysis of Engine Processes – Availability Relationships – Entropy changes in Ideal Cycles – Availability Analysis of Ideal Cycles.	
UNIT V – Thermo Chemistry	**[12 hours]**
Ideal gas laws and properties of Mixtures, Combustion Stoichiometry, Application of First Law of Thermodynamics – Heat of Reaction – Enthalpy of Formation – Adiabatic flame temperature. Second law of Thermodynamics applied to combustion – entropy, maximum work and efficiency Chemical equilibrium: - Equilibrium constant evaluation Kp & Kf, Equilibrium composition evaluation of ideal gas and real gas mixtures.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Apply the law of thermodynamics to thermal systems.	**K3**
CO2	Solve the actual thermodynamic cycles	**K3**
CO3	Develop a multi component thermodynamic system	**K3**
CO4	Apply the thermodynamics concepts in automotive systems	**K3**
CO5	Illustrate and analyse the combustion of different fuels	**K3**

COs and POs Mapping:

COs	POs		
	1	**2**	**3**
CO1	2	-	3
CO2	2	1	3
CO3	2	-	3
CO4	2	1	3
CO5	2	1	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	**2**	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. Kenneth Wark., J.R, Advanced Thermodynamics for Engineers, McGraw-Hill Inc., 1995.
2. K.Annamalai, I.K.Puri, M.A.Jog, Advanced Thermodynamics Engineering, Second Edition, CRC Press, 2011.
3. Advanced Thermodynamics, S.S. Thipse, Narosa Publishing Home Pvt. Ltd., 2013
4. Yunus A. Cengel and Michael A. Boles, Thermodynamics, McGraw-Hill Inc., 2006.
5. B.P. Pundir, I.C. engine combustion and emissions. Bejan, A., Advanced Engineering Thermodynamics, John Wiley and Sons, 1988.
6. Holman,J.P., Thermodynamics, Fourth Edition, McGraw-Hill Inc., 1988.

Web Links and Video Lectures (E-Resources):

1. Thermodynamic Property Relations: https://onlinecourses.nptel.ac.in/noc22_me113/preview
2. Real Gas Behavior and Multi-Component Systems: https://onlinecourses.nptel.ac.in/noc22_me113/preview
3. Availability Analysis: https://onlinecourses.nptel.ac.in/noc22_me113/preview
4. Fuel - Air Cycles and Their Analysis: https://onlinecourses.nptel.ac.in/noc22_me113/preview
5. Thermo Chemistry: https://onlinecourses.nptel.ac.in/noc22_me113/preview

Suggested Skill Activities:

1. Describe the correlation between various properties of a thermodynamic system, such as temperature, pressure, volume, internal energy, enthalpy and entropy.
2. Application of modified ideal gas equation to real gas.
3. Energy based optimization for various thermodynamical systems.
4. Experimental investigation of engines performance for modified fueled engines.

Course Code:	24TE104	Course Title:	Advanced Fluid Mechanics
Credits:	3	L – T – P	3-0-0

Course objectives:

To impart knowledge on the

- To understand the laws of fluid flow for ideal and viscous fluids.
- To represent the real solid shapes by suitable flow patterns and to analyze the same for aerodynamics performances.
- To understand the changes in properties in compressible flow and shock expansion.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – Basic Equations of Flow	[9 hours]
Three dimensional continuity equation - differential and integral forms – equations of motion momentum and energy - Reynolds transport theorem – Navier – Stokes equation – Engineering Applications	
UNIT II – Potential Flow Theory	**[9 hours]**
Rotational and irrorational flows - circulation – vorticity - stream and potential functions for standard flows and combined flows – representation of solid bodies by flow patterns. Pressure distribution over stationery and rotating cylinders in a uniform flow - Magnus effect - Kutta –Zhukov sky theorem. Complex potential functions. Conformal transformation to analyze the flow over flat plate, cylinder, oval body and airfoils. Thin airfoil theory – generalized airfoil theory for cambered and flapped airfoils.	
UNIT III – Viscous Flow Theory	**[9 hours]**
Laminar and turbulent flow - laminar flow between parallel plates - Poiseuille's equation for flow through circular pipes. Turbulent flow - Darcy Weisbach equation for flow through	

circular pipe - friction factor - smooth and rough pipes - Moody diagram – losses during flow through pipes. Pipes in series and parallel – transmission of power through pipes.	
UNIT IV – Boundary Layer Concept	**[9 hours]**
Boundary Layer - displacement and momentum thickness - laminar and turbulent boundary layers in flat plates - velocity distribution in turbulent flows in smooth and rough boundaries - laminar sub layer.	
UNIT V – Compressible Fluid Flow	**[9 hours]**
One dimensional compressible fluid flow – flow through variable area passage – nozzles and diffusers – fundamentals of supersonics – normal and oblique shock waves and calculation of flow and fluid properties over solid bodies (like flat plate, wedge, diamond) using gas tables	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Illustrate the basic equations of flow.	**K3**
CO2	Identify the flow over flat plate, cylinder, oval body and airfoils.	**K3**
CO3	Classify the various losses during flow through pipes.	**K3**
CO4	Illustrate the boundary layer concept in flat plate.	**K3**
CO5	Interpretation of flow and fluid properties of compressed gases.	**K3**

COs and POs Mapping:

COs	**POs**		
	1	**2**	**3**
CO1	3	-	3
CO2	3	-	3
CO3	2	-	3
CO4	3	-	2
CO5	2	-	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. Anderson J.D., Fundamentals of Aerodynamics, McGraw Hill, Boston, 2001.
2. Bansal R.K., Fluid Mechanics, Saurabh and Co., New Delhi, 1985.
3. Houghten E.L. and Carruthers N.B., Aerodynamics for Engineering Students, Arnold Publishers, 1993.

4. Kumar K.L., Engineering Fluid Mechanics, Eurasia Publishing House, New Delhi, 2002.
5. Munson B.R., Young D.F. and Okiisi, T.H., Fundamentals of Fluid Mechanics, John Wiley and Sons Inc., NewYork, 1990.
6. Schlichting H., Boundary layer theory, Mc Graw Hill Book Company, 1979
7. Shames, Mechanics of Fluids, Mc Graw Hill Book Company, 1962.
8. Streeter V.L., Wylie E.B. and Bedford K.W., Fluid Mechanics, WCB McGraw Hill, Boston, 1998.

Web Links and Video Lectures (E-Resources):

1. Basic Equations of Flow: https://onlinecourses.nptel.ac.in/noc22_me102/preview
2. Potential Flow Theory: https://onlinecourses.nptel.ac.in/noc22_me102/preview
3. Viscous Flow Theory: https://onlinecourses.nptel.ac.in/noc22_me102/preview
4. Boundary Layer Concept: https://onlinecourses.nptel.ac.in/noc22_me102/preview
5. Compressible Fluid Flow: https://onlinecourses.nptel.ac.in/noc22_me102/preview

Suggested Skill Activities:

1. Surface pressure distribution on a two-dimensional symmetric airfoil at different angles of incidence at low speeds.
2. Smoke flow visualization studies on a two dimensional multi-element airfoil with flaps and slats at different angles of incidence at low speeds.
3. Energy losses in pipe fittings

Course Code:	24RM101	Course Title:	Research Methodology And IPR
Credits:	**2**	**L – T – P**	**2-0-0**

Course objectives: To impart knowledge on the • To study various research process and design • To prepare and explore various data collection methods and sources • To study about various research data analyzing techniques and reporting formats • To study the various practices involved in Intellectual Property Rights • To study about the registration of Patent
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. NPTEL and Other Videos 3. Smart Class Room 4. Flipped Class 5. Technical Seminar 6. Poster Presentation

UNIT I – Research Design	[6 hours]
Overview of research process and design, Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys.	
UNIT II – Data Collection and Sources	**[6 hours]**
Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data - Preparing, Exploring, examining and displaying	
UNIT III – Data Analysis and Reporting	**[6 hours]**
Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation.	

UNIT IV – Intellectual Property Rights	[6 hours]
Intellectual Property – The concept of IPR, Evolution and development of concept of IPR, IPR development process, Trade secrets, utility Models, IPR & Bio diversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.	

UNIT V – Patents	[6 hours]
Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification, Types of patent application, process E-filling, Examination of patent, Grant of patent, Revocation, Equitable Assignments, Licences, Licensing of related patents, patent agents, Registration of patent agents	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Formulate research problem	**K6**
CO2	Analyze literature review and find research gaps to finalize research objectives	**K4**
CO3	Identify the need of ethics in research	**K3**
CO4	Identify the need of IPR of research projects for economic growth and social benefits	**K3**
CO5	Apply their research work for patent through IPR	**K3**

COs and POs Mapping:

COs	POs		
	1	2	3
CO1	2	-	-
CO2	2	1	-
CO3	2	2	-
CO4	3	1	-
CO5	3	2	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	60	100	40
	CIE – II	100			
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	10	10	10
Understand	20	30	20
Apply	30	40	40
Analyze	10	10	10
Evaluate	10	10	10
Create	20	-	10

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. Cooper Donald R, Schindler Pamela S and Sharma JK, “Business Research Methods”, Tata McGraw Hill Education, 11e (2012).
2. Catherine J. Holland, “Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets”, Entrepreneur Press, 2007
3. David Hunt, Long Nguyen, Matthew Rodgers, “Patent searching: tools & techniques”, Wiley, 2007.
4. The Institute of Company Secretaries of India, Statutory body under an Act of parliament, “Professional Programme Intellectual Property Rights, Law and practice”, September 2013.

Web Links and Video Lectures (E-Resources):

1. https://onlinecourses.nptel.ac.in/noc23_ge36/preview

Suggested Skill Activities:

1. Developing a Research Plan
2. Data Collection Analysis for a defined problem
3. Poster preparation
4. Thesis Report Writing
5. Case studies using patent database

Course Code:	**24TE131**	**Course Title:**	**Thermal Engineering Laboratory**
Credits:	**2**	**L – T – P**	**0-0-4**

Course objectives:

To impart knowledge on the

- To conduct experiments on various Thermal Engineering devices to study the performance and its applications.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Experimental Learning

List of Experiments	[60 hours]

1. Performance and emission characteristics of multi cylinder Spark Ignition and Compression Ignition engines using alternate fuels.
2. Thermal performance of variable compression ratio engines.
3. Thermal analysis of natural / forced draught cooling towers.
4. Thermal analysis of heat pumps systems.
5. Experimental studies on vapour compression refrigeration systems using natural refrigerants
6. Overall performance of solar water heating system.
7. Physical, Chemical and thermal Properties of any liquid and gas fuels.
8. Experimental analysis of a Boiler.
9. Calibration of Temperature sensors (RTD / any thermocouple)
10. Calibration of Pressure sensors
11. Experimental studies on axial / centrifugal fan characteristics

List of Equipment	Quantity
Single cylinder / multi cylinder Automotive Engine with data acquisition system	1
Flue gas analyzer	1
Smoke meter	1
Single cylinder variable Compression ratio petrol engine	1
Single cylinder variable Compression ratio Diesel engine	1
Cooling tower test rig	1
Refrigeration cum Heat Pump test rig	1
100 LPD Solar flat plate water heater test rig	1
Pyranometer	1
Redwood / Saybolt viscometer	1
Bomb calorimeter apparatus	1
Gas calorimeter	1
Cloud & Pour point apparatus	1
IBR / Non-IBR Boiler test rig	1
Fan test rig	1
Pressure Calibrator	1
Temperature Calibrator	1

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Know the various alternate fuels are available for IC engines	K1
CO2	Demonstrate with the thermodynamic relations for thermal engineering devices.	K2
CO3	Apply the working principle of different renewable energy sources for energy applications.	K3
CO4	Select the properties of different fuels	K3
CO5	Experiment with refrigeration and air conditioning system	K3

COs and POs Mapping:

COs	POs		
	1	**2**	**3**
CO1	3	-	2
CO2	3	-	2
CO3	2	-	2
CO4	2	-	3
CO5	2	-	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	Continuous Assessment	75	75	100	60
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Lab Exam	100	40	40	40
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	**2**	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

Course Code:	**24TE201**	**Course Title:**	**Instrumentation for Thermal Engineering**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

- To impart knowledge on the
- To classify various measuring instruments.
- To categories temperature sensors and their applications in measurement.
- To outline the advancements in pressure and volume measurements.
- To explore the various measurement techniques for thermos physical properties.
- To compare the different data acquisition systems.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – Measurement Characteristics	**[9 hours]**
Instrument Classification, Characteristics of Instruments – Static and dynamic, experimental error analysis, Systematic and random errors, Statistical analysis, Uncertainty, Experimental planning and selection of measuring instruments, Reliability of instruments	
UNIT II – Temperature Measurement	**[9 hours]**
Temperature, Types, materials, Accuracy - Selection of Temperature sensors - Effect of length of sensor on temperature measurements- calibration of thermocouple, RTD's & Thermistors- Standards for temperature measurement - Cryogenic & High Temperature measurement techniques.	
UNIT III – Pressure Flow & Volume Measurements	**[9 hours]**
Pressure Sensors: Types & materials - piezoelectric transducers- calibration of pressure sensors-selection of pipes & fittings for pressure sensors. Volume sensors: Standard	

volumetric flask- Types, Density measurement instruments for liquids & gases. Flow Sensors: Caroli's mass flow measurements - flow measurements for water, gases, other oils & other chemicals.	
UNIT IV – Measurement of Thermo Physical Properties	**[9 hours]**
Thermal Conductivity measurement of solids - liquids & gases- Sensors & calibration methods- Thermal conductivity of microbar nano composites - Specific heat of liquids, solids through DSC Analysis - viscosity measurement of Newtonian & non-Newtonian fluids through rheological analysis	
UNIT V – Data Acquisition System	**[9 hours]**
Data acquisition systems, Evolution of SCADA, Communication technologies, Monitoring and supervisory functions, SCADA applications in Utility Automation, Industries - SCADA System Components: Schemes- Remote Terminal Unit (RTU), Intelligent Electronic Devices (IED), Communication Network, SCADA Server, SCADA/HMI Systems Various SCADA architectures.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Infer the role of uncertainty analysis in measuring instruments.	K2
CO2	Select the appropriate temperature sensors based on specific applications.	K3
CO3	Identify the suitable sensors for pressure and volume measurements.	K3
CO4	Interpret the thermos physical properties of media.	K2
CO5	Utilize the data acquisition systems in Thermal Systems.	K3

COs and POs Mapping:

COs	POs		
	1	2	3
CO1	1	1	-
CO2	2	-	2
CO3	2	-	2
CO4	2	-	2
CO5	2	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. Holman J.P., Experimental methods for engineers, McGraw-Hill, 2012.
2. Barnery, Intelligent Instrumentation, Prentice Hall of India, 2010.
3. Bolton.W, Industrial Control & Instrumentation, Universities Press, Second Edition, 2001.
4. John G Webster, The measurement, Instrumentation and sensors Handbook, CRC and IEE Press, 2014.
5. Morris A.S, Principles of Measurements and Instrumentation Prentice Hall of India, 2004.
6. Nakra, B.C., Choudhry K.K., Instrumentation, Measurements and Analysis Tata McGraw Hill, New Delhi, 2nd Edition 2003.
7. T.G.Beekwith R.D., Marangoni and J.H. Lienhard, Mechanical Measurements, Pearson Education, 2001

Web Links and Video Lectures (E-Resources):

1. Measurement Characteristics: https://onlinecourses.nptel.ac.in/noc23_ee105/preview
2. Temperature Measurement: https://onlinecourses.nptel.ac.in/noc23_ee105/preview
3. Pressure Flow & Volume Measurements: https://onlinecourses.nptel.ac.in/noc23_ee105/preview
4. Measurement of Thermo Physical Properties: https://onlinecourses.nptel.ac.in/noc23_ee105/preview
5. Data Acquisition System: https://onlinecourses.nptel.ac.in/noc23_ee105/preview

Suggested Skill Activities:

1. Monitoring the sensors in electronic injection system in an engine.
2. Monitoring the sensors in electronic ignition system in an engine.
3. Monitoring the sensors in engine lubrication system.
4. Monitoring the sensors in engine cooling system.

Course Code:	**24TE202**	**Course Title:**	**Internal Combustion Engine Design**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives: • To provide the basic grounding on the piston engine design philosophy
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. Lab experiment videos 3. Blended Mode of Learning 4. Project based Learning 5. Experiential Learning 6. NPTEL and Other Videos 7. Smart Class Room 8. Flipped Class

UNIT I – Generalia	**[5 hours]**
Principle of similitude, Choice of material, Stress, Fatigue and Noise, Vibration and Harshness considerations (NVH)	
UNIT II – Design of Major Components	**[12 hours]**
Piston system, Power cylinder system, Connecting rod assembly, Crankshaft system, Valve Gearing, Stress analyses.	
UNIT III – Design of Other Components / Subsystems	**[12 hours]**
Inlet and exhaust manifolds, cylinder block, cylinder-head, crankcase. Design aspects of engine mountings, gaskets, bearings. Basics of ignition, lubrication and cooling system design. Introduction to design of catalytic converters, particulate traps and EGR systems.	
UNIT IV – Design Specifics of Two-Stroke Engine Systems	**[10 hours]**
Thermal Conductivity measurement of solids - liquids & gases- Sensors & calibration methods- Thermal conductivity of microbar nano composites - Specific heat of liquids, solids through DSC Analysis - viscosity measurement of Newtonian & non-Newtonian fluids through rheological analysis	
UNIT V – Concepts of Computer Aided Design	**[6 hours]**
Preparation of working drawings of designed components using CAD system.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Illustrate the principle of similitude, Choice of material, Stress, Fatigue and Noise, Vibration and Harshness considerations.	K2
CO2	Summarize major components like Piston system, Power cylinder system, Connecting rod assembly, Crankshaft system, Valve Gearing, Stress analyses.	K2
CO3	Develop the subsystems of engine components for ignition, lubrication and cooling system.	K3
CO4	Demonstrate the specific parts of two-stroke engine system.	K2
CO5	Apply the concept of CAD in IC engine components.	K3

COs and POs Mapping:

COs	**POs**		
	1	**2**	**3**
CO1	1	1	-
CO2	2	-	2
CO3	2	-	2
CO4	2	-	2
CO5	2	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. An Introduction to Engine Testing and Development, Richard D. Atkids, SAE International, USA, 2009.
2. Design and Simulation of Four-Stroke Engines, Gordon P. Blair, Society of Automotive Engineers, Inc., USA, 1999.
3. Diesel Engine Reference Book, Second Edition, Rodica Baranescu and Bernard Challen (Editors), Society of Automotive Engineers, Inc., USA, 1999.
4. Engineering Design, A Systematic Approach, G. Pahl, W. Beltz J. Fieldhusen and K.H. Grote, Springer
5. Engineering Fundamentals of the Internal Combustion Engine, Willard W. Pulkrabek, Second Edition, Prentice – Hall of India Pvt. Ltd., New Delhi, 2006.
6. Internal Combustion Engine Design, A. Kolchin and V. Demidov, MIR Publishers, Moscow, 1984.
7. Internal Combustion Engine Fundamentals, John B. Heywood, McGraw – Hill Book Company, 1988.
8. Internal Combustion Engine Handbook: Basics, Components, Systems and Perpectives, Richard Van Basshuysen and Fred Schafer (Editors) SAE International USA and Siemes VDO Automotive, Germany, 2002.
9. Introduction to Engine Valve trains, Yushu Wang, SAE International, USA, 2007.
10. 1Introduction to Internal Combustion Engines, Richard Stone, Fourth Edition SAE International, USA and Macmillan Press, 2012.

11. Modern Engine Technology from A to Z, Richard Van Basshuysen and Fred Schafer, SAE International, USA and Siemens VDO, Germany, 2007.
12. Springer – Verlag, Wien, Austria, 2006.
13. Vehicular Engine Design, Kevin L. Hoag, SAE International USA.

Web Links and Video Lectures (E-Resources):

1. Internal Combustion Engine Design: https://onlinecourses.nptel.ac.in/noc22_me65/preview

Suggested Skill Activities:

1. Design major components like Piston system, Power cylinder system.
2. Design major components like Connecting rod assembly, Crankshaft system, Valve Gearing, Stress analyses.
3. Design subsystems of engine components.
4. Design of ignition, lubrication and cooling system.

Course Code:	**24TE203**	**Course Title:**	**Fuels, Combustion And Emission Control**
Credits:	**4**	**L – T – P**	**4-0-0**

Course objectives: • To understand the types of fuels. • To compare the fuels in specific point. • To understand the principles of combustion and combustion equipment's. • To understand the thermodynamic process behind the combustion. • To identify the level of emission standards.
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. Lab experiment videos 3. Blended Mode of Learning 4. Project based Learning 5. Experiential Learning 6. NPTEL and Other Videos 7. Smart Class Room 8. Flipped Class

UNIT I – Solid Fuels	**[9 hours]**
Solid Fuel Types - Coal Family - Properties - Calorific Value - ROM, DMMF, DAF and Bone Dry Basis - Ranking - Bulk & Apparent Density - Storage - Washability - Coking & Caking Coals – Renewable Solid Fuels - Biomass - Wood Waste - Agro Fuels - Manufactured Solid Fuels.	
UNIT II – Liquid and Gaseous Fuels	**[9 hours]**
Liquid Fuel Types - Sources - Petroleum Fractions - Classification - Refining - Properties of Liquid Fuels - Calorific Value, Specific Gravity, Flash & Fire Point, Octane Number, Cetane Number etc., - Alcohols - Tar Sand Oil - Liquefaction of Solid Fuels. Gaseous Fuel Classification - Composition & Properties - Estimation of Calorific Value - Gas Calorimeter. Rich & Lean Gas - Wobbe Index - Natural Gas - Dry & Wet Natural Gas - Stripped NG -	

Foul & Sweet NG - LPG - LNG - CNG - Methane - Producer Gas - Gasifiers - Water Gas - Town Gas - Coal Gasification - Gasification Efficiency - Non - Thermal Route - Biogas - Digesters - Reactions - Viability - Economics.	
UNIT III – Combustion: Stoichiometry & Kinetics	**[9 hours]**
Stoichiometry – Mass Basis & Volume Basis – Excess Air Calculation – Fuel & Flue Gas Compositions - Calculations – Rapid Methods – Combustion Processes – Stationary Flame – Surface or Flameless Combustion – Submerged Combustion – Pulsating & Slow Combustion Explosive Combustion. Mechanism of Combustion – Ignition & Ignition Energy – Spontaneous Combustion – Flame Propagation – Solid, Liquid & Gaseous Fuels Combustion – Flame Temperature – Theoretical, Adiabatic & Actual – Ignition Limits – Limits of Inflammability. Thermo Chemistry - Equilibrium combustion products. Low temperature combustion products – High temperature combustion products.	
UNIT IV – Combustion Equipments	**[9 hours]**
Coal Burning Equipments – Types – Pulverized Coal Firing – Fluidized Bed Firing – Fixed Bed & Recycled Bed – Cyclone Firing – Spreader Stokers – Vibrating Grate Stokers – Sprinkler Stokers, Traveling Grate Stokers. Oil Burners – Vaporizing Burners, Atomizing Burners – Design of Burners. Gas Burners – Atmospheric Gas Burners – Air Aspiration Gas Burners – Burners Classification according to Flame Structures – Factors Affecting Burners & Combustion.	
UNIT V – Emission Control Methods	**[9 hours]**
Emissions - Emission index - Corrected concentrations - Control of emissions for premixed and non-prefixed combustion. Flue gas Desulphurization, Coal Beneficiation, Coal Blending, Efficiency Improvement Methods (CO2 reduction) – Super critical boilers, Integrated Gasification Combined Cycle Power Plant, Carbon Capture & Storage (CCS)	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Identify to enable the fuels used for different purposes.	K3
CO2	Select the fuels at different conditions.	K3
CO3	Summarize the fuels and its combustion levels.	K2
CO4	Select the correct Equipment’s on combustion techniques.	K2
CO5	Illustrate the emission control at a standard rate.	K2

COs and POs Mapping:

COs	POs		
	1	**2**	**3**
CO1	3	-	2
CO2	3	-	2
CO3	3	-	2
CO4	-	-	2
CO5	3	-	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. B.I. Bhatt and S.M. Vora, Stoichiometry, 2nd Edition, Tata Mcgraw Hill, 2010.
2. Blokh A.G., Heat Transfer in Steam Boiler Furnace, Hemisphere Publishing Corpn, 1988.
3. Civil Davies, Calculations in Furnace Technology, Pergamon Press, Oxford, 1966.
4. Holman J.P., Thermodynamics, Fourth Edition, McGraw-Hill Inc., 1988.
5. Samir Sarkar, Fuels & Combustion, 2nd Edition, Orient Longman, 1990.
6. Sharma SP., Mohan Chander, Fuels & Combustion, Tata Mcgraw Hill, 1984.
7. Yunus A. Cengel and Michael A. Boles, Thermodynamics, McGraw-Hill Inc., 2006.

Web Links and Video Lectures (E-Resources):

1. Solid Fuels: https://onlinecourses.nptel.ac.in/noc24_ae09/preview
2. Liquid and Gaseous Fuels: https://archive.nptel.ac.in/courses/103/105/103105110/
3. Combustion: Stoichiometry & Kinetics: https://onlinecourses.nptel.ac.in/noc23_me27/preview
4. Combustion Equipments: https://onlinecourses.nptel.ac.in/noc23_me27/preview
5. Emission Control Methods: https://onlinecourses.nptel.ac.in/noc23_ce14/preview

Suggested Skill Activities:

1. Analyze various emission control equipments for solid fuels.
2. Analyze various emission control equipments for fossil fuels.
3. Analyze various emission control methods on automobiles.

Course Code:	24TE231	Course Title:	Thermal Systems Simulation Laboratory
Credits:	2	L – T – P	0-0-4

Course objectives:
To impart knowledge on the • To learn the modeling and simulation analysis of various thermal engineering application using analysis software. • To educate the students about calibration and its essentiality in thermal systems.
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Experimental Learning

DYNAMIC LINKING OF MAT LAB AND REF PROP SOFTWARE SIMPLE CFD PROBLEMS FOR PRACTICE

NOTE: The above exercises are only guidelines to maintain the standard for teaching and conduct of examination.

List of Experiments	[60 hours]
1. Heat exchanger analysis – NTU method 2. Heat exchanger analysis – LMTD method 3. Convection heat transfer analysis – Velocity boundary layer. 4. Convection heat transfer analysis – Internal flow 5. Radiation heat transfer analysis – Emissivity 6. Critical radius of insulation 7. Lumped heat transfer analysis 8. Conduction heat transfer analysis 9. Condensation heat transfer analysis	

List of Equipment
Software - Modeling software like ProE, Gambit, Ansys, etc Analysis software like Ansys, fluent, CFX, etc.
Equation solving software like Matlab, Engg equation solver.
Every students in a batch must be provided with a terminal.
Hardwares are compatible with the requirement of the above software.

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Explain the basic concepts of ANSYS Software	K2
CO2	Develop the thermal behavior of heat exchangers using ANSYS Software	K3
CO3	Summarize the thermal deformation for conduction and convection heat transfer applications	K2
CO4	Develop the thermal deformation for conduction and condensation heat transfer applications	K3
CO5	Summarize the thermal deformation for lumped heat transfer applications	K2

COs and POs Mapping:

COs	**POs**		
	1	**2**	**3**
CO1	3	2	2
CO2	3	2	2
CO3	3	2	2
CO4	3	2	2
CO5	3	2	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE)	Continuous Assessment	75	75	100	60
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Lab Exam	100	40	40	40
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

PROFESSIONAL ELECTIVES SEMESTER I, (ELECTIVE I & II)

S. No.	Course Code	Course Title	Course Category	L	T	P	C
PROFESSIONAL ELECTIVE COURSES							
1.	24TE111	Aircraft and Jet Propulsion	PEC	3	0	0	3
2.	24TE112	Hydrogen and Fuel Cell Technologies	PEC	3	0	0	3
3.	24TE113	Energy Resources	PEC	3	0	0	3
4.	24TE114	Advanced Internal Combustion Engines	PEC	3	0	0	3
5.	24TE115	Cryogenic Engineering	PEC	3	0	0	3
6.	24TE116	Refrigeration Systems	PEC	3	0	0	3
7.	24TE117	Electronic Engine Management Systems	PEC	3	0	0	3
8.	24TE118	Cogeneration and Waste Heat Recovery Systems	PEC	3	0	0	3

Course Code:	**24TE111**	**Course Title:**	**Aircraft and Jet Propulsion**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To gain insight on the working principle of rocket engines, different feed systems, propellants and their properties and dynamics of rockets

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – GAS DYNAMICS	**[8hours]**
Wave motion - Compressible fluid flow through variable area devices – Stagnation state Mach Number and its influence and properties, Isentropic Flow, Rayleigh and Fanno Flow. Deflagration and Detonation – Normal shock and oblique shock waves	
UNIT II – THERMODYNAMICS OF AIRCRAFT ENGINES	**[9 hours]**
Theory of Aircraft propulsion – Thrust – Various efficiencies – Different propulsion systems – Turboprop – Ram Jet – Turbojet, Turbojet with after burner, Turbo fan and Turbo shaft. Variable thrust- nozzles – vector control.	
UNIT III – PERFORMANCE CHARACTERISTICS OF AIRCRAFT ENGINES	**[9 hours]**
Engine - Aircraft matching – Design of inlets and nozzles – Performance characteristics of Ramjet, Turbojet, Scramjet and Turbofan engines.	

UNIT IV – ROCKET PROPULSION	[9 hours]
Theory of rocket propulsion – Rocket equations – Escape and Orbital velocity – Multi-staging of Rockets – Space missions – Performance characteristics – Losses and efficiencies.	
UNIT V – ROCKET THRUST CHAMBER	**[10hours]**
Combustion in solid and liquid propellant classification – rockets of propellants and Propellant Injection systems – Non-equilibrium expansion and supersonic combustion – Propellant feed systems – Reaction Control Systems - Rocket heat transfer.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Explain the basics of Compressible fluid flow	K2
CO2	Interpret the working principle of aircraft system	K2
CO3	Solve the performance characteristics of air craft engines like Ramjet, Turbojet, Scramjet and Turbofan engines	K3
CO4	Interpret the working principle of rocket propulsion systems	K2
CO5	Explain the various propellant and combustion system used in rockets	K2

COs and POs Mapping:

COs	POs		
	1	2	3
CO1	2	-	2
CO2	2	-	2
CO3	2	-	2
CO4	2	-	2
CO5	2	-	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Bonney E.A., Zucrow N.J,. Principles of Guided Missile Design, Van Nostranc Co.,

1956.

2. Khajuria P.R. and Dubey S.P., Gas Turbines and Propulsive Systems, Dhanpat Rai Publications, 2003.
3. Mattingly J.D., Elements of Gas turbine Propulsion, McGraw Hill, 1st Edition, 1997.

Reference Books:

1. Philip G. Hill and Carl R. Peterson, Mechanics and Thermodynamics of Propulsion, Second Edition, Addition – Wesley Publishing Company, New York, 2009.
2. S.M.Yahya, Fundamentals of Compressible Flow, Third edition, New Age International Pvt. Ltd, 2003.
3. Zucrow N.J., Principles of Jet Propulsion and Gas Turbines, John Wiley and Sons, New York, 1970.
4. Zucrow N.J., Aircraft and Missile Propulsion, Vol. I and Vol. II, John Wiley and Sons Inc, New York, 1975.

Web Links and Video Lectures (E-Resources):

1. Compressible fluid flow through variable area devices:https://archive.nptel.ac.in/courses/101/108/101108086/
2. Aircraft propulsion: https://onlinecourses.nptel.ac.in/noc21_me95/preview
3. Aircraft Performance : https://archive.nptel.ac.in/courses/101/104/101104061/
4. Rocket propulsion: https://archive.nptel.ac.in/courses/101/106/101106082/
5. Fundamentals of supersonic and hyper sonic flow: https://onlinecourses.nptel.ac.in/noc24_ae12/preview

Suggested Skill Activities:

1. What type of gas flow occurs when the flow velocity is less than the speed of sound and disturbances propagate upstream?
2. What is the purpose of the dual ignition system on an aircraft?

Course Code:	**24TE112**	**Course Title:**	**HYDROGEN AND FUEL CELL TECHNOLOGIES**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To study in detail on the hydrogen production methodologies, possible applications and various storage options.
- To understand the working principle of a typical fuel cell, its types and to elaborate on its thermodynamics and kinetics.
- To study the cost effectiveness and eco-friendliness of Fuel Cells.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – HYDROGEN – BASICS AND PRODUCTION TECHNIQUES	**[9hours]**
Hydrogen – physical and chemical properties, salient characteristics. Production of hydrogen – steam reforming – water electrolysis – gasification and woody biomass conversion – biological hydrogen production – photo dissociation – direct thermal or catalytic splitting of water.	
UNIT II – HYDROGEN STORAGE AND APPLICATIONS	**[9 hours]**
Hydrogen storage options – compressed gas – liquid hydrogen – Hydride – chemical Storage – comparisons. Safety and management of hydrogen. Applications of Hydrogen	
UNIT III FUEL CELLS	**[9 hours]**
History – principle - working - thermodynamics and kinetics of fuel cell process – performance evaluation of fuel cell – comparison on battery Vs fuel cell.	
UNIT IV – FUEL CELL – TYPES	**[9 hours]**

Types of fuel cells – AFC, PAFC, SOFC, MCFC, DMFC, PEMFC – relative merits and demerits.	
UNIT V–APPLICATION OF FUEL CELL AND ECONOMICS	**[9hours]**
Fuel cell usage for domestic power systems, large scale power generation, Automobile, Space. Economic and environmental analysis on usage of Hydrogen and Fuel cell. Future trends in fuel cells.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Classify the basics of fuel cells	K2
CO2	Explain the working principles of Hydrogen storage technologies	K2
CO3	Infer the working principles of fuel cells	K2
CO4	Interpret the merits and demerits of various types of fuel cells	K2
CO5	Illustrate the application of fuel cells and its economics	K2

COs and POs Mapping:

COs	**POs**		
	1	**2**	**3**
CO1	**2**	**1**	-
CO2	**2**	**1**	-
CO3	**2**	**1**	-
CO4	**2**	**1**	-
CO5	**2**	**1**	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Viswanathan B. and Aulice Scibioh.M, Fuel Cells – Principles and Applications, Universities Press, 2006.
2. Rebecca L. and Busby, Hydrogen and Fuel Cells: A Comprehensive Guide, Penn Well Corporation, Oklahoma, 2005.
3. Bent Sorensen (Sørensen), Hydrogen and Fuel Cells: Emerging Technologies and Applications, Elsevier, UK 2005.

Reference Books:

1. Kordesch K. and G.Simader, Fuel Cell and Their Applications, Wiley-Vch, Germany 1996.
2. Hart A.B. and G.J.Womack, Fuel Cells: Theory and Application, Prentice Hall, New York Ltd., London 1989.
3. Jeremy Rifkin, The Hydrogen Economy, Penguin Group, USA 2002.
4. Barclay F.J., Fuel Cells, Engines and Hydrogen, Wiley, 2009.

Web Links and Video Lectures (E-Resources):

1. Introduction about hydrogen energy :

   https://archive.nptel.ac.in/courses/103/101/103101215/

2. Hydrogen Energy: Production, Storage

   :https://onlinecourses.nptel.ac.in/noc22_ch66/

3. Introduction about fuel cell https://www.youtube.com/watch?v=L2VSOccUrSk

4. Fuel cell technology https://archive.nptel.ac.in/courses/103/102/103102015/

5. Fuel cell application https://www.youtube.com/watch?v=62363H_I_Qk

Suggested Skill Activities:

1. What are two common ways to produce hydrogen today?
2. How do fuel cells generate electricity from hydrogen?
3. How do you boost the amount of electricity a fuel cell system produces?
4. When hydrogen is used in a fuel cell to create electricity, what is emitted?

Course Code:	24TE113	Course Title:	ENERGY RESOURCES
Credits:	3	L – T – P	3-0-0

Course objectives:

To impart knowledge on the

- To explain concept of various forms of Non-renewable and renewable energy.
- To outline division aspects and utilization of renewable energy sources for both domestics and industrial applications.
- To study the environmental and cost economics of using renewable energy sources compared to fossil fuels.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – COMMERCIAL ENERGY	[9hours]
Coal, Oil, Natural gas, Nuclear power and Hydro - their utilization pattern in the past, present and future projections of consumption pattern - Sector-wise energy consumption – environmental impact of fossil fuels – Energy scenario in India – Growth of energy sector and its planning in India	
UNIT II – SOLAR ENERGY	**[9 hours]**
Solar radiation at the earth’s surface – solar radiation measurements – estimation of average solar radiation - solar thermal flat plate collectors - concentrating collectors – solar thermal applications - heating, cooling, desalination, drying, cooking, etc – solar thermal electric power plant - principle of photovoltaic conversion of solar energy, types of solar cells – Photovoltaic applications: battery charger, domestic lighting, street lighting, water pumping etc - solar PV power plant – Net metering concept.	

UNIT III – WIND ENERGY	[9 hours]
Nature of the wind – power in the wind – factors influencing wind – wind data and energy estimation - wind speed monitoring - wind resource assessment - Betz limit - site selection – wind energy conversion devices - classification, characteristics, applications – offshore wind energy - Hybrid systems - safety and environmental aspects – wind energy potential and installation in India - Repowering concept	
UNIT IV – BIO-ENERGY	**[9 hours]**
Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - direct combustion – biomass gasification - pyrolysis and liquefaction – biochemical conversion - anaerobic digestion - types of biogas Plant - applications - alcohol production from biomass – bio diesel production – Urban waste to energy conversion - Biomass energy programme in India.	
UNIT V – OTHER TYPES OF ENERGY	**[9hours]**
Ocean energy resources - principle of ocean thermal energy conversion (OTEC) - ocean thermal power plant - ocean wave energy conversion - tidal energy conversion – small hydro - geothermal energy - geothermal power plant – hydrogen production and storage - Fuel cell – principle of working - various types - construction and applications	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Outline the commercial energy and renewable energy sources.	K2
CO2	Explain the working principle of Solar energy systems	K2
CO3	Explain the working principle of Wind energy systems	K2
CO4	Explain the working principle of Bio energy systems	K2
CO5	Explain the working principle of other energy systems	K2

COs and POs Mapping:

COs	POs		
	1	**2**	**3**
CO1	**2**	**-**	2
CO2	**2**	**-**	2
CO3	**2**	**-**	2
CO4	**2**	**-**	2
CO5	**2**	**-**	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	**2**	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Sukhatme S.P., "Solar Energy", Tata McGraw Hill, 1984.
2. Twidell J.W. and Weir A., "Renewable Energy Sources", EFN Spon Ltd., 1986.
3. Kishore V.V.N., "Renewable Energy Engineering and Technology", Teri Press, New Delhi, 2012
4. Peter Gevorkian, "Sustainable Energy Systems Engineering," McGraw Hill, 2007.
5. Kreith F. and Kreider J.F., "Principles of Solar Engineering", McGraw-Hill, 1978.

Reference Books:

1. Godfrey Boyle, "Renewable Energy Power for a Sustainable Future", Oxford University Press, U.K, 1996.
2. Veziroglu T.N., Alternative Energy Sources", Vol 5 and 6, McGraw-Hill, 1990.
3. Anthony San Pietro, "Biochemical and Photosynthetic aspects of Energy Production", Academic Press, 1980.
4. Bridgurater A.V., "Thermochemical processing of Biomass", Academic Press, 1981.
5. Bent Sorensen, "Renewable Energy", Elsevier, Academic Press, 2011.

Web Links and Video Lectures (E-Resources):

1. **COMMERCIAL ENERGY** https://archive.nptel.ac.in/courses/103/107/103107157/
2. Solar energyhttps://onlinecourses.nptel.ac.in/noc20_ph14/
3. Wind energy https://archive.nptel.ac.in/courses/103/103/103103206/
4. Bio energy https://onlinecourses.nptel.ac.in/noc19_bt16/preview
5. Ocean and other thermal energy https://www.youtube.com/watch?v=DD0Y6Snxpdk

Suggested Skill Activities:

1. What happens during the process nuclear fission?
2. Why is nuclear energy nonrenewable?
3. What can solar cells be used in?
4. What are the Advantages of Fossil Fuels

Course Code:	**24TE114**	**Course Title:**	**ADVANCED INTERNAL COMBUSTION ENGINES**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To gain insight on the working principle of spark ignition engines and compression ignition engines.
- To study the pollutant formation and its control in IC engines.
- To study the recent technologies adopted in IC engine applications

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – SPARK IGNITION ENGINES	**[9hours]**
Spark ignition Engine mixture requirements – Fuel – Injection systems – Mono point, Multipoint injection, Direct injection – Stages of combustion – Normal and abnormal combustion – factors affecting knock – Combustion chambers.	
UNIT II – COMPRESSION IGNITION ENGINES	**[9 hours]**
States of combustion in C.I. Engine – Direct and indirect injection systems – Combustion chambers – Fuel spray behavior – spray structure, spray penetration and evaporation – air motion – Introduction to Turbo charging.	
UNIT III – POLLUTANT FORMATION AND CONTROL	**[9 hours]**
Pollutant – Sources – Formation of carbon monoxide, Unburnt hydrocarbon, NOx, Smoke and Particulate matter – Methods of controlling Emissions – Catalytic converters and Particulate Traps – Methods of measurements and Introduction to emission norms and Driving cycles	

UNIT IV – ALTERNATIVE FUELS	**[9 hours]**
Alcohol, Hydrogen, Natural Gas and Liquefied Petroleum Gas- Properties, Suitability, Merits and Demerits as fuels, Engine Modifications.	
UNIT V – RECENT TRENDS	**[9hours]**
Lean Burn Engines – Stratified charge Engines – homogeneous charge compression ignition engines – Plasma Ignition – Measurement techniques – laser Doppler, Anemometry. Use of nano technology in IC Engines.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Summarize the various methods of combustion and injection systems on a spark ignition engine	K2
CO2	Demonstrate the various methods of combustion, spray behavior and injection systems on a Compressed Ignition engine	K2
CO3	Contrast the emission and control in SI & CI Engines	K2
CO4	Illustrate the properties merits and demerits of various alternative fuels	K2
CO5	Explain the recent trends of advanced combustion and measurement techniques.	K2

COs and POs Mapping:

COs	**POs**		
	1	**2**	**3**
CO1	**2**		2
CO2	**2**		
CO3	**2**		2
CO4	**2**		2
CO5	**2**		2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Duffy Smith, Auto fuel Systems, The Good Heart Willox Company, Inc., 1989.
2. Heywood, J.B., Internal Combustion Engine Fundamentals, McGraw-Hill, 1988.
3. K.K. Ramalingam, Internal Combustion Engine fundamentals, Scitech Publications, 2002.

Reference Books:

1. Kirpal Singh, Automobile Engineering Vol - I, Standard Publishers, Delhi 2013.
2. R.B. Mathur and R.P.Sharma, Internal Combustion Engines, Dhanapat Rai Publications, 1993.
3. V. Ganesan, Internal Combustion Engines, II Edition, Tata McGraw-Hill Education, 2002.
4. Willard W. Pulkrabek, Engineering Fundamentals of the Internal Combustion Engine, Prentice Hall, 1997.

Web Links and Video Lectures (E-Resources):

1. Ignition systems http://acl.digimat.in/nptel/courses/video/112103262/L14.html
2. Alternatives fuels https://archive.nptel.ac.in/courses/103/105/103105110/
3. IC engine pollution control https://www.youtube.com/watch?v=aI8GcsTiL30
4. Combustion engine https://archive.nptel.ac.in/courses/112/103/112103262/

Suggested Skill Activities:

1. What is the stoichiometric ratio of the Air + Gasoline mixture?
2. What is the compression ratio of a typical spark-ignition (SI) engine?
3. What is Compression ratio/Expansion ratio/Clearance ratio?
4. How does knocking occur in a Petrol/Diesel engine
5. How does a Turbocharger / Supercharger work?

Course Code:	24TE115	Course Title:	CRYOGENIC ENGINEERING
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To give introductory knowledge of cryogenic Engineering.
- To impart knowledge in liquefaction, separation of cryogenics gases and working of cryocoolers.
- To embark on a research career in Cryogenic Engineering.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – INTRODUCTION	[9hours]
Insight on Cryogenics, Properties of Cryogenic fluids, Material properties at Cryogenic Temperatures. Applications of Cryogenics in Space Programs, Superconductivity, Cryo Metallurgy, Medical applications.	
UNIT II – LIQUEFACTION CYCLES	**[9 hours]**
Carnot Liquefaction Cycle, F.O.M. and Yield of Liquefaction Cycles. Inversion Curve – Joule Thomson Effect. Linde Hampson Cycle, Precooled Linde Hampson Cycle, Claudes Cycle Dual Cycle, Ortho-Para hydrogen conversion, Eollins cycle, Simpson cycle, Critical Components in Liquefaction Systems.	
UNIT III – SEPARATION OF CRYOGENEIC GASES	**[9 hours]**
Binary Mixtures, T-C and H-C Diagrams, Principle of Rectification, Rectification Column Analysis- McCabe Thiele Method. Adsorption Systems for purification.	

UNIT IV – CRYOGENIC REFRIGERATORS	[9 hours]
J. T. Cryocoolers, Stirling Cycle Refrigerators, G.M.Cryocoolers, Pulse Tube Refrigerators Regenerators used in Cryogenic Refrigerators, Dilution refrigerators, Magnetic Refrigerators.	
UNIT V – HANDLING OF CRYOGENS	**[9hours]**
Cryogenic Dewar, Cryogenic Transfer Lines. Insulations used in Cryogenic Systems, Instrumentation to measure Flow, Level and Temperature	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Explain the Concepts of Cryogenics	K2
CO2	Solve the various cycles during liquefaction.	K3
CO3	Explain the various methods adopted in the separation of cryogenic gases.	K2
CO4	Explain the working principle of cryogenic refrigerator.	K2
CO5	Explain the concepts in handling of cryogens.	K2

COs and POs Mapping:

COs	POs		
	1	2	3
CO1	2	-	-
CO2	2	-	-
CO3	2	-	-
CO4	2	-	-
CO5	2	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Klaus D. Timmerhaus and Thomas M. Flynn, Cryogenic Process Engineering, PlenumPress,New York, 1989.
2. Randall F. Barron, Cryogenic Systems, McGraw-Hill, 1985.
3. Scott R.B., Cryogenic Engineering, Van Nostrand and Co., 1962.

Reference Books:

1. .Herald Weinstock, Cryogenic Technology, Boston Technical Publishers, inc., 1969.

2. Robert W. Vance, Cryogenic Technology, John wiley & Sons, Inc., New York, London.

3. G.Venkatarathnam, Cryogenic Mixed Refrigerant Processes, Springer Publication, 2010.

4. J.G.Weisend, Hand Book of Cryogenic Engineering —II, Taylor and Francis, 1998.

Web Links and Video Lectures (E-Resources):

1. Cryogenic engine https://www.youtube.com/watch?v=4gGMBNEzeuc
2. Introduction https://www.youtube.com/watch?v=4gGMBNEzeuc&t=10s
3. LIQUEFACTION CYCLES https://youtu.be/UOi9JXlicXA
4. Safety of crogenic https://nptel.ac.in/courses/112101004

Suggested Skill Activities:

1. What is the meaning of negative exergy destruction in a cryogenic system?
2. What is cryogenic machining used for?
3. How does cryogenic machining work?
4. What are the benefits of cryogenic machining?
5. What types of tools are used in cryogenic machining
6. What safety precautions are needed for cryogenic machining?

Course Code:	**24TE116**	**Course Title:**	**REFRIGERATION SYSTEMS**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To study the cycle analysis pertaining to Refrigeration systems.
- To study the performance of system components and their balancing in cycles.
- To study the significance of Refrigerants and their impact on the environment

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – INTRODUCTION AND REFRIG ERANTS	**[9hours]**
Applications, Unit of refrigeration – Ideal cycles - Classification of Refrigerants, Refrigerant properties, Oil Compatibility, Environmental Impact-Montreal / Kyoto protocols-Eco Friendly Refrigerants, alternatives to HCFCS, Secondary Refrigerants.	
UNIT II – REFRIGERATION CYCLES – ANALYSIS	**[9 hours]**
Development of Vapor Compression Refrigeration Cycle from Reverse Carnot Cycle-conditions for high COP-deviations from ideal vapor compression cycle, Multipressure System, Cascade Systems-Analysis. Vapor Absorption Systems-Aqua Ammonia & Li-Br Systems, Steam Jet Refrigeration Thermo Electric Refrigeration, Air Refrigeration cycles, Heat pumps.	
UNIT III – REFRIGERATION SYSTEM COMPONENTS	**[9 hours]**
Compressor- Types, performance, Characteristics, Types of Evaporators & Condensers and their functional aspects, Expansion Devices and their Behaviour with fluctuating load, cycling controls, other components such as Accumulators, Receivers, Oil Separators, Strainers, Driers,	

Check Valves, Solenoid Valves Defrost Controllers, etc.	
UNIT IV – SYSTEM BALANCING	**[9 hours]**
Balance points and system simulation - compressor, condenser, evaporator and expansion devices performance – Complete system performance; graphical and mathematical analysis – sensitivity analysis.	
UNIT V – ELECTRICAL DRIVES & CONTROLS	**[9hours]**
Electric circuits in Refrigeration systems, Refrigerant control devices, Types of Motors, Starters, Relays, Thermostats, Microprocessor based control systems, Pressure controls and other controls, Acoustics and noise controls.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Summarize the various refrigerants used in Refrigeration system	K2
CO2	Make use of the various cycles of Refrigeration	K3
CO3	Explain the working Principle of components of refrigerated system	K2
CO4	Utilize the performance of refrigeration devices	K3
CO5	Explain the working principle of drives and control devices used in refrigerated systems	K2

COs and POs Mapping:

COs	**POs**		
	1	**2**	**3**
CO1	**2**	**2**	-
CO2	**2**	**2**	-
CO3	**2**	**2**	-
CO4	**2**	**2**	-
CO5	**2**	**2**	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Arora C.P., Refrigeration and Air conditioning, McGraw Hill, 3rd Ed., 2010.
2. Dossat R.J., Principles of refrigeration, John Wiley, S.I. Version, 2001.
3. Jordan and Priester, Refrigeration and Air conditioning 1985.

Reference Books:

1. Kuehn T.H., Ramsey J.W. and Threlkeld J.L., Thermal Environmental Engineering, 3rd Edition, Prentice Hall, 1998.
2. Langley Billy C., ‘Solid state electronic controls for HVACR, Prentice-Hall 1986.
3. Rex Milter, Mark R.Miller., Air conditioning and Refrigeration, McGraw Hill, 2006.

Stoecker W.F., Refrigeration and Air conditioning, McGraw-Hill BookCompany,1989

Web Links and Video Lectures (E-Resources):

1. **Introduction about refrigeration**
   https://www.youtube.com/watch?v=nlsNmhiID74
2. **Application of refrigeration system**
   https://archive.nptel.ac.in/courses/112/105/112105129/
3. **Refrigeration cycle** https://www.youtube.com/watch?v=kC-VswG3W8s
4. **Fundamental of electrical drives**
   https://www.youtube.com/watch?v=1AT1yuQ9awM&list=PLFW6lRTa1g83sIfVY1p1xGqPGYUmXyahx

Suggested Skill Activities:

1. What does a vapour absorption refrigerator use in the form of a refrigerant?
2. one ton of refrigeration in the S.J. unit is:
3. At a domestic refrigerator’s back, the bank of tubes is known as:
4. Which refrigerants is highly flammable and toxic?

Course Code:	**24TE117**	**Course Title:**	**ELECTRONIC ENGINE MANAGEMENT SYSTEMS**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To provide basic grounding on electronics
- To learn the various sensors used in engine management systems
- Give an overview of different types of ignition systems
- To understand the significance of gasoline injection systems
- To know the latest advancements in Diesel injection systems

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS	**[9hours]**
Components for Electronic Engine Management System- Open and Closed Loop Control Strategies- PID Control- Look Up Tables- Introduction to Modern Control Strategies Like Fuzzy Logic and Adaptive Control. Switches- Active Resistors- Transistors- Current Mirrors/Amplifiers- Voltage and Current References- Comparator- Multiplier. Amplifier- Filters- A/D and D/A Converters.	
UNIT II – SENSORS AND ACTUATORS	**[9 hours]**
Inductive- Hall Effect- Thermistor- Piezo Electric- Piezoresistive- Based Sensors. Throttle Position- Mass Air Flow- Crank Shaft Position- Cam Position- Engine Speed Sensor- Exhaust Oxygen Level (Two Step- Linear Lambda and Wideband)- Knock- Manifold Temperature and Pressure Sensors. Solenoid- Relay (Four and Five Pin)- Stepper Motor	

UNIT III – SI ENGINE MANAGEMENT	[9 hours]
Layout and Working of SI Engine Management Systems. Group and Sequential Injection Techniques. MPFI- GDI- Advantages of Electronic Ignition Systems. Types of Solid State Ignition Systems and Their Principle of Operation- Contactless (BREAKERLESS) Electronic Ignition System- Electronic Spark Timing Control	
UNIT IV – CI ENGINE MANAGEMENT	**[9 hours]**
Fuel Injection System Parameters Affecting Combustion- Noise and Emissions in CI Engines. Electronically Controlled Unit Injection System. Common Rail Fuel Injection System. Working of Components Like Fuel Injector- Fuel Pump- Rail Pressure Limiter- Flow Limiter- EGR Valve.	
UNIT V – DIGITAL ENGINE CONTROL SYSTEM	**[9hours]**
Cold Start and Warm Up Phases- Idle Speed Control- Acceleration and Full Load Enrichment- Deceleration Fuel Cut-off. Fuel Control Maps- Open Loop and Closed Loop Control – Integrated Engine Control System- Electromagnetic Compatibility – EMI Suppression Techniques – Electronic Dash Board Instruments – Onboard Diagnosis System.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Explain the basic electronic components and controls used in Sensors	K2
CO2	Explain the different types of sensors used in an automobile engine	K2
CO3	Explain the ignition and injection methods used in an SI engine	K2
CO4	Illustrate the fuel injection systems in a diesel engine and the emission control systems	K2
CO5	Explain the electronic systems used in the fuel control system and the dash board unit.	K2

COs and POs Mapping:

COs	POs		
	1	**2**	**3**
CO1	**2**		2
CO2	**2**		2
CO3	**1**	**1**	
CO4	**2**		1
CO5	**2**		

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Understanding Automotive Electronics William B Ribbens, SAE 1998
2. Automobile Electronics by Eric Chowanietz SAE

Reference Books:

1. Diesel Engine Management by Robert Bosch, SAE Publications, 3rd Edition, 2004
2. Gasoline Engine Management by Robert Bosch, SAE Publications, 2nd Edition, 2004

Web Links and Video Lectures (E-Resources):

1. **Fundamental of automotive systems**

   https://archive.nptel.ac.in/courses/107/106/107106088/
2. **Digital engine control system**

   https://archive.nptel.ac.in/courses/108/105/108105186/
3. fuel system http://acl.digimat.in/nptel/courses/video/112106299/L26.html
4. **senor and actuars https://onlinecourses.nptel.ac.in/noc21_ee32/preview**

Suggested Skill Activities:

1. What are the important parameters in a gasoline engine that can be controlled?
2. Hall effect pickup use
3. LVDT is used to measure
4. Thermistors are desirable because of their
5. Seebeck effect is used in?
6. Catalytic converters use lambda sensors to keep?

Course Code:	**24TE118**	**Course Title:**	**COGENERATION AND WASTE HEAT RECOVERY SYSTEMS**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To analyze the basic energy generation cycles.
- To detail about the concept of cogeneration, its types and probable areas of applications.
- To study the significance of waste heat recovery systems and carry out its economic analysis.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – INTRODUCTION	**[9hours]**
Introduction – principles of thermodynamics – cycles – topping – bottoming – combined cycle-organic rankine cycles – performance indices of cogeneration systems – waste heat recovery – sources and types – concept of tri and quad generation	
UNIT II – COGENERATION TECHNOLOGIES	**[9 hours]**
Configuration and thermodynamic performance – steam turbine congeneration systems – gas turbine cogeneration systems – reciprocating IC engines cogeneration systems – combined cycles cogeneration systems – advanced cogeneration systems: fuel cell, Stirling engines etc	
UNIT III – ISSUES AND APPLICATIONS OF COGENERATION TECHNOLOGIES	**[9 hours]**
Cogeneration plants electrical interconnection issues – utility and cogeneration plant interconnection issues – applications of cogeneration in utility sector – industrial sector –	

building sector – rural sector – impacts of cogeneration plants – fuel, electricity and environment.	
UNIT IV – WASTE HEAT RECOVERY SYSTEMS	**[9 hours]**
Selection criteria for waste heat recovery technologies – recuperators – Regenerators – economizers – plate heat exchangers – thermic fluid heaters – Waste heat boilers – classification, location, service conditions, design Considerations – fluidized bed heat exchangers – heat pipe exchangers – heat pumps – sorption systems.	
UNIT V – ECONOMIC ANALYSIS	**[9hours]**
Investment cost – economic concepts – measures of economic performance – procedure for economic analysis – examples – procedure for optimized system selection and design – load curves – sensitivity analysis – regulatory and financial frame work for cogeneration and waste heat recovery systems.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Explain the basic concepts of waste heat recovery systems.	K2
CO2	Illustrate the technologies in cogeneration systems.	K2
CO3	Explain the issues and applications of cogeneration technologies.	K2
CO4	Explain the working of various waste heat recovery systems.	K2
CO5	Explain the concepts of economic analysis of waste heat recovery systems.	K2

COs and POs Mapping:

COs	**POs**		
	1	**2**	**3**
CO1	**2**	**1**	**-**
CO2	**2**	**1**	**-**
CO3	**-**	**1**	**-**
CO4	**2**	**-**	**-**
CO5	**2**	**1**	**-**

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Charles H. Butler, Cogeneration, McGraw Hill Book Co., 1984.
2. De Nevers, Noel, Air Pollution Control Engineering, McGraw Hill, New York,1995.
3. EDUCOGEN – The European Educational tool for cogeneration, Second Edition, 2001.

Reference Books:

1. Energy Cogeneration Hand book, George Polimveros, Industrial Press Inc, New York 1982.
2. Horlock JH., Cogeneration - Heat and Power, Thermodynamics and Economics, Oxford, 1987.
3. Institute of Fuel, London, Waste Heat Recovery, Chapman & Hall Publishers, London, 1963.
4. Seagate Subrata, Lee SS EDS, Waste Heat Utilization and Management, Hemisphere, Washington, 1983.

Web Links and Video Lectures (E-Resources):

1. **Co-generation system https://onlinecourses.nptel.ac.in/noc23_ge47/preview**
2. **Thermodynamics basic https://onlinecourses.nptel.ac.in/noc22_me88/preview**
3. **Energy conservation https://archive.nptel.ac.in/courses/112/105/112105221/**
4. **Economic analysis https://www.youtube.com/watch?v=rey19R8ng0A**

Suggested Skill Activities:

1. Having two separate units for process heat and power is?
2. A plant producing both, electrical power & process heat simultaneously is?
3. The waste heat source with the highest potential to recover quality waste heat is
4. Cogeneration is the simultaneous generation of
5. The Ranking Cycle is related to

PROFESSIONAL ELECTIVES SEMESTER II, (ELECTIVE III, IV & V)

S. No.	Course Code	Course Title	Course Category	L	T	P	C
PROFESSIONAL ELECTIVE COURSES							
1.	24TE211	Design of Turbo Machines	PEC	3	0	0	3
2.	24TE212	Electronics Cooling and Packaging	PEC	3	0	0	3
3.	24TE213	Air Conditioning Systems	PEC	3	0	0	3
4.	24TE214	Alternate Fuels for IC Engines	PEC	3	0	0	3
5.	24TE215	Design of Heat Exchangers	PEC	3	0	0	3
6.	24TE216	Battery Thermal Management System	PEC	3	0	0	3
7.	24TE217	Advanced Energy Storage Technologies	PEC	3	0	0	3
8.	24TE218	Hybrid and Electric Vehicles	PEC	3	0	0	3
9.	24TE219	Advanced Power Plant Engineering	PEC	3	0	0	3

Course Code:	**24TE211**	**Course Title:**	**DESIGN OF TURBO MACHINES**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To analyze the basic energy generation cycles.
- To detail about the concept of cogeneration, its types and probable areas of applications.
- To study the significance of waste heat recovery systems and carry out its economic analysis.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – INTRODUCTION	**[9hours]**
Energy transfer between fluid and rotor velocity triangles for a generalised turbo machines – velocity triangle. Euler's equation for turbo machines and its different forms. Degree of reaction in turbo-machines – various efficiencies – isentropic, mechanical, thermal, overall and polytropic – fan laws – Dimensionless parameters – Specific speed – Cordier Diagram	
UNIT II – CENTRIFUGAL BLOWERS	**[9 hours]**
Centrifugal Blowers: Theoretical characteristic curves, velocity triangles, losses and hydraulic efficiency, flow through impeller casing, inlet, nozzle, volute, diffusers. Leakage losses, mechanical losses, multi-vane impellers, cross flow fans. Selection of Centrifugal blower for duct flow.	
UNIT III – AXIAL FLOW FANS	**[9 hours]**

Rotor design using airfoil theory, vortex theory, cascade effects, degree of reaction, blade twist, stage design, surge and stall, stator and casing, mixed flow impellers. Selection of axial fans / blower for duct flow.	
UNIT IV – COMPRESSORS	**[9 hours]**
Reciprocating compressors, Construction Type – open, hermetic and semi sealed, effect of cylinder cooling, heating and friction. Dynamic compressor - centrifugal compressor, velocity triangles, performance characteristics, part load operation, Capacity control. Selection of compressor for different applications.	
UNIT V – DESIGN AND APPLICATIONS	**[9hours]**
Special design and applications of blowers / compressors for air conditioning plants, cooling towers, ventilation systems, booster systems - turbocharger.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Apply the fundamentals of Turbo machinery and solve the problems on Energy Transfer	K3
CO2	Apply the Centrifugal Blowers and Fans for various applications.	K3
CO3	Summarize the different types of axial fan design and performance.	K2
CO4	Interpret the various compressors based on its performance.	K2
CO5	Choose the fans / blowers /compressors for the given applications	K3

COs and POs Mapping:

COs	**POs**		
	1	**2**	**3**
CO1	**2**	**1**	-
CO2	**2**	**1**	-
CO3	**-**	**1**	-
CO4	**2**	**-**	-
CO5	**2**	**1**	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Austin H. Church, Centrifugal pumps and blowers, John Wiley and Sons, 2017
2. Dixon, Fluid Mechanics, Thermodynamics of turbo machinery Pergamon Press, 1984.

Reference Books:

1. Fans & Ventilation A practical guide (Bill) cory WTW, Elsevier, 2005.
2. Jay Matley., Fluid Movers: Pumps, Compressors, Fans and Blowers, McGraw-Hill Publications, 1990.
3. Royce N. Brown, Compressors: Selection and Sizing, Elsevier, 2005.
4. Tony Giampaolo, Compressor Hand Book Principles and Practice, The Fairmont Press, 2010.
5. Yahya S. M., Turbines compressors and fans(4th Edition), Tata McGraw-Hill, 2010.
6. Forsthoffer's rotating equipment handbooks Volume 3: Compressors, Elsevier Advanced Technolgy, UK, 2005

Web Links and Video Lectures (E-Resources):

1. Introduction to Turbomachinery

   https://archive.nptel.ac.in/courses/112/104/112104305/
2. Centrifugal blowers: https://www.youtube.com/watch?v=b1dyUVA19kQ
3. Axial flow fans: https://archive.nptel.ac.in/courses/101/105/101105089/
4. Compressors: https://www.youtube.com/watch?v=NakOoD-G0IY
5. Design and Applications: https://www.youtube.com/watch?v=vRx8UH9cqB0

Course Code:	24TE212	Course Title:	ELECTRONICS COOLING AND PACKAGING
Credits:	3	L – T – P	3-0-0

Course objectives:

To impart knowledge on the

- To analyze the basic energy generation cycles.
- To detail about the concept of cogeneration, its types and probable areas of applications.
- To study the significance of waste heat recovery systems and carry out its economic analysis.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – INTRODUCTION	[9hours]
Electronic Equipment, Components of Electronic Systems, Thermal management in electronic devices - Packaging Trends. Electronic packaging and interconnection technology. Conduction in Electronic Equipment: Thermal Conductivity, Thermal Resistances, Conductivity in Solids, Conductivity in Fluids, Conduction—Steady State, Conduction in Simple Geometries, Conduction through a Plane Wall, Conduction through Cylinders and Spheres.	
UNIT II – ELECTRONICS ASSISTED IN THERMAL COMPONENTS	**[9 hours]**
Conduction—Transient, Lumped Capacitance Method, Conduction in Extended Surfaces. Fin Efficiency, Fin Optimization, Fin Surface Efficiency, Thermal Contact Resistance in Electronic Equipment, Discrete Heat Sources and Thermal Spreading. Fluid Dynamics for Electronic Equipment- Boundary Layer Theory, Turbulent Flow, Loss Coefficients and Dynamic Drag, Fans and Pumps, Electronic Chassis Flow.	
UNIT III – IMPACT OF RADIATION ON SURFACE	**[9 hours]**

Radiation Heat Transfer in Electronic Equipment, The Electromagnetic Spectrum, Radiation Equations, Stefan-Boltzmann Law, Surface Characteristics, Emittance, Emittance Factor, Emittance from Extended Surface, Absorptance, Reflectance, Specular Reflectance, Heat Transfer with Phase Change. Combined Modes of Heat Transfer for Electronic Equipment, Radiation and Convection in Parallel	
UNIT IV – ANALYSIS OF ELECTRONIC EQUIPMENT	**[9 hours]**
Introduction to Thermal Design of Electronic Equipment. Analysis of Thermal Failure of Electronic Components. Analysis of Thermal Stresses and Strain, Effect of PCB Bending Stiffness on Wire Stresses, Vibration Fatigue in Lead Wires and Solder Joints. Electronics Cooling Methods in Industry. Heat Sinks, Heat Pipes, Heat Pipes in Electronics Cooling, Thermoelectric Cooling, Immersion Cooling, Cooling Techniques for High Density Electronics.	
UNIT V – COOLING SYSTEMS FOR ELECTRONIC PACKAGES	**[9hours]**
Cooling systems for electronics packages – heat sinks, heat spreaders, heat pipes, microchannels, actuators, fans, cold plates; Thermo-mechanical issues in electronic packages Effects of Vibration – vibrating systems, vibration of axially loaded components, circuit boards, Theorem of Castigliano; Reliability Metrology and Analysis, Environmental Stress Screening	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Identify the basic knowledge about the packaging of electronics	K3
CO2	Utilize the ability of electronic cooling system.	K3
CO3	Relate the radiation through multi electronic devices	K2
CO4	Summarize the performance calculation of Electronics Equipment.	K2
CO5	Applying cooling systems for different thermal sourcing agents	K3

COs and POs Mapping:

COs	**POs**		
	1	**2**	**3**
CO1	**2**	**1**	**-**
CO2	**2**	**1**	**-**
CO3	**-**	**1**	**-**

CO4	**2**	**-**	-
CO5	**2**	**1**	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**Terminal Examination**
	1	**2**	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Rao R. Tummala : Fundamentals of Microsystem Packaging, McGraw Hill, 2001.
2. Richard K. Ulrich &William D. Brown Advanced Electronic Packaging - 2nd Edition: IEEE Press,2006.

Reference Books:

1. Yunus A. Cengel : Heat Transfer – A Practical Approach, McGraw Hill, 2003.
2. The Electronic Packaging Handbook- Glenn R. Blackwell, 1st Edition, 2000 Royce N. Brown, Compressors: Selection and Sizing, Elsevier, 2005.

Web Links and Video Lectures (E-Resources):

1. Introduction of Electronic Equipment : https://nptel.ac.in/courses/113105025
2. Electronics Assisted In Thermal Components :
   https://archive.nptel.ac.in/courses/108/108/108108110/
3. Impact Of Radiation On Surface :
   https://archive.nptel.ac.in/courses/112/107/112107256/
4. Analysis Of Electronic Equipment :
   https://archive.nptel.ac.in/courses/108/101/108101167/
5. cooling systems for electronic packages :
   https://archive.nptel.ac.in/courses/112/105/112105267/

Course Code:	**24TE213**	**Course Title:**	**AIR CONDITIONING SYSTEMS**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To analyze the basic energy generation cycles.
- To detail about the concept of cogeneration, its types and probable areas of applications.
- To study the significance of waste heat recovery systems and carry out its economic analysis.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – PSYCHROMETRY AND AIR CONDITIONING PROCESSES	**[9hours]**
Moist Air properties, use of Psychrometric Chart, Various Psychrometric processes, Air Washer, Adiabatic Saturation. Summer and winter Air conditioning, Enthalpy potential and its insights.	
UNIT II – LOAD ESTIMATION	**[9 hours]**
Thermal comfort – Design conditions – Solar Radiation-Heat Gain through envelopes – Infiltration and ventilation loads – Internal loads – Procedure for heating and cooling load estimation.	
UNIT III – AIR CONDITIONING SYSTEMS	**[9 hours]**
Thermal distribution systems – Single, multi zone systems, terminal reheat systems, Dual duct systems, variable air volume systems, water systems and Unitary type systems.	
UNIT IV – AIR DISTRIBUTION AND CONTROL	**[9 hours]**

Flow through Ducts , Static & Dynamic Losses , Diffusers , Duct Design–Equal Friction Method, System Balancing , Fans & Duct System Characteristics , Fan Arrangement Variable Air Volume systems, Air Handling Units and Fan Coil units – Control of temperature, humidity, air flow and quality.	
UNIT V – HVAC SYSTEM IN AUTOMOBILES	**[9hours]**
Automotive System layout and Components- Commonly used Refrigerants- Safety devices – Climate control – Fuel efficiency aspects.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Demonstrate the psychometrically the Air conditioning processes.	K3
CO2	Experiment with the heat load for summer and winter Air conditioning applications.	K3
CO3	Understand and appreciate the utility of different Air conditioning systems for different applications.	K2
CO4	Develop a fan-duct system for Air conditioning application.	K3
CO5	Understand and appreciate the individual components of an automobile Air conditioning system. Various HVAC system components for various applications in the building requirements.	K2

COs and POs Mapping:

COs	**POs**		
	1	**2**	**3**
CO1	**2**	**1**	**-**
CO2	**2**	**1**	**-**
CO3	**-**	**1**	**-**
CO4	**2**	**-**	**-**
CO5	**2**	**1**	**-**

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. ALI VEDAVARZ, SUNIL KUMAR, Mohammed Iqbal, Hussain Handbook of Heating, Ventilation and Air conditioning for Design Implementation, Industrial press Inc, 2007.
2. Arora C.P., Refrigeration and Air Conditioning, Tata McGraw Hill Pub. Company, 2010.

Reference Books:

1. ASHRAE , Fundamentals and equipment , 4 volumes-ASHRAE Inc. 2005.
2. Carrier Air Conditioning Co., Handbook of Air Conditioning Systems design, McGraw Hill, 1985.
3. Jones, Air Conditioning Engineering, Edward Amold pub. 2001.
4. Kuehn T.H., Ramsey, J.W. and Threlkeld, J.L., Thermal Environmental Engineering, 3rd Edition, Prentice Hall, 1998
5. Langley, Billy C. ,Refrigeration and Air Conditioning Ed. 3, Engie wood Cliffs (N.J) Prentice Hall 1986.

Web Links and Video Lectures (E-Resources):

1. PSYCHROMETRY AND AIR CONDITIONING PROCESSES:

   https://archive.nptel.ac.in/courses/112/107/112107208/
2. LOAD ESTIMATION:

   https://archive.nptel.ac.in/courses/112/105/112105129/
3. AIR CONDITIONING SYSTEMS:

   https://www.youtube.com/watch?v=nvUhiXD63Eg
4. AIR DISTRIBUTION AND CONTROL:

   https://www.youtube.com/watch?v=URazpNDS-u0
5. HVAC SYSTEM IN AUTOMOBILES:

   https://archive.nptel.ac.in/courses/107/106/107106088/

Course Code:	**24TE214**	**Course Title:**	**ALTERNATE FUELS FOR IC ENGINES**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To analyze the basic energy generation cycles.
- To detail about the concept of cogeneration, its types and probable areas of applications.
- To study the significance of waste heat recovery systems and carry out its economic analysis.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – INTRODUCTION	**[9hours]**
Availability, Suitability, Properties, Merits and Demerits of Potential Alternative Fuels – Alcohols, Biodiesel, Hydrogen, Liquefied Petroleum Gas, Natural Gas, Biogas, Fuel standards – ASTM & EN.	
UNIT II – SPECIAL AND SYNTHETIC FUELS	**[9 hours]**
Different synthetic fuels, Merits, and demerits, Dual, Bi-fuel and Pilot injected fuel systems, Fuel additives – types and their effect on performance and emission characteristics of engines, Flexi-fuel systems, Ethers - as fuel and fuel additives, properties and characteristics.	
UNIT III – ALCOHOL FUELS	**[9 hours]**
Alcohols – Properties, Production methods and usage in engines. Blending, dual fuel operation, surface ignition, spark ignition and oxygenated additives. Performance, combustion and emission Characteristics in engines. Issues & limitation in alcohols	

UNIT IV – BIO-DIESEL FUELS	[9 hours]
Vegetable oils and their important properties. Fuel properties characterization. Methods of using vegetable oils – Blending, preheating, Transesterification and emulsification – Performance, combustion and emission characteristics in diesel engines. Third generation biofuels, Ternary and Quaternary fuels, Issues & limitation of using vegetable oils in IC engines	
UNIT V – GASEOUS FUELS	**[9hours]**
Biogas, Natural gas, LPG, Hydrogen – Properties, problems, storage and safety aspects. Methods of utilisation in engines. Performance, combustion and emission characteristics in engines. Issues & limitation in Gaseous fuels	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Identify the potential alternate fuels and their characteristics	**K3**
CO2	Make use of appropriate synthetic fuels and fuel additives for better combustion characteristics	**K3**
CO3	Illustrate the alcohol fuels effectively for lower emissions	**K2**
CO4	Summarize the utilization of Bio-Diesel and its types as a suitable fuel in CI engines	**K2**
CO5	Utilize the different gaseous fuels and predict their performance and combustion characteristics	**K3**

COs and POs Mapping:

COs	POs		
	1	**2**	**3**
CO1	**2**	**1**	**-**
CO2	**2**	**1**	**-**
CO3	**-**	**1**	**-**
CO4	**2**	**-**	**-**
CO5	**2**	**1**	**-**

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Keith Owen and Trevor Eoley, Automotive Fuels Handbook, SAE Publications, 1990.
2. Pundir B.P, I.C. Engines Combustion and Emission, 2010, Narosa Publishing House.

Reference Books:

1. Pundir B.P , Engine Combustion and Emission, 2011, Narosa Publishing House Keith

2. Richard L. Bechtold, Automotive Fuels Guide Book, SAE Publications, 1997

Web Links and Video Lectures (E-Resources):

1. INTRODUCTION: https://archive.nptel.ac.in/courses/112/103/112103262/
2. SPECIAL AND SYNTHETIC FUELS: https://nptel.ac.in/courses/112104033
3. ALCOHOL FUELS: https://www.youtube.com/watch?v=RUYU279222M
4. BIO-DIESEL FUELS: https://www.youtube.com/watch?v=VnGH2EScMDE
5. GASEOUS FUELS : https://archive.nptel.ac.in/courses/103/105/103105110/

Course Code:	**24TE215**	**Course Title:**	**DESIGN OF HEAT EXCHANGERS**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To analyze the basic energy generation cycles.
- To detail about the concept of cogeneration, its types and probable areas of applications.
- To study the significance of waste heat recovery systems and carry out its economic analysis.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – FUNDAMENTALS OF HEAT EXCHANGER	**[9hours]**
Temperature distribution and its implications types–shell and tube heat exchangers–regenerators and recuperators – analysis of heat exchangers–LMTD and effectiveness method.	
UNIT II – STRESS ANALYSIS	**[9 hours]**
Effect of turbulence – friction factor – pressure loss – stress in tubes – header sheets and pressure vessels – thermal stresses, shear stresses –types of failures.	
UNIT III – DESIGN ASPECTS	**[9 hours]**
Heat transfer and pressure loss – flow configuration – effect of baffles – effect of deviations from ideality – design of double pipe – finned tube – shell and tube heat exchangers – simulation of heat exchangers.	
UNIT IV – COMPACT AND PLATE HEAT EXCHANGERS	**[9 hours]**
Types–merits and demerits–design of compact heat exchangers, plate heat exchangers–performance influencing parameters– limitations.	

UNIT V – CONDENSERS AND COOLING TOWERS	[9hours]
Design of surface and evaporative condensers–cooling tower –performance characteristics	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Identify the heat exchangers and illustrate the applications of various types of heat exchangers	K3
CO2	Interpret the significance of stress analysis of heat exchangers	K2
CO3	Apply the design of tubular heat exchangers for various applications	K3
CO4	Apply the design of compact heat exchangers for industrial requirements	K3
CO5	Solve the performance calculation of condensers and cooling towers	K3

COs and POs Mapping:

COs	**POs**		
	1	**2**	**3**
CO1	**2**	**1**	-
CO2	**2**	**1**	-
CO3	**-**	**1**	-
CO4	**2**	**-**	-
CO5	**2**	**1**	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			

End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. SadikKakac, Hongtan Liu, Anchasa Pramuanjaroenkij, "Heat Exchangers Selection, Rating and Thermal Design", CRC Press,Third Edition,2012.
2. Ramesh K.Shah, Dušan P.Sekulić, "Fundamentals of heat exchanger design", John Wiley & Sons, 2003.

Reference Books:

1. Robert W. Serth, "Process heat transfer principles and applications", Academic press, Elesevier, 2010.
2. T. Kuppan, "Heat exchanger design hand book",New York: Marcel Dekker,2009.
3. Arthur.P Frass, "Heat Exchanger Design", John Wiley & Sons,1989.

Web Links and Video Lectures (E-Resources):

1. FUNDAMENTALS OF HEAT EXCHANGER: https://archive.nptel.ac.in/courses/112/105/112105248/
2. STRESS ANALYSIS : https://nptel.ac.in/courses/112105248
3. DESIGN ASPECTS: https://onlinecourses.nptel.ac.in/noc23_me121/preview

4. COMPACT AND PLATE HEAT EXCHANGERS:
   https://www.youtube.com/watch?v=Kj0ebo-vVAg
5. **CONDENSERS AND COOLING TOWERS :**
   https://www.youtube.com/watch?v=XFwm3SJhJMk

Course Code:	**24TE216**	**Course Title:**	**BATTERY THERMAL MANAGEMENT SYSTEM**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To analyze the basic energy generation cycles.
- To detail about the concept of cogeneration, its types and probable areas of applications.
- To study the significance of waste heat recovery systems and carry out its economic analysis.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – INTRODUCTION	**[9hours]**
Introduction to Battery Management System, Cells & Batteries, Nominal voltage and capacity, C rate, Energy and power, Cells connected in series, Cells connected in parallel, Electrochemical and lithiumion cells, Rechargeable cell, Charging and Discharging Process, Overcharge and Undercharge, Modes of Charging.	
UNIT II – BATTERY MANAGEMENT SYSTEM REQUIREMENT	**[9 hours]**
Introduction and BMS functionality, Battery pack topology, BMS Functionality, Voltage Sensing, Temperature Sensing, Current Sensing, BMS Functionality, High-voltage contactor control, Isolation sensing, Thermal control, Protection, Communication Interface, Range estimation, State-of- charge estimation, Cell total energy and cell total power.	
UNIT III – BATTERY STATE OF CHARGE AND STATE OF HEALTH ESTIMATION, CELL BALANCING	**[9 hours]**

Battery state of charge estimation (SOC), voltage-based methods to estimate SOC, Model-based state estimation, Battery Health Estimation, Lithium-ion aging: Negative electrode, Lithium-ion aging: Positive electrode, Cell Balancing, Causes of imbalance, Circuits for balancing.

UNIT IV – MODELLING AND SIMULATION	**[9 hours]**
Equivalent-circuit models (ECMs), Physics-based models (PBMs), Empirical modelling approach, Physics-based modelling approach, simulating an electric vehicle, Vehicle range calculations, simulating constant power and voltage, Simulating battery packs,	
UNIT V – DESIGN OF BATTERY BMS	**[9hours]**
Design principles of battery BMS, Effect of distance, load, and force on battery life and BMS, energy balancing with multi-battery system.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Interpret the role of battery management system	K2
CO2	Explain the requirements of Battery Management System	K2
CO3	Interpret the concept associated with battery charging / discharging process	K2
CO4	Identify the various parameters of battery and battery pack	K3
CO5	Make use of the model of battery pack	K3

COs and POs Mapping:

COs	**POs**		
	1	**2**	**3**
CO1	**2**	**1**	**-**
CO2	**2**	**1**	**-**
CO3	**-**	**1**	**-**
CO4	**2**	**-**	**-**
CO5	**2**	**1**	**-**

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Plett, Gregory L. Battery management systems, Volume I: Battery modeling. Artech House, 2015.
2. Plett, Gregory L. Battery management systems, Volume II: Equivalent-circuit methods, Artech House, 2015.

Reference Books:

1. Bergveld, H.J., Kruijt, W.S., Notten, P.H.L "Battery Management Systems -Design

by Modelling" Philips Research Book Series 2002.
2. Davide Andrea," Battery Management Systems for Large Lithium-ion Battery Packs" Artech House, 2010
3. Pop, Valer, et al. Battery management systems: Accurate state-of-charge indication for battery powered applications. Vol. 9. Springer Science & Business Media, 2008.

Web Links and Video Lectures (E-Resources):

1. INTRODUCTION: https://www.youtube.com/watch?v=KMVoci_xJ2E
2. SPECIAL AND SYNTHETIC FUELS:

http://acl.digimat.in/nptel/courses/video/103108162/L32.html

3. ALCOHOL FUELS : https://www.youtube.com/watch?v=Y5NOQWTqJIo
4. BIO-DIESEL FUELS : https://nptel.ac.in/courses/113105102
5. GASEOUS FUELS : https://www.youtube.com/watch?v=qgMll02dP1w

Course Code:	**24TE217**	**Course Title:**	**ADVANCED ENERGY STORAGE TECHNOLOGIES**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives: To impart knowledge on the • To analyze the basic energy generation cycles. • To detail about the concept of cogeneration, its types and probable areas of applications. • To study the significance of waste heat recovery systems and carry out its economic analysis.
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. Lab experiment videos 3. Blended Mode of Learning 4. Project based Learning 5. Experiential Learning 6. NPTEL and Other Videos 7. Smart Class Room 8. Flipped Class

UNIT I – INTRODUCTION	**[9hours]**
Necessity of energy storage–types of energy storage–comparison of energy storage technologies– Applications.	
UNIT II – THERMAL STORAGE SYSTEM	**[9 hours]**
Thermal storage–Types–Modelling of thermal storage units–Simple water and rock bed storage system–pressurized water storage system–Modelling of phase change storage system –Simple units, packed bed storage units – Modelling using porous medium approach, Use of TRNSYS.	
UNIT III – ELECTRICAL ENERGY STORAGE	**[9 hours]**
Fundamental concept of batteries–measuring of battery performance, charging and discharging of a battery, storage density, energy density, and safety issues. Types of batteries – Lead Acid, Nickel–Cadmium, Zinc Manganese di oxide and modern batteries for example(i)zinc-Air(ii)Nickel Hydride,(iii)Lithium Battery.	

UNIT IV – HYDROGEN AND BIOGAS STORAGE	[9 hours]
Hydrogen storage options–compressed gas–liquid hydrogen–Metal Hydrides, chemical Storage, Biogas storage-comparisons. Safety and management of hydrogen and Biogas storage-Applications.	

UNIT V – ALTERNATE ENERGY STORAGE TECHNOLOGIES	[9hours]
Flywheel, Super capacitors, Principles & Methods–Applications, Compressed air Energy storage, Concept of Hybrid Storage – Applications.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Identify the energy storage technologies for suitable applications.	K3
CO2	Interpret the energy storage systems using TRNSYS.	K2
CO3	Summarize the concepts and types of batteries.	K2
CO4	Examine the principle of operation of Hydrogen and Biogas storage systems.	K3
CO5	Explain the working of super capacitor, Flywheel and compressed energy storage systems	K2

COs and POs Mapping:

COs	**POs**		
	1	**2**	**3**
CO1	**2**	**1**	-
CO2	**2**	**1**	-
CO3	**-**	**1**	-
CO4	**2**	**-**	-
CO5	**2**	**1**	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Ibrahim Dincer and Mark A. Rosen, Thermal Energy Storage Systems and Applications, John Wiley & Sons 2010.
2. Viswanathan, Fuel cell principle and applications university press,2006.

Reference Books:

1. Luisa F.Cabeza, Advances in Thermal Energy Storage Sy stems: Methods and Applications, Elsevier Wood head Publishing, 2015
2. Robert Huggins, Energy Storage: Fundamentals, Materials and Applications ,2nd

edition, Springer,2015.
3. Ru-shiliu, Leizhang, Xueliang sun, Electrochemical technologies for energy storage and conversion,,Wileypublications,2012.
4. National Energy Technology Laboratory, U.S. Department of Energy, Fuel Cell Handbook (Seventh Edition).

Web Links and Video Lectures (E-Resources):

1. INTRODUCTION: https://archive.nptel.ac.in/courses/113/105/113105102/
2. THERMAL STORAGE SYSTEM: https://www.youtube.com/watch?v=0FSEKHc-COA
3. ELECTRICAL ENERGY STORAGE: https://www.youtube.com/watch?v=yar51GJVqgg
4. HYDROGEN AND BIOGAS STORAGE: https://onlinecourses.nptel.ac.in/noc22_ch66/preview
5. ALTERNATE ENERGY STORAGE TECHNOLOGIES: https://www.youtube.com/watch?v=yar51GJVqgg

Course Code:	**24TE218**	**Course Title:**	**HYBRID AND ELECTRIC VEHICLES**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To analyze the basic energy generation cycles.
- To detail about the concept of cogeneration, its types and probable areas of applications.
- To study the significance of waste heat recovery systems and carry out its economic analysis.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – INTRODUCTION	**[9hours]**
Basics of vehicle performance, vehicle power source characterization, transmission characteristics, History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.	
UNIT II – HYBRID ELECTRIC DRIVE TRAINS	**[9 hours]**
Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis. Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.	
UNIT III – CONTROL OF AC & DC DRIVES	**[9 hours]**
Introduction to electric components used in hybrid and electric vehicles, Configuration and control - DC Motor drives, Induction Motor drives, Permanent Magnet Motor drive, and Switch Reluctance Motor drives, drive system efficiency.	

UNIT IV – ENERGY STORAGE	[9 hours]
Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Energy storage and its analysis - Battery based, Fuel Cell based, and Super Capacitor based, Hybridization of different energy storage devices.	
UNIT V – DRIVE SIZING AND ENERGY MANAGEMENT STRATEGIES	**[9hours]**
Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selection of appropriate energy storage technology, Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification and comparison of energy management strategies, implementation issues.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Interpret the Characterize and configure hybrid drivetrains requirement for a vehicle	K2
CO2	Summarize the appropriate hybrid and electric drive trains in a vehicle	K2
CO3	Classify the suitable AC and DC drives for electric vehicles.	K2
CO4	Relate the suitable energy storage system for a hybrid / electric vehicle	K2
CO5	Illustrate the energy management strategies to ensure better economy and efficiency	K2

COs and POs Mapping:

COs	POs		
	1	2	3
CO1	2	1	-
CO2	2	1	-
CO3	-	1	-
CO4	2	-	-
CO5	2	1	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.
2. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003

Reference Books:

1. MehrdadEhsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.
2. Rand D.A.J, Woods, R & Dell RM Batteries for Electric vehicles, John Wiley &

Sons, 1998

Web Links and Video Lectures (E-Resources):

1. INTRODUCTION: https://archive.nptel.ac.in/courses/108/103/108103009/
2. HYBRID ELECTRIC DRIVE TRAINS : https://nptel.ac.in/courses/108106170
3. CONTROL OF AC & DC DRIVES: https://onlinecourses.nptel.ac.in/noc23_ee01/preview
4. ENERGY STORAGE: https://archive.nptel.ac.in/courses/108/106/108106182/
5. DRIVE SIZING AND ENERGY MANAGEMENT STRATEGIES : https://www.youtube.com/watch?v=3E1SXG7VkQk

Course Code:	**24TE219**	**Course Title:**	**ADVANCED POWER PLANT ENGINEERING**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To analyze the basic energy generation cycles.
- To detail about the concept of cogeneration, its types and probable areas of applications.
- To study the significance of waste heat recovery systems and carry out its economic analysis.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – INTRODUCTION	**[9hours]**
Energy scenario: India Vs. World – Load curves and–thermodynamic analysis of Conventional Power Plants (Coal, Gas Turbine and Diesel)-Advanced Power Cycles-Kalina Cycle, IGCC.	
UNIT II – COAL BASED THERMAL POWER PLANTS	**[9 hours]**
Basics of typical power plant utilities – Boilers, Nozzles, Turbines, Condensers, Cooling Towers, Water Treatment and Piping system – steam rate and heat rate – mean temperature of heat addition-Rankine cycle improvements–Superheat, Reheat, Regeneration, Supercritical, AFBC/PFBC – computation of per unit cost of power generation from coal/biomass	
UNIT III – GAS TURBINE AND DIESEL POWER PLANTS	**[9 hours]**
Brayton cycle – Open and Closed – Improvements – Intercooler, Reheating and Regeneration. Diesel power plant – Layout – Performance analysis and improvement – Techniques for starting, cooling and lubrication of diesel engines-computation of per unit cost of power generation .	

UNIT IV – CHP AND MHD POWER PLANTS	[9 hours]
Cogeneration systems–types-heat to power ratio-Thermodynamic performance of steam turbine gas turbine and IC engine-based cogeneration systems–Poly Generation-Binary Cycle-Combined cycle. MHD –Open cycle and closed cycle-Hybrid MHD & steam power plants	
UNIT V – HYDRO ELECTRIC & NUCLEAR POWER PLANTS	**[9hours]**
Hydroelectric Power plants – classifications – essential elements – pumped storage systems – micro and mini hydel power plants. General aspects of Nuclear Engineering – Components of nuclear power plants – Nuclear reactors & types – PWR, BWR, CANDU, Gas Cooled, Liquid Metal Cooled and Breeder reactor-nuclear safety–Environmental Issues-Computation of per Unit cost of power generation.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Classify the appropriate power generation technologies for mitigating the energy gap	K2
CO2	Interpret the steam rate, heat rate and cost for generating electricity from coal based thermal power plants	K2
CO3	Choose the measures for improving the performance of gas turbine and diesel power plants	K3
CO4	Explain the applicability and performance of a cogeneration system	K2
CO5	Infer the suitable type of hydroelectric/nuclear power plant commensurate with the prevailing conditions	K2

COs and POs Mapping:

COs	POs		
	1	2	3
CO1	2	1	-
CO2	2	1	-
CO3	-	1	-
CO4	2	-	-
CO5	2	1	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Nag, P.K., Power Plant Engineering, Tata McGraw Hill Publishing Co Ltd, New Delhi,1998.
2. Haywood, R.W., Analysis of Engineering Cycles,4th Edition, Pergamon Press,Oxford,1991.

Reference Books:

1. Wood, A.J., Wollen berg, B.F., Power Generation, operation and control, John Wiley, New York,1984.
2. Gill, A.B., Power Plant Performance, Butter worths,1984.
3. Lamarsh, J.R., Introduction to Nuclear Engg. 2nd edition, Addison-Wesley, 1983.

Web Links and Video Lectures (E-Resources):

1. INTRODUCTION : https://archive.nptel.ac.in/courses/112/107/112107291/
2. COAL BASED THERMAL POWER PLANTS :
   http://www.digimat.in/nptel/courses/video/112107291/L31.html
3. GAS TURBINE AND DIESEL POWER PLANTS :
   https://archive.nptel.ac.in/courses/112/103/112103262/
4. CHP AND MHD POWER PLANTS :
   https://archive.nptel.ac.in/courses/112/107/112107291/
5. HYDRO ELECTRIC & NUCLEAR POWER PLANTS :
   https://archive.nptel.ac.in/courses/112/103/112103243/

AUDIT COURSES SEMESTER I & II,

S. No.	Course Code	Course Title	Course Category	L	T	P	C
AUDIT COURSES							
1.	24AC201	English for Research Paper Writing	PEC	2	0	0	0
2.	24AC202	Disaster Management	PEC	2	0	0	0
3.	24AC203	Constitution of India	PEC	2	0	0	0

Course Code:	24AC201	Course Title:	ENGLISH FOR RESEARCH PAPER WRITING
Credits:	0	L – T – P	2-0-0

Course objectives:

To impart knowledge on the

- To analyze the basic energy generation cycles.
- To detail about the concept of cogeneration, its types and probable areas of applications.
- To study the significance of waste heat recovery systems and carry out its economic analysis.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – INTRODUCTION TO RESEARCH PAPER WRITING	[6 hours]
Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.	
UNIT II – PRESENTATION SKILLS	**[6 hours]**
Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction	
UNIT III – TITLE WRITING SKILLS	**[6 hours]**
Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check	
UNIT IV - RESULT WRITING SKILLS	**[6 hours]**

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions.

UNIT V – VERIFICATION SKILLS	**[6 hours]**
Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selection of appropriate energy storage technology, Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification and comparison of energy management strategies, implementation issues.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Understand that how to improve your writing skills and level of readability	K2
CO2	Infer about what to write in each section	K2
CO3	Understand the skills needed when writing a Title	K2
CO4	Understand the skills needed when writing the Conclusion	K2
CO5	Interpret the good quality of paper at very first-time submission	K2

COs and POs Mapping:

COs	**POs**		
	1	**2**	**3**
CO1	**2**	**1**	-
CO2	**2**	**1**	-
CO3	**-**	**1**	-
CO4	**2**	**-**	-
CO5	**2**	**1**	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			

	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011
2. Day R How to Write and Publish a Scientific Paper, Cambridge University Press 2006

Reference Books:

1. Goldbort R Writing for Science, Yale University Press (available on Google Books) 2006
2. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book 1998.

Course Code:	**24AC202**	**Course Title:**	**DISASTER MANAGEMENT**
Credits:	**0**	**L – T – P**	**2-0-0**

Course objectives:

To impart knowledge on the

- To analyze the basic energy generation cycles.
- To detail about the concept of cogeneration, its types and probable areas of applications.
- To study the significance of waste heat recovery systems and carry out its economic analysis.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – INTRODUCTION TO RESEARCH PAPER WRITING	**[6 hours]**
Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.	
UNIT II – REPERCUSSIONS OF DISASTERS AND HAZARDS	**[6 hours]**
Economic Damage, Loss of Human and Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.	
UNIT III – DISASTER PRONE AREAS IN INDIA	**[6 hours]**
Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics	
UNIT IV - DISASTER PREPAREDNESS AND MANAGEMENT	**[6 hours]**

Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.	
UNIT V – RISK ASSESSMENT	**[6 hours]**
Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Summarize the basics of disaster	K2
CO2	Explain the critical understanding of key concepts in disaster risk reduction and humanitarian response.	K2
CO3	Illustrate the disaster risk reduction and humanitarian response policy and practice from multiple perspectives.	K2
CO4	Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.	K2
CO5	Relate the strengths and weaknesses of disaster management approaches	K2

COs and POs Mapping:

COs	**POs**		
	1	**2**	**3**
CO1	**2**	**1**	-
CO2	**2**	**1**	-
CO3	**-**	**1**	-
CO4	**2**	**-**	-
CO5	**2**	**1**	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Goel S. L., Disaster Administration And Management Text And Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi,2009.

Reference Books:

1. NishithaRai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company,2007.
2. Sahni, PardeepEt.Al. ," Disaster Mitigation Experiences And Reflections", Prentice Hall OfIndia, New Delhi, 2001.

Course Code:	**24AC203**	**Course Title:**	**CONSTITUTION OF INDIA**
Credits:	**0**	**L – T – P**	**2-0-0**

Course objectives:

To impart knowledge on the

- To analyze the basic energy generation cycles.
- To detail about the concept of cogeneration, its types and probable areas of applications.
- To study the significance of waste heat recovery systems and carry out its economic analysis.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – HISTORY OF MAKING OF THE INDIAN CONSTITUTION	**[3 hours]**
History, Drafting Committee, (Composition & Working)	
UNIT II – PHILOSOPHY OF THE INDIAN CONSTITUTION	**[3 hours]**
Preamble, Salient Features	
UNIT III – CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES	**[6 hours]**
Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.	
UNIT IV - ORGANS OF GOVERNANCE	**[6 hours]**
Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.	

UNIT V – LOCAL ADMINISTRATION	[6 hours]
District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy(Different departments), Village level:Role of Elected and Appointed officials, Importance of grass root democracy.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Summarize the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics	K2
CO2	Explain the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.	K2
CO3	Illustrate the circumstances surrounding the foundation of the Congress Socialist Party under the leadership of Jawaharlal Nehru	K2
CO4	Interpret the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.	K2
CO5	Contrast the passage of the Hindu Code Bill of 1956.	K2

COs and POs Mapping:

COs	**POs**		
	1	**2**	**3**
CO1	**2**	**1**	-
CO2	**2**	**1**	-
CO3	**-**	**1**	-
CO4	**2**	**-**	-
CO5	**2**	**1**	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	60	40
Apply	60	20	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. The Constitution of India,1950(Bare Act),Government Publication.
2. Dr.S.N.Busi, Dr.B. R.Ambedkar framing of Indian Constitution,1st Edition, 2015.

Reference Books:

1. M.P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis,2014.
2. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

ROHINI COLLEGE OF ENGINEERING AND TECHNOLOGY

(AUTONOMOUS)

(Anjugramam-Kanyakumari Main Road, Palkulam,Variyoor P.O.-629 401, K.K.Dist.)

Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai

Accredited with A+ Grade by NAAC

ME. CONSTRUCTION ENGINEERING AND MANAGEMENT

Curriculum & Syllabus

(*2024-2025 Admitted Students Onwards*)

Vision Statement of RCET

To be an academic institute of continuous excellence towards education and research in rural regime and provide service to nation in terms of nurturing potentially higher social, ethical and engineering companion graduands.

Mission Statement of RCET

To foster and promote technically competent graduands by imparting the state of art Engineering education in rural regime. To enunciate research assisted scientific learning by dissemination of knowledge towards science, agriculture, industry and national security.

Vision of the Department

To develop professional knowledge and competent Civil Engineers to create ethically skilled students for better contribution to the society.

Mission of the Department

M1: To provide technically valuable education for the development of Civil Professionals

M2: To make a platform for the students to explore their potential and critical thinking in research field.

M3: To create awareness and spirit of ethical thoughts in societal concerns for professional development.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1 Excel in research or will succeed in Construction Engineering and Management profession in the government, public and private sector organizations.

PEO2 Have a sound knowledge in statistics, project management and construction engineering fundamentals required for solving real time construction Engineering and Management problems using modern equipment and software tools.

PEO3 Become entrepreneurs and develop processes and construction technologies through innovation, by integrating their knowledge in multidisciplinary management to meet the needs of society and formulate solutions that are technically sound, economically feasible, and socially acceptable.

PEO4 Have professional and ethical attitude, effective communication skills, teamwork skills, leadership quality, multidisciplinary approach and an ability to relate Construction Engineering and Management issues in broader social context.

PEO5 Have competence of excellence, leadership, written ethical codes and guidelines, and the life-long learning needed for a successful professional career.

PROGRAMME OUTCOMES (PO)

PO1 An ability to independently carry out research /investigation and development work to solve practical problems

PO2 An ability to write and present a substantial technical report/document.

PO3 Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program

PROGRAMME SPECIFIC OUTCOMES (PSOS)

PSO1: In-depth knowledge in the construction management, engineering and technologies necessary to formulate, plan, schedule and execute construction projects

PSO2: Critically analyze and solve construction engineering and management problems by applying the modern tools and concepts of Construction Engineering & Management and make innovative advances in theoretical and practical.

PSO3: Conceptualize the problems in construction industry and develop appropriate solutions which are technically feasible and economically viable with due consideration of sustainability.

CREDIT INFO		
Sl.No	**Category**	**Credits**
1	Foundation Courses (FC)	4
2	Professional Core Courses (PCC)	25
3	Professional Electives (PEC)	15
4	Open Electives (OEC)	3
5	Research Methodology And IPR Courses (RMC)	2
6	Employability Enhancement Courses (EEC)	21
7	Non Credit/ Audit Course	--
Total Credits		**70**

Foundation Courses (FC)							
Sl.No	**Course Code**	**Course Title**	**Course Type**	**L**	**T**	**P**	**Credit**
1	24CN101	Statistical Methods for Engineers	FC	4	0	0	4
Professional Core Courses (PCC)							
Sl.No	**Course Code**	**Course Title**	**Course Type**	**L**	**T**	**P**	**Credit**
1	24CN102	Modern Construction Materials	PCC	3	0	0	3
2	24CN103	Construction Equipment and Management	PCC	3	0	0	3
3	24CN104	Contract Laws and Regulations	PCC	3	0	0	3
4	24CN201	Advanced Construction Techniques	PCC	3	0	0	3
5	24CN202	Project Formulation and Appraisal	PCC	3	0	0	3
6	24CN203	Construction Planning, Scheduling And Control	PCC	3	0	0	3
7	24CN204	Safety Practices and Management	PCC	3	0	0	3
8	24CN131	Construction Engineering Laboratory	PCC	0	0	4	2
9	24CN231	Advanced Computing Techniques Laboratory	PCC	0	0	4	2

Professional Electives Courses (PEC)							
1	24CN211	Advanced Concrete Technology	PEC	3	0	0	3
2	24CN212	Human Resources Management in Construction	PEC	3	0	0	3
3	24CN213	Construction Project Management	PEC	3	0	0	3
4	24CN214	Sustainable Construction	PEC	3	0	0	3
5	24CN221	Economics and Finance Management in Construction	PEC	3	0	0	3
6	24CN222	Design of Energy Efficient Buildings	PEC	3	0	0	3
7	24CN223	Personnel Management in Construction	PEC	3	0	0	3
8	24CN224	Computer Applications in Construction Engineering and Planning	PEC	3	0	0	3
9	24CN241	Quality Control and Assurance in Construction	PEC	3	0	0	3
10	24CN242	Resource Management And Control In Construction	PEC	3	0	0	3
11	24CN243	Shoring, Scaffolding and Formwork	PEC	3	0	0	3
12	24CN244	System Integration in Construction	PEC	3	0	0	3
13	24CN311	Advanced Data Analysis	PEC	3	0	0	3
14	24CN312	Environmental Impact Assessment for Construction Engineers	PEC	3	0	0	3
15	24CN313	Lean Construction Concepts, Tools and Practices	PEC	3	0	0	3
16	24CN314	Maintenance, Repair and Rehabilitation of Structures	PEC	3	0	0	3
17	24CN321	Quality Control and Assurance in Construction	PEC	3	0	0	3
18	24CN322	Digital Design and Construction	PEC	3	0	0	3
19	24CN323	Organizational Behaviour	PEC	3	0	0	3
20	24CN324	Supply Chain Management And Logistics in Construction	PEC	3	0	0	3

Open Electives Courses (OEC)							
1	24CP311	Block Chain Technologies	OEC	3	0	0	3
2	24CP310	Deep Learning	OEC	3	0	0	3
3	24IS342	Vibration and Noise Control Strategies	OEC	3	0	0	3
4	24TE341	Energy Conservation and Management in Domestic Sectors	OEC	3	0	0	3
5	24TE342	Electric Vehicle Technology	OEC	3	0	0	3
6	24TE343	New Product Development	OEC	3	0	0	3
7	24IS341	Micro and Small Business Management	OEC	3	0	0	3
8	24IS343	Intellectual Property Rights	OEC	3	0	0	3
9	24IS344	Ethical Management	OEC	3	0	0	3
10	24EM341	IoT for Smart Systems	OEC	3	0	0	3
11	24EM342	Smart Grid	OEC	3	0	0	3
12	24CP301	Security Practices	OEC	3	0	0	3
13	24CP206	Cloud Computing Technologies	OEC	3	0	0	3
14	24TE344	Design Thinking	OEC	3	0	0	3
15	24CP341	Principles of Multimedia	OEC	3	0	0	3
16	24CP342	Big Data Analytics	OEC	3	0	0	3
17	24CM341	Medical Robotics	OEC	3	0	0	3
18	24EM343	Embedded Automation	OEC	3	0	0	3
19	24TE345	Textile Reinforced Composites	OEC	3	0	0	3
20	24TE346	Nanocomposite Materials	OEC	3	0	0	3
Research Methodology And IPR Courses (RMC)							
1	24RM101	Research Methodology and IPR	RMC	2	0	0	2
Employability Enhancement Courses (EEC)							
1	24CN151	Technical Seminar	EEC	0	0	2	1
2	24CN251	Practical Training -I	EEC	0	0	0	1
3	24CN331	Practical Training –II	EEC	0	0	0	1
4	24CN351	Project Phase I	EEC	0	0	12	6
5	24CN451	Project Phase II	EEC	0	0	24	12
Non Credit/ Audit Course (AC)							
1	24AC201	English for Research Paper Writing	AC	2	0	0	0
2	24AC202	Disaster Management	AC	2	0	0	0
3	24AC203	Constitution Of India	AC	2	0	0	0
4	24AC204	நற்றமிழ் இலக்கியம்	A	2	0	0	0

SEMESTER – I

S. No.	Course Code	Course Title	Course Category	L	T	P	C
THEORY COURSES							
1	24CN101	Statistical methods for Engineers	FC	4	0	0	4
2	24CN102	Modern construction Materials	PCC	3	0	0	3
3	24CN103	Construction equipment and Management	PCC	3	0	0	3
4	24CN104	Contract laws and regulations	PCC	3	0	0	3
5	24RM101	Research Methodology and IPR	RMC	2	0	0	2
6	24CN11X	Professional elective I	PEC	3	0	0	3
7	24AC2XX	Audit course I*	AC	2	0	0	0
LABORATORY COURSES							
8	24CN131	Construction Engineering laboratory	PCC	0	0	4	2
9	24CN151	Technical seminar	EEC	0	0	2	1
Total				**18+2**	**0**	**6**	**21**

*** Audit Course is optional**

SEMESTER – II

S. No.	Course Code	Course Title	Course Category	L	T	P	C
THEORY COURSES							
1	24CN201	Advanced construction Techniques	PCC	3	0	0	3
2	24CN202	Project formulation and Appraisal	PCC	3	0	0	3
3	24CN203	Construction planning, scheduling and control	PCC	3	0	0	3
4	24CN204	Safety practices and Management	PCC	3	0	0	3
5	24CN22X	Professional Elective II	PEC	3	0	0	3
6	24CN24X	Professional Elective III	PEC	3	0	0	3
7	24AC2XX	Audit course II*	AC	2	0	0	0
LABORATORY COURSES							
8	24CN231	Advanced computing techniques laboratory	PCC	0	0	4	2
9	24CN251	Practical training -I	EEC	0	0	0	1
Total				**18+2**	**1**	**4**	**21**

Course Code:	**24CN101**	**Course Title:**	**STATISTICAL METHODS FOR ENGINEERS**
Credits:	**4**	**L – T – P**	**4-0-4**

Course objectives:

To impart knowledge on the

- To develop the ability to apply the concepts of Estimation Theory and Correlation & Regression in Engineering problems.
- To understand basic concepts of Probability theory and Random Variables, how to deal with multiple Random Variables.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To use the concepts of multivariate normal distribution and principal components analysis.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I- ESTIMATION THEORY	**[12hours]**
Estimators: Unbiasedness, Consistency, Efficiency and sufficiency – Maximum likelihood estimation – Method of moments.	

UNIT II ESTIMATION THEORY	**[12hours]**
Sampling distributions - Small and large samples -Tests based on Normal, t, Chi square, and F distributions for testing of means, variance and proportions – Analysis of r x c tables – Goodness of fit.	

UNIT III ESTIMATION THEORY	[12hours]
Multiple and partial correlation – Method of least squares – Plane of regression – Properties of residuals – Coefficient of multiple correlation – Coefficient of partial correlation – Multiple correlation with total and partial correlations – Regression and partial correlations in terms of lower order co - efficient.	

UNIT IV ESTIMATION THEORY	[12hours]
Analysis of variance – One way and two way classifications – Completely randomized design – Randomized block design – Latin square design - 2^2 Factorial design.	

UNIT V ESTIMATION THEORY	[12hours]
Random vectors and matrices – Mean vectors and covariance matrices – Multivariate normal density and its properties – Principal components: Population principal components – Principal components from standardized variables.	

TOTAL: 60 PERIODS

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Use the method of moments and method of maximum likelihood to obtain the value of the point estimators	K3
CO2	Apply the various statistical methods in hypothesis testing for mean and variances of large and small samples	K3
CO3	Apply the method of least square to obtain the regression line and also to calculate the partial and multiple correlation coefficient for the given set of data points.	K3
CO4	Apply various ANOVA techniques like CRD, RBD, LSD etc. to obtain the variances	K3
CO5	Obtain principal component analysis of random vectors and matrices by multivariate statistical methods	K3

COs and POs Mapping:

COs	POs					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	**2**	
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

Reference Books:

1. Gupta.S.C., and Kapoor, V.K., “Fundamentals of Mathematical Statistics”, 12th Edition, Sultan Chand and Sons, 2020.
2. Jay L. Devore, “Probability and statistics for Engineering and the Sciences”, 8th Edition, Cengage Learning, 2014.
3. Johnson, R.A., Miller, I and Freund J., "Miller and Freund’s Probability and Statistics for Engineers", 9th Edition, Pearson Education, Asia, 2016
4. Johnson, R.A. and Wichern, D. W. “Applied Multivariate Statistical Analysis”, 6th Edition, Pearson Education, Asia, 2012.
5. Rice, J.A. "Mathematical Statistics and Data Analysis", 3rd Edition, Cengage Learning, 2015.

Web Links and Video Lectures (E-Resources):

1. Probability and Statisticshttps://nptel.ac.in/courses/111105090

Activity-Based Learning /Practical-Based Learning:

1. http://nptel.ac.in
2. https://swayam.gov.in

Course Code:	**24CN102**	**Course Title:**	**MODERN CONSTRUCTION MATERIALS**
Credits:	**3**	**L – T – P**	**3-0-3**

Course objectives:

To impart knowledge on the

- To study and understand the properties of modern construction materials
- Use of modern construction materials such as special concretes, metals, composites, water proofing compounds, non-weathering materials, and smart materials.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNITI SPECIALCONCRETES	[9 hours]
Concretes - Behavior of concretes —Properties and Advantages of High Strength and High Performance Concrete–Properties and Applications of Fibre Reinforced Concrete ,Self-compacting concrete, Geo Polymer Concrete, Alternate Materials to concrete on high performance & high Strength concrete.	

UNIT II METALS	[9 hours]
Types of Steels – Manufacturing process of steel – Advantages of new alloy steels – Properties and advantages of aluminum and its products – Types of Coatings & Coatings to reinforcement – Applications of Coatings.	

UNITIII COMPOSITES	[9 hours]
. Multiple and partial correlation – Method of least squares – Plane of regression – Properties of residuals – Coefficient of multiple correlation – Coefficient of partial correlation – Multiple correlation with total and partial correlations – Regression and partial correlations in terms of lower order co - efficient	

UNIT IV NON STRUCTURAL MATERIALS,ASSOCESSORIES AND FINISHES	[9 hours]
Introduction of Non-Structural Materials and Criteria for Selection - Types and properties of Water Proofing Materials—Types of Non-Weathering Materials and its uses —Types of Polymer Floor Finishes-Paint-Tiles-AcousticTreatmentmaterials-DryWalls-Anchors.	

UNIT V SMARTANDINTELLIGENTMATERIALS	[9 hours]
Types & Differences between Smart and Intelligent Materials – Special features – Nano Concrete - NanoTechnologyinConstruction-Casestudiesshowingtheapplicationsofsmart&Intelligent Materials.	

TOTAL: 45 PERIODS

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Apply knowledge of modern materials in production of variety of concrete.	K3
CO2	Apply different type of steel and insulating materials in constructions.	K3
CO3	Explain the composites and chemicals in production of modern concrete.	K2
CO4	Choose the different flooring materials and application of façade materials	K3
CO5	Apply the knowledge of smart and intelligent materials in construction field	K3

COs and POs Mapping:

COs	POs					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final Marks</th></tr>
<tr><td rowspan="5">Continuous Internal Examination (CIE) - Theory</td><td>CIE – I</td><td>100</td><td rowspan="2">50</td><td rowspan="5">100</td><td rowspan="5">40</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>Assignment/Project</td><td>20</td><td>10</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td>End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>100</td><td>100</td><td>60</td></tr>
<tr><td colspan="5">Total</td><td>100</td></tr>
</table>

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	40	40	40
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

REFERENCE BOOKS :

1. Shetty, M.S. and Jain, A.K., Concrete Technology: Theory and Practice, S.Chand & Company Ltd., New Delhi, Eighth Edition, 2018.
2. Rajput, R.K., Engineering Materials, S. Chand & Company Ltd., New Delhi, Third Edition, 2006.
3. IS 11384 -1985, Code of Practice for Composite Construction in structural steel and concrete, 1985.
4. http://nptel.ac.in/downloads/105106053.

Web Links and Video Lectures (E-Resources):

http://nptel.ac.in/downloads/105106053.

Activity-Based Learning /Practical-Based Learning:

1. http://nptel.ac.in
2. https://swayam.gov.in

Course Code:	**24CN103**	**Course Title:**	**CONSTRUCTION EQUIPMENT AND MANAGEMENT**
Credits:	**3**	**L – T – P**	**3-0-3**

Course objectives:
To impart knowledge on the • To study and understand the various types of equipment's used for earthwork, tunneling, drilling, blasting, dewatering, material handling conveyors and its applications in construction projects. • To study and understand appropriate equipment contributes to economy, quality, safety, speed and timely completion of a project
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. PowerPoint presentation 3. Lab experiment videos 4. Blended Mode of Learning 5. Experiential Learning 6. NPTEL and Other Videos 7. Smart Class Room 8. Flipped Class

UNIT I CONSTRUCTION EQUIPMENT SELECTION	**[9 hours]**
Identification – Planning of equipment – Selection of Equipment - Equipment Management in Projects - Maintenance Management – Equipment cost – Operating cost – Cost Control of Equipment - Depreciation Analysis – Replacement of Equipment- Replacement Analysis - Safety Management.	

UNIT II EQUIPMENT FOR EARTHWORK	**[9 hours]**
Fundamentals of Earth Work Operations - Earth Moving Operations - Types of Earth Work Equipment - Tractors, Motor Graders, Scrapers, Front end Waders – Dozer, Excavators, Rippers, Loaders, trucks and hauling equipment, Compacting Equipment, Finishing equipment	

UNIT III OTHER CONSTRUCTION EQUIPMENT	[9 hours]
Equipment for Dredging, Trenching, Drag line and clamshells, tunneling – Equipment for Drilling and Blasting - Pile driving Equipment - Erection Equipment - Crane, Mobile crane - Types of pumps used in Construction - Equipment for Dewatering and Grouting – Equipment for Demolition.	

UNIT IVASPHALT AND CONCRETING EQUIPMENT	[9 hours]
Aggregate production- Different Crushers – Feeders - Screening Equipment - Handling Equipment - Batching and Mixing Equipment - Pumping Equipment – Ready mix concrete equipment, Concrete pouring equipment. Asphalt Plant, Asphalt Pavers, Asphalt compacting Equipment.	

UNIT V MATERIALS HANDLING EQUIPMENT	[9 hours]
Forklifts and related equipment - Portable Material Bins – Material Handling Conveyors – Material Handling Cranes- Industrial Trucks.	

TOTAL: 45 PERIODS

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Develop knowledge on the planning of equipment and selection of equipment	K3
CO2	Explain the knowledge on fundamentals of earth work operations, earth moving operations and types of earth work equipment	K2
CO3	Develop the knowledge on special construction equipment	K3
CO4	Apply the knowledge on asphalt and concrete plants	K3
CO5	Apply the knowledge and select the proper materials handling equipment	K3

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	40	40	40
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

REFERENCE BOOKS :

1. Peurifoy, R.L., Schexnayder, C. and Aviad Shapira., Construction Planning, Equipment and Methods, McGraw Hill, Singapore, 2010.
2. Granberg G.,Popescu M Construction Equipment and Management for Engineers Estimators and Owners, Taylor and Francis Publishers, New York, 2006
3. Deodhar, S.V. Construction Equipment and Job Planning, Khanna Publishers, New Delhi, 2001.
4. Arora S.P. and Bindra S.P., Building Construction, Planning Techniques and Method of Construction, DhanpatRai and Sons, 2010.
5. Sharma S.C. Construction Equipment and Management, Khanna Publishers, New Delhi, 2019

Activity-Based Learning /Practical-Based Learning:

1. http://nptel.ac.in
2. https://swayam.gov.in

Course Code:	**24CN104**	**Course Title:**	**CONTRACT LAWS AND REGULATIONS**
Credits:	**3**	**L – T – P**	**3-0-3**

Course objectives:

To impart knowledge on the

- To study the various types of construction contract and their legal aspects and provisions.
- To learn concepts in Tenders.
- To learn concepts in Arbitration and legal requirements
- To study the concepts in labour regulations.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I CONSTRUCTION CONTRACTS	**[9 hours]**
Indian Contracts Act – Elements of Contracts – Types of Contracts – Features – Suitability – Design of Contract Documents – International Contract Document – Standard Contract Document – Law of Torts.	

UNIT II TENDERS	**[9 hours]**
Prequalification – Bidding – Accepting – Evaluation of Tender from Technical, Contractual and Commercial Points of View – Contract Formation and Interpretation – Potential Contractual Problems – World Bank Procedures and Guidelines – Tamilnadu Transparency in Tenders Act.	

UNIT III ARBITRATION	[9 hours]
Comparison of Actions and Laws – Agreements – Subject Matter – Violations – Appointment of Arbitrators – Conditions of Arbitration – Powers and Duties of Arbitrator – Rules of Evidence – Enforcement of Award – Costs	

UNIT IVLEGAL REQUIREMENTS	[9 hours]
Insurance and Bonding – Laws Governing Sale, Purchase and Use of Urban and Rural Land – Land Revenue Codes – Tax Laws – Income Tax, Sales Tax, Excise and Custom Duties and their Influence on Construction Costs – Legal Requirements for Planning – Property Law – Agency Law – Local Government Laws for Approval – Statutory Regulations.	

UNIT V LABOUR REGULATIONS	[9 hours]
Social Security – Welfare Legislation – Laws relating to Wages, Bonus and Industrial Disputes, Labour Administration – Insurance and Safety Regulations – Workmen's Compensation Act – Indian Factory Act – Tamil nadu Factory Act – Child Labour Act - Other Labour Laws.	

TOTAL: 45 PERIODS

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Examine the elements of concluding, and administering contracts	K4
CO2	Determine about the procedure for tendering and documentation.	K4
CO3	Explain the duties of the arbitrator and legal procedures	K2
CO4	Identify about the labour requirements in terms of tax and cost analysis.	K3
CO5	Analyse about labour regulations and their impact on managing of contracts	K4

COs and POs Mapping:

COs	POs					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

Reference Books:

1. Gajaria G.T., Laws Relating to Building and Engineering Contracts in India, 2000.
2. Jimmie Hinze, Construction Contracts, McGraw Hill, 3rd Edition, 2013.
3. Ali D. Haidar, Handbook of Contract Management in Construction, Springer Cham, 1st Edition, 2021
4. Patil. B.S, Civil Engineering Contracts and Estimates, Universities Press (India) Private Limited, 4th Edition 2015.
5. Dharmendra Rautray, Principles of Law of Arbitration in India, Wolters Kluwer, 2018.

Activity-Based Learning /Practical-Based Learning:

1. http://nptel.ac.in
2. https://swayam.gov.in

Course Code:	**24RM101**	**Course Title:**	**RESEARCH METHODOLOGY AND IPR**
Credits:	**2**	**L – T – P**	**2-0-2**

Course objectives:

To impart knowledge on the

- To give an overview of the research methodology and explain the technique of defining a research problem
- To explain the functions of the literature review in research.
- To explain various research designs and their characteristics.
- To explain the details of sampling designs, measurement and scaling techniques and also different methods of data collections.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I RESEARCH DESIGN	**[6 hours]**
.Overview of research process and design, Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys.	

UNIT II DATA COLLECTION AND SOURCES	**[6 hours]**
Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data - Preparing, Exploring, examining and displaying	

UNIT III DATA ANALYSIS AND REPORTING	**[6 hours]**
Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation.	

UNIT IVINTELLECTUAL PROPERTY RIGHTS	[6 hours]
. Intellectual Property – The concept of IPR, Evolution and development of concept of IPR, IPR development process, Trade secrets, utility Models, IPR & Bio diversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.	

UNIT V PATENTS	[6 hours]
Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification, Types of patent application, process E-filling, Examination of patent, Grant of patent, Revocation, Equitable Assignments, Licences, Licensing of related patents, patent agents, Registration of patent agents	

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	To explain various research designs and their characteristics.	K2
CO2	To explain the details of sampling designs, and also different methods of data collections	K2
CO3	To explain the art of interpretation and the art of writing research reports.	K2
CO4	Explain and summarise the need of information about Intellectual Property Right to be promoted among student community in general & engineering in particular	K2
CO5	Relate that IPR protection provides an incentive to inventors for further research work and investment in R & D	K2

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	**2**	
Remember	40	40	40
Understand	60	60	60
Apply	0	0	0
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Reference Books:

1. Cooper Donald R, Schindler Pamela S and Sharma JK, "Business Research Methods", Tata McGraw Hill Education, 11e (2012).
2. Catherine J. Holland, "Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets", Entrepreneur Press, 2007.
3. David Hunt, Long Nguyen, Matthew Rodgers, "Patent searching: tools & techniques", Wiley, 2007.
4. The Institute of Company Secretaries of India, Statutory body under an Act of parliament,
"Professional Programme Intellectual Property Rights, Law and practice", September 2013.

Activity-Based Learning /Practical-Based Learning:

1. http://nptel.ac.in
2. https://swayam.gov.in

Course Code:	**24CN131**	**Course Title:**	**CONSTRUCTION ENGINEERING LABORATORY**
Credits:	**2**	**L – T – P**	**0-0-4**

Course objectives:

To impart knowledge on the

- To provide a thorough knowledge of material selection through the material testing based on specification

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

List of Experiments:

1. Mix Design of Concrete as per Indian Standards (IS), American Concrete Institute (ACI) , BS Method for high performance concrete
2. Mix Design of self-compacting concrete as per European Federation of National Associations Representing for Concrete (EFNARC) guidelines.
3. Flow characteristics of self-compacting concrete
4. Effect of minerals in concrete at fresh and hardened state with relevance to workability, strength and durability.
5. Effect of chemical admixtures in concrete at fresh and hardened state with relevance to workability, strength and durability.
6. Permeability tests on hardened concrete
7. Determination of in-situ strength and quality of concrete using

   i. Rebound hammer   ii. Ultrasonic pulse velocity tester
8. Ultrasonic interferometer – ultrasonic velocity in liquid

9. Electrical conductivity of metals and alloys with temperature-four probe method
10. Resistivity measurements
11. NDT – Ultrasonic flaw detector
12. Strain gauge meter – Determination of Young's modulus of a metallic wire

TOTAL:60 PERIODS

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Explain the high performance Concrete mix design procedure as per ACI IS and BS method	K2
CO2	Experiment with method of testing of workability of flow Characteristics of Self Compacting concrete.	K4
CO3	Examine the properties of fresh and hardened concrete	K4
CO4	Examine the concrete quality through NDT	K4

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

The weightage of Continuous Internal Evaluation (CIE) is 60% and for End Semester Examination (ESE) is 40%

S.No	Component	Type of Assessment	Max Marks	Reduced Marks	Total	Final Marks
1.	**Continuous Internal Examination(CIE) - Laboratory**	Continuous Assessment	75	75	100	60
2.		Model Lab Exam	25	25		
3.	**End Semester Examination (ESE)**	Lab Exam	100	40	40	40
					Total	100

Assessment Pattern

Bloom's Category	Terminal Examination
Remember	0
Understand	0
Apply	100
Analyse	0
Evaluate	0
Create	0

Course Code:	24CN151	Course Title:	TECHNICAL SEMINAR
Credits:	1	L – T – P	0-0-2

Course objectives:

To impart knowledge on the

- To work on a specific technical topic in Construction Engineering and Management in order to acquire the skills of oral presentation and to acquire technical writing abilities for seminars and conferences.
- The students have to refer the journals and conference proceedings and collect the literature.
- The student can select a course oriented topic.
- The students have to collect at least 30 research papers published in the last decades.
- Student has to make presentation for 20 minutes followed by 10 minutes discussion using power point
- The student has to make three presentations in the semester.
- The student has to write a technical report for about 30 - 50 pages (Title page, one-page Abstract, Review of Research paper under various sub - headings, concluding remarks and list of references).
- The technical report has to be submitted to the course coordinator one week before the final presentation.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. PowerPoint presentation
2. Lab experiment videos
3. Blended Mode of Learning
4. Experiential Learning
5. NPTEL and Other Videos
6. Smart Class Room

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Identify the area of interest of the student.	K2
CO2	Identify the thrust areas by referring journals, conference proceedings etc.	K2
CO3	Demonstrate own ideas in the current advancement in construction industry	K2
CO4	Develop report writing and presentation	K3

COs and POs Mapping:

COs	POs					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

The weightage of Continuous Evaluation (CE) is 100%

S.No	Type of Assessment	Max Marks	Reduced Marks	Total	Final Marks
1.	Continuous Assessment-I	100	50	100	100
2.	Continuous Assessment-II	100	50		
				Total	100

Course Code:	**24CN201**	**Course Title:**	**ADVANCED CONSTRUCTION TECHNIQUES**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To study and understand the latest construction techniques applied to engineering construction for sub structure, super structure, special structures.
- To gain the knowledge about the rehabilitation and strengthening techniques.
- To learn about the various demolition techniques.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I- SUB STRUCTURE CONSTRUCTION	**[9hours]**
Box jacking - Pipe jacking - Under water construction of diaphragm walls and basement - Tunneling techniques - Piling techniques - Driving well and caisson - sinking cofferdam - cable anchoring and grouting - Driving diaphragm walls, Sheet piles - Laying operations for built up offshore system - Shoring for deep cutting - Large reservoir construction - well points - Dewatering for underground open excavation.	

UNIT II SUPER STRUCTURE CONSTRUCTION FOR BUILDINGS	**[9hours]**
Vacuum dewatering of concrete flooring – Concrete paving technology – Techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections – Erection techniques of tall structures, Large span structures – launching techniques for heavy decks – in-situ prestressing in high rise structures, Post tensioning of slab- Aerial transporting – Handling and erecting lightweight components on tall structures.	

UNIT III CONSTRUCTION OF SPECIAL STRUCTURES	**[9hours]**
Erection of lattice towers - Rigging of transmission line structures – Construction sequence in cooling towers, Silos, chimney, and sky scrapers - Bow string bridges, Cable stayed bridges – Launching and pushing of box decks – Construction of jetties and break water structures – Construction sequence and methods in domes – Support structure for heavy equipment and machinery in heavy industries – Erection of articulated structures and space decks.	

UNIT IV REHABILITATION AND STRENGTHENING TECHNIQUES	**[9hours]**
Seismic retrofitting - Strengthening of beams, columns, slab and masonry wall - Protection methods of structures, Mud jacking and grouting for foundation – Micro piling and underpinning for strengthening floor and shallow profile - Sub grade water proofing, Soil Stabilization techniques.	
UNIT V DEMOLITION	**[9hours]**
Demolition Techniques, Demolition by Machines, Demolition by Explosives, Advanced techniques using Robotic Machines, Demolition Sequence, Dismantling Techniques, Safety precaution in Demolition and Dismantling.	

TOTAL:45 PERIODS

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Explain the various processes and techniques involved in sub-structure construction	K2
CO2	Choose the different methods used in super-structure construction.	K3
CO3	Categorize the construction process of special structures and offshore structures with advanced machinery and equipment.	K4
CO4	Discover the idea about the rehabilitation techniques carried out for strengthening of a structure	K4
CO5	Explain about the advanced demolition techniques carried out for dismantling a structure	K2

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final Marks</th></tr>
<tr><td rowspan="5">Continuous Internal Examination (CIE) - Theory</td><td>CIE – I</td><td>100</td><td rowspan="2">50</td><td rowspan="5">100</td><td rowspan="5">40</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>Assignment/Project</td><td>20</td><td>10</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td>End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>100</td><td>100</td><td>60</td></tr>
<tr><td colspan="5">Total</td><td>100</td></tr>
</table>

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

Reference Books:

1.Robertwade Brown, Practical foundation engineering handbook, McGrawHill Publications, 2000.

2.Concrete Structures: Repair, Rehabilitation and Strengthening, Dr.MohamedA.El-Reedy, 2020

3.Patrick Powers.J., Construction Dewatering: New Methods and Applications, JohnWiley& Sons, 1992.

4.Peter H.Emmons,"Concreterepairandmaintenanceillustrated",GalgotiaPublicationsPvt. Ltd., 2001.Press, 2008.

5.Sankar, S.K. and Saraswati, S., Construction Technology, Oxford University, New Delhi, 2008.

Web Links and Video Lectures (E-Resources):

1. Probability and Statisticshttps://nptel.ac.in/courses/111105090

Activity-Based Learning /Practical-Based Learning:

1. http://nptel.ac.in
2. https://swayam.gov.in

Course Code:	24CN202	Course Title:	PROJECT FORMULATION AND APPRAISAL
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To study and understand the formulation, and costing of construction projects, appraisal, finance, and private sector participation.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I- PROJECT FORMULATION	[9hours]
Project – Concepts – Capital investments - Generation and Screening of Project Ideas - Project identification – Preliminary Analysis, Market, Technical, Financial, Economic and Ecological - Pre- Feasibility Report and its Clearance, Project Estimates and Techno-Economic Feasibility Report, Detailed Project Report – Different Project Clearances required.	

UNIT II PROJECT COSTING	[9hours]
Project Cash Flows – Principles – Types – New Project and Replacement Project – Biases in Cash flow Estimation – Time Value of Money – Present Value – Future Value – Single amount - Annuity – Cost of Capital – Cost of Debt, Preference, Equity – Proportions - Cost of Capital Calculation – Financial Institutions Considerations.	

UNIT III PROJECT APPRAISAL	[9hours]
NPV – BCR – IRR – ARR – Urgency – Pay Back Period – Assessment of Various Methods – Indian Practice of Investment Appraisal – International Practice of Appraisal – Analysis of Risk – Different Methods – Selection of a Project and Risk Analysis in Practice.	

UNIT IV PROJECT FINANCING	[9hours]
Project Financing – Means of Finance – Financial Institutions – Special Schemes – Key Financial Indicators – Ratios – financial cost-benefit analysis, social-cost benefit analysis.	

UNIT V PRIVATE SECTOR PARTICIPATION	[9hours]
Private sector participation in Infrastructure Development Projects - BOT, BOLT, BOOT-Technology Transfer and Foreign Collaboration - Scope of Technology Transfer.	

TOTAL:45 PERIODS

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Explain the elements of Project formulation and appraisal.	K2
CO2	Develop the cost analysis report on the project.	K3
CO3	Classify the investment Appraisal the risk analysis and its assessment in practice.	K3
CO4	Analyse Financial aspects of projects	K4
CO5	Analyze the Implementations of Private Sector Participation in construction projects.	K4

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test 1	Continuous Assessment Test 2	Terminal Examination
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

Reference Books:

1. Barcus,S.W.and Wilkinson. J.W.,Hand Book of Management Consulting Services, McGraw Hill, New York, first edition, 1995.
2. Joy P.K., Total Project Management - The Indian Context, New Delhi, Laxmi Publications Pvt. Ltd, First edition 2017.
3. PrasannaChandra.,Projects—Planning,Analysis,Selection,Implementation Review, McGrawHill Publishing CompanyLtd.,NewDelhi.,Ninthedition, 2019.
4. United Nations Industrial Development Organisation (UNIDO) Manual for the Preparation of Industrial Feasibility Studies, (IDBI Reproduction) Bombay, 1995.
5. RainaV.K,"Construction Management Practice—Theinside Story",Tata McGrawHill Publishing Limited, 2005

Web Links and Video Lectures (E-Resources):

1. Probability and Statisticshttps://nptel.ac.in/courses/111105090

Activity-Based Learning /Practical-Based Learning:

1. http://nptel.ac.in

2. https://swayam.gov.in

Course Code:	**24CN203**	**Course Title:**	**CONSTRUCTION PLANNING, SCHEDULING AND CONTROL**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To study and understand the concept of planning.
- To impart concepts in Network representation and analysis.
- To impart concepts in Precedence Network analysis.
- To impart concepts in resource scheduling.
- To learn Concepts in project monitoring and controlling

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I- CONSTRUCTION PLANNING	**[9hours]**
Basic Concepts in the Development of Construction Plans – Choice of Technology and Construction Method – Defining Work Tasks and Work Break down Levels – Defining Precedence Relationships among Activities – Estimating Activity Durations – Estimating Resource Requirements for Work Activities – Coding Systems - Planning Project Schedule and Budget.	

UNIT II NETWORK REPRESENTATION AND ANALYSIS	**[9hours]**
Duration Estimation – Gantt / Bar Chart – Types of Network and Techniques – Introduction to Floats, Types of Floats, usage of Floats for Project Decisions - Presenting Project Schedules – Scheduling for Activity-on-Node and with Leads, Lags, and Windows – Critical Path Method (CPM) Network Analysis - PERT Network Modeling and Time Analysis - Case Illustrations.	

UNIT III PRECEDENCE NETWORK ANALYSIS	[9hours]
Introduction to Precedence Diagramming Method (PDM) - PDM network representation, Procedure and Analysis, Issues in PDM, Case Illustrations, Defining Relationship, Project Monitoring and Control Process.	

UNIT IV SCHEDULING PROJECT WORK AND RESOURCE SCHEDULING	[9hours]
Work Scheduling Fundamentals – Bar chart method of Work scheduling – Network Based Project Scheduling – Line of Balance Scheduling for Repetitive Projects - Scheduling with Uncertain Durations – Resources Scheduling Considerations – Crashing and Time/Cost Trade-offs- Case Illustrations – Use of Project management Software for scheduling Process.	

UNIT V PROJECT MONITORING AND CONTROLLING	[9hours]
The Cost Control Approach – Direct and Indirect Cost Control – Activity Cost Control – Financial Accounting Systems and Cost Accounts – Control of Project Cash Flows - Performance Control using Earned Value Management Concepts – Time progress monitoring and Controlling – Time Reduction Techniques – Guidelines for reviewing project Time and Cost Progress.	

TOTAL:45 PERIODS

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Identify and estimate the activity in the construction.	K3
CO2	Develop the networking of activities using the critical path method.	K3
CO3	Analyze the project budget required for the particular construction project.	K4
CO4	Explain the various quality control tool required in the construction industry	K2
CO5	Explainthedifferentdatabasesthatcanbemaintainedintheconstruction industry using computers	K2

COs and POs Mapping:

COs	POs					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	**2**	
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

Reference Books:

1. Albert Lester, Project Management, Planning and Control, 7th Edition, Butterworth-Heinemann, USA, 2017.
2. Chitkara K K., Construction project management, planning, scheduling and control, McGraw Hill (INDIA) publishers, New Delhi, third edition 2014.
3. Chris Hendrickson and Tung Au, Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.
4. Calin M. Popescu, Chotchai Charoenngam, Project Planning, Scheduling and Control in Construction: An Encyclopaedia of terms and Applications, Wiley, New York, 1995.
5. Halpin, D. W., Financial and Cost Concepts for Construction Management, John Wiley

Web Links and Video Lectures (E-Resources):

2. Probability and Statistics https://nptel.ac.in/courses/111105090

Activity-Based Learning /Practical-Based Learning:

1. http://nptel.ac.in
2. https://swayam.gov.in

Course Code:	24CN204	Course Title:	SAFETY PRACTICES AND MANAGEMENT
Credits:	**3**	**L – T – P**	**3-0-3**

Course objectives:
• Using risk assessment methods to determine priorities for eliminating hazards and reducing risks • Improved compliance with laws related to workforce safety and security
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. PowerPoint presentation 3. Lab experiment videos 4. Blended Mode of Learning 5. Experiential Learning 6. NPTEL and Other Videos 7. Smart Class Room 8. Flipped Class

UNIT I- CONSTRUCTION ACCIDENTS	[9hours]
Construction Accidents - Construction Safety Management: Importance – Causes of Accidents, Safety Measurers –Environmental Issues in Construction – Construction Industry related laws. Human Factors in Construction Safety - Legal and Financial aspects of accident in Construction - Occupational and Safety Hazard Assessment.	

UNIT II SAFETY PROGRAMMES AND CONTRACTUAL OBLIGATIONS	[9hours]
Safety Programmes – Construction safety – Element of effective safety programmes – job –site assessment – Safety meetings – Safety Incentives. Contractual Obligations – Safety in Construction Contracts – Substance abuse – Safety Record keeping.	
UNIT III DESIGNING FOR SAFETY	**[9hours]**
Safety Culture–Safe Workers– Safety and First Line Supervisors–Safety and Middle Managers – Top Management Practices, Company Activities and Safety – Safety Personnel– Sub contractual Obligation– Project Coordination and Safety Procedures– Workers Compensation.	

UNIT IV OWNER’S AND DESIGNER’S OUTLOOK	[9hours]
Accident Prevention – Cost of Accidents – Safety and Productivity – Safety Provision in the Factories act – Accident Reporting Investigation and Statistics – Total loss control and damage control – Safety sampling – Safety audit – Critical incidents technique – Safety equipment – Planning and Site preparation – safety system of storing construction materials – excavation – Blasting –Timbering – Scaffolding – Safe use of Ladder – Safety in Welding.	

UNIT V SAFETY IN HANDLING EQUIPMENT	[9hours]
Safety in hand tools – Safety in grinding – Hoisting Apparatus and Conveyors – Safety in the Use of Mobile Cranes –manual Handling – Safety in Demolition work – Trusses , Girders and beams – First aid - Fire hazard and Prevention Methods – Interesting experience at the construction site against the fire accident.	

TOTAL:45 PERIODS

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Define all staff their accountabilities and responsibilities for the development and delivery of safety	K2
CO2	Plan the adequate and appropriate safety information and training provided to all staff	K3
CO3	Infer that all staff is provided with adequate and appropriate safety information	K2
CO4	Develop the necessary training to build and maintain a meaningful operational safety	K3
CO5	Make use of the measurement of the organizational safety performance and safety targets are in place.	K3

COs and POs Mapping:

COs	POs					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

Reference Books:

1. Tim Howarth. and Paul Watson., Construction Safety Management, Wiley-Blackwell Publishing, New Jersey, First Edition, 2009.
2. Richard Coble, J. Jimmie Hinze. and Theo C. Haupt., Construction Safety and Health Management, Prentice Hall Inc., New Jersey, First Edition, 2009.
3. Alan Griffith. and Tim Howarth., Construction Health and Safety Management, CRC Press, Florida, First Edition, 2014.
4. Handbook On Construction Safety Practice, SP – 70, BIS, 2001.

Web Links and Video Lectures (E-Resources):

1. Probability and Statisticshttps://nptel.ac.in/courses/111105090

Activity-Based Learning /Practical-Based Learning:

1. http://nptel.ac.in

2. https://swayam.gov.in

Course Code:	**24CN231**	**Course Title:**	**ADVANCED COMPUTING TECHNIQUES LABORATORY**
Credits:	**2**	**L – T – P**	**0-0-4**

Course objectives:

To impart knowledge on the

- To train the students in utilizing the sophisticated spreadsheets programs,
- To train the students to handle estimation software.
- To train the students to handle the Project management software.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. PowerPoint presentation
2. NPTEL and Other Videos
3. Smart Class Room
4. Flipped Class

List of Experiments:

1. Quantity take off, Preparation and delivery of the bid or proposal of an engineering construction project.
2. Design of a simple equipment information system for a construction project.
3. Scheduling of a construction project using software.
4. Scheduling of a construction project using tools like MS project scheduling systems.
5. Resource allocation for construction project and levelling of the resources.
6. Monitoring of the construction project, tracking and taking reports using tools like MS project scheduling systems.
7. Inventory management system for the given construction project.
8. Simulation models for project risk analysis

TOTAL:60 PERIODS

List of Software

•MS OFFICE

•MS PROJECT

•PRIMAVERA SOFTWARE

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Apply computational techniques in optimization and sequencing problems	K3
CO2	Plan using management tools	K3
CO3	Analyze resources for construction projects	K4
CO4	Explain the volume of activities involved in a project	K3

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

The weightage of Continuous Internal Evaluation (CIE) is 60% and for End Semester Examination (ESE) is 40%

S.No	Component	Type of Assessment	Max Marks	Reduced Marks	Total	Final Marks
1.	**Continuous Internal Examination(CIE) - Laboratory**	Continuous Assessment	75	75	100	60
2.		Model Lab Exam	25	25		
3.	**End Semester Examination (ESE)**	Lab Exam	100	40	40	40
					Total	100

Assessment Pattern

Bloom's Category	Terminal Examination
Remember	0
Understand	0
Apply	100
Analyse	0
Evaluate	0
Create	0

Course Code:	24CN251	Course Title:	PRACTICAL TRAINING I
Credits:	**1**	**L – T – P**	**0-0-2**

Course objectives: • To train the students in the field work so as to have a first-hand knowledge of practical problems related to Construction Management in carrying out engineering tasks.
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. PowerPoint presentation 2. NPTEL and Other Videos 3. Smart Class Room 4. Flipped Class

SYLLABUS:

The students individually undertake training in reputed engineering companies doing construction during the summer vacation for a specified duration of four weeks. At the end of training, a detailed report on the work done should be submitted within ten days from the commencement of the semester. The students will be evaluated through a viva-voce examination by a team of internal staff.

Course Code:	24CN211	Course Title:	ADVANCED CONCRETE TECHNOLOGY
Credits:	**3**	**L – T – P**	**3-0-3**

Course objectives: To impart knowledge on the • To develop the ability to apply the concepts of Estimation Theory and Correlation & Regression in Engineering problems. • To understand basic concepts of Probability theory and Random Variables, how to deal with multiple Random Variables. • To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems. • To use the concepts of multivariate normal distribution and principal components analysis.
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. PowerPoint presentation 3. Lab experiment videos 4. Blended Mode of Learning 5. Experiential Learning 6. NPTEL and Other Videos 7. Smart Class Room 8. Flipped Class

UNIT I- CONCRETE MAKING MATERIALS	[9hours]
Aggregates classification IS Specifications, Properties, Grading, Methods of combining aggregates, specified grading, Testing of aggregates - Cement, Grade of cement, Chemical composition, Testing of concrete, Hydration of cement, Structure of hydrated cement, special cements - Water - Chemical admixtures, Mineral admixture.	

UNIT II MIX DESIGN	[9hours]
Principles of concrete mix design, Methods of concrete mix design, IS Method, ACI Method, DOE Method – Mix design for special concretes- changes in Mix design for special materials	

UNIT III CONCRETING METHODS	[9hours]
Process of manufacturing of concrete, methods of transportation, placing and curing, cracking, plastic shrinkage, Extreme weather concreting, special concreting methods. Vacuum dewatering – Underwater Concrete	

UNIT IV SPECIAL CONCRETES	[9hours]
Light weight concrete Fly ash concrete, Fiber reinforced concrete, Sulphur impregnated concrete, Polymer Concrete – High performance concrete. High performance fiber reinforced concrete, Self- Compacting Concrete, Geo Polymer Concrete, Waste material-based concrete – Ready mixed concrete.	

UNIT V TESTS ON CONCRETE	[9hours]
Properties of fresh concrete, Hardened concrete, Strength, Elastic properties, Creep and shrinkage – Durability of concrete. Non-destructive Testing Techniques - microstructure of concrete.	

TOTAL:45 PERIODS

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Develop knowledge on various materials needed for concrete manufacture	K3
CO2	Apply the rules to do mix designs for concrete by various methods	K3
CO3	Develop the methods of manufacturing of concrete.	K3
CO4	Explain about various special concrete	K2
CO5	Explain various tests on fresh and hardened concrete	K2

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	40	40	40
Apply	30	30	30
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Reference Books:

1. Gupta.B.L., Amit Gupta, "Concrete Technology, Jain Book Agency, 2017.
2. Shetty M.S., Concrete Technology, S.Chand and Company Ltd. Delhi, 2019.
3. Gambhir.M.L., Concrete Technology, McGraw Hill Education, 2006.
4. Neville, A.M., Properties of Concrete, Prentice Hall, 1995, London.
5. Job Thomas., Concrete Technology, Cencage learning India Private Ltd, New Delhi, 2015

Activity-Based Learning /Practical-Based Learning:

1. http://nptel.ac.in

2. https://swayam.gov.in

Course Code:	24CN212	Course Title:	HUMAN RESOURCES MANAGEMENT IN CONSTRUCTION
Credits:	3	L – T – P	3-0-3

Course objectives: To impart knowledge on the • To impart knowledge on manpower planning. • To learn the organization structure. • To study the human relations and organizational behavior. • To gain knowledge on welfare measures, job evaluation, insurance. • To understand the managerial roles and development methods
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. PowerPoint presentation 3. Lab experiment videos 4. Blended Mode of Learning 5. Experiential Learning 6. NPTEL and Other Videos 7. Smart Class Room 8. Flipped Class

UNIT I- MANPOWER PLANNING	[9hours]
Manpower planning and forecasting – Recruitment, selection process-Sources-Induction- Orientation and Training -Manpower Planning process - Organising, Staffing, directing, and Controlling - Factors influencing supply and demand of human resources – Role of HR manager – Personnel Principles	

UNIT II ORGANISATION	[9hours]
Elements of an organization- Management process in organizations- Planning-Organizing-Staffing- Directing- Controlling – Delegation of authority – responsibility – accountability – lines and staff organization Workforce diversity-international dimensions of Organization- Organizational structure determinants of organizational design	

UNIT III HUMAN RELATIONS AND ORGANISATIONAL BEHAVIOUR	[9hours]
Basic individual psychology – Approaches to job design and job redesign – Self managing work teams – Intergroup – Conflict in organizations – Leadership-Engineer as Manager –aspects of decision making – Significance of human relation and organizational – Individual in organization –Motivation – Personality and creativity – Group dynamics, Team working – Communication and negotiation skills	

UNIT IV WELFARE MEASURES	[9hours]
Compensation – Safety and health – GPF – EPF – Group Insurance – Housing - Pension – Laws related to welfare measures.	

UNIT V MANAGEMENT AND DEVELOPMENT METHODS	[9hours]
Wages and Salary, Employee benefits, Employee appraisal and assessment - Management Development - On-the-job and off-the-job- Management Developments – Performance appraisal in practice. Managing careers: Career planning and development - Managing promotions and transfer of operations – Developing policies, practices and establishing process pattern – Competency up gradation and their assessment – New methods of training and development – Performance Management - Total Quality Management	

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Apply the practices and techniques for evaluating performance and structuring teams	K3
CO2	Explain the role of the leader and leadership principles & attitudes.	K2
CO3	Demonstrate the professional and ethical responsibilities	K2
CO4	Develop commitment to quality, timeliness, and continuous improvement.	K3
CO5	Organize managerial role with emphasis on the management of the human resources.	K3

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	40	40	40
Apply	30	30	30
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Reference Books:

1. D. Longford M.R. Hancock, R. Rellows & A. W. Gale, "Human Recourse Management In Construction" Longman Group Limited, fourth impression 2000.
2. Carleton Counter II and Jill Justice Coulter, "The Complete Standard Hand Book of Construction Personnel Management ", Prentice Hall, Inc., New Jersey, 1989.
3. Memoria,C.B., "Personnel Management", Himalaya Publishing Co., 1997.
4. Andrew,D., Szilagg, "Hand Book of Engineering Management", 1982.
5. Oxley Rand Poslcit, "Management Techniques applied to the Construction Industry",Granda Publishing Ltd., 1980.

Activity-Based Learning /Practical-Based Learning:

1. http://nptel.ac.in
2. https://swayam.gov.in

Course Code:	**24CN213**	**Course Title:**	**CONSTRUCTION PROJECT MANAGEMENT**
Credits:	**3**	**L – T – P**	**3-0-3**

Course objectives:

To impart knowledge on the

- To learn the various stages of a project, project life cycle and the role of project managers.
- To learn the strategic planning and organization of project participants.
- To gain knowledge on project design and construction process.
- To study the utilization of labour, materials & equipments and also cost estimation.
- To learn the thrust areas of construction project management.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I- THE OWNERS' PERSPECTIVE	[9hours]
Introduction - Project Life Cycle - Types of Construction - Selection of Professional Services - Construction Contractors - Financing of Constructed Facilities - Legal and Regulatory Requirements - Changing Environment of the Construction Industry - Role of Project Managers.	

UNIT II ORGANIZING FOR PROJECT MANAGEMENT	[9hours]
Project Management – Modern trends - Strategic Planning - Effects of Project Risks on Organization - Organization of Project Participants -Traditional Designer-Constructor Sequence -Professional Construction Management - Owner-Builder Operation - Turnkey Operation - Leadership and Motivation for the Project Team.	

UNIT III DESIGN AND CONSTRUCTION PROCESS	[9hours]
Design and Construction as an Integrated System - Innovation and Technological Feasibility -Innovation and Economic Feasibility - Design Methodology - Functional Design - Construction Site Environment.	

UNIT IV LABOUR, MATERIALS, EQUIPMENTS AND COST ESTIMATION	[9hours]
Labour Productivity – Labour Relations in Construction - Problems in Collective Bargaining - Material Procurement and Delivery - Inventory Control - Construction Equipments - Choice of Equipments and Standard Production Rates – Type of Construction Cost Estimates - Effects of Scale on Construction Cost - Unit Cost Method of Estimation - Methods for Allocation of Joint Costs - Historical Cost Data - Estimate Based on Engineer's List of Quantities - Estimation of Operating Costs.	

UNIT V THRUST AREAS IN PROJECT MANAGEMENT	[9hours]
Strengths, Weaknesses, opportunities, threats analysis (SWOT) - S. W. O. T. matrix utility of S. W. O. T. matrix on strategic planning and management - Supply Chain Management (SCM) - Management strategy for implementing SCM in construction organizations and on construction projects - Concepts of critical chain in construction projects based on the theory of constraints -Earned Value Analysis.	

TOTAL:45 PERIODS

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Apply the practices and techniques for evaluating performance and structuring teams	K3
CO2	Explain the role of the leader and leadership principles & attitudes.	K2
CO3	Demonstrate the professional and ethical responsibilities	K2
CO4	Develop commitment to quality, timeliness, and continuous improvement.	K3
CO5	Organize managerial role with emphasis on the management of the human resources.	K3

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	40	40	40
Apply	30	30	30
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Reference Books:

1. Prasanna Chandra "Project Planning, Analysis, Selection, Implementation and review" ,Tata McgrawHill, 8h Edition, 2017.
2. Choudhury S, "Project Management", McGraw-Hill Publishing Company, New Delhi, 2017.
3. Chitkara, K.K. "Construction Project Management: Planning, Scheduling and Control", Tata McGraw-Hill Publishing Company, New Delhi, 3rd Edition, 2014.
4. Frederick E. Gould, "Construction Project Management", Wentworth Institute of Technology, Vary E. Joyce, Massachusetts Institute of Technology,4th Edition, 2013.
5. Chris Hendrickson and Tung Au, "Project Management for Construction
6. Fundamental Concepts for Owners", Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2nd edition, 2000.

Activity-Based Learning /Practical-Based Learning:

1. http://nptel.ac.in
2. https://swayam.gov.in

Course Code:	**24CN214**	**Course Title:**	**SUSTAINABLE CONSTRUCTION**
Credits:	**3**	**L – T – P**	**3-0-3**

Course objectives:

To impart knowledge on the

- To impart knowledge about sustainable construction and to understand the concepts of sustainable materials, energy calculations, green buildings and environmental effects.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I INTRODUCTION	**[9hours]**
Introduction and definition of Sustainability - Carbon cycle - role of construction material: concrete and steel, etc. - CO2 contribution from cement and other construction materials.	

UNITII MATERIALS USED IN SUSTAINABLE CONSTRUCTION	**[9hours]**
Construction materials and indoor air quality - No/Low cement concrete - Recycled and manufactured aggregate - Role of QC and durability - Life cycle and sustainability.	

UNITIII ENERGY CALCULATIONS	**[9hours]**
Components of embodied energy - calculation of embodied energy for construction materials - Energy concept and primary energy - Embodied energy via-a-vis operational energy in conditioned building - Life Cycle energy use	

UNITIV GREEN BUILDINGS	[9hours]
Control of energy use in building - ECBC code, codes in neighboring tropical countries -OTTV conceptsandcalculations—FeaturesofLEEDandTERI—Griharatings-Roleofinsulationand thermal properties of construction materials - influence of moisture content and modeling – Performance ratings of green buildings-Zero energy building	

UNITV ENVIRONMENTALEFFECTS	[9hours]
Non-renewable sources of energy and Environmental aspects – energy norm, coal, oil, natural gas -Nuclear energy - Global temperature, Green house effects, global warming - Acid rain: Causes, effects and control methods - Regional impacts of temperature change.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Select the various sustainable materials used in construction.	K3
CO2	Apply the method of estimating the amount of energy required for building.	K3
CO3	Interpret the features of LEED, TERI and GRIHA ratings of buildings	K2
CO4	Explain the concept and performance of zero energy buildings.	K2
CO5	Select less carbon emission materials for construction.	K2

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	40	40	40
Apply	30	30	30
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Reference Books:

1. Charles J Kibert, Sustainable Construction : Green Building Design & Delivery, 4th Edition , Wiley Publishers 2016.
2. SteveGoodhew, Sustainable Construction Process,WileyBlackwell,UK,2016.
3. CraigA.Langston&GraceK.C.Ding,SustainablePracticesintheBuiltEnvironment, Butterworth Heinemann Publishers, 2011.
4. William P Spence, Construction Materials, Methods & Techniques (3e), Yesdee Publication Pvt. Ltd,2012.

Activity-Based Learning /Practical-Based Learning:

1.http:/nptel.ac.in

2.http:/Swayam.gov.in

Course Code:	**24CN221**	**Course Title:**	**ECONOMICS AND FINANCE MANAGEMENT IN CONSTRUCTION**
Credits:	**3**	**L – T – P**	**3-0-3**

Course objectives:

To impart knowledge on the

- To learn the basic principles of economics in Civil Engineering.
- To discuss the financial management system.
- To study the fundamentals of financial accounting principles.
- To learn the various alternative proposals methods to financial reporting purposes.
- To study the investment alternatives and property evaluation.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT- I BASIC PRINCIPLES OF ECONOMICS IN CIVIL ENGINEERING	**[9hours]**
Role of civil engineering in industrial development - Advances in civil engineering and engineering economics - Support matters of economy as related to engineering Market demand and supply -Time Value of Money – Cash Flow diagram – Constant increment to periodic payments –Arithmetic Gradient (G), Geometric Gradient (C).	

UNIT-II FINANCIAL MANAGEMENT	**[9hours]**
Project Finance – Sources of finance - Long-term and short -term finance, Working Capital Management, Inventory valuation, Mortgage Financing - Leasing - Equity financing - Internal generation of funds - External commercial borrowings - International financial management - Foreign currency management.	

UNIT-III FUNDAMENTALS OF MANAGEMENT ACCOUNTING	[9hours]
Management accounting, Financial accounting principles- basic concepts, Financial statements –accounting ratios - funds flow statement -Ratio analysis - Investment and financing decision –Financial control Job control and centralized management– Cash flow statement- Balance Sheet -Profit and Loss account.	

UNIT-IV ALTERNATIVES PROPOSALS	[9hours]
Investigation and evaluation – Comparing alternatives- Present worth Analysis, Annual worth Analysis, Future worth Analysis, Rate of Return Analysis (ROR) and Incremental Rate of Return (IROR) Analysis, Benefit/Cost Analysis, Break Even Analysis- Accounting for tax reporting purposes and financial reporting purposes.	

UNIT-V EVALUATING ALTERNATIVE INVESTMENTS	[9hours]
Alternative investments – Real Estate - Investment Property, Equipment Replace Analysis, Depreciation – Tax before and after depreciation – Valuation- Value Added Tax (VAT) – Inflation.	

TOTAL:45 PERIODS

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Explain the elements of construction economics	K2
CO2	Summarize the financial management system and practical problems.	K2
CO3	Apply accounting principles in construction management.	K3
CO4	Explain the alternative methods for proposals	K2
CO5	Plan to Prepare income, profit and loss statements and implement management accounting	K3

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	**2**	
Remember	30	30	30
Understand	40	40	40
Apply	30	30	30
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Reference Books:

1. Patel, B. M., "Project management- strategic Financial Planning, Evaluation and Control", Vikas Publishing House Pvt. Ltd. New Delhi,2000.
2. Shrivastava,U.K., "Construction Planning and Management",2nd Edn. Galgotia Publications Pvt. Ltd. New Delhi, 2000.
3. Collier.C and GlaGola .C., "Engineering Economics & Cost Analysis", 3nd Edn. Addison
   Wesley Education Publishers,1998.
4. Blank, L.T., and Tarquin,a.J "Engineering Economy",4th Edn. Mc-Graw Hill Book Co,1988.
5. Steiner, H.M. "Engineering Economic principles", 2nd Edn. Mc-Graw Hill Book, New York,1996.

Activity-Based Learning /Practical-Based Learning:

1.http:/nptel.ac.in

2.http:/Swayam.gov.in

Course Code:	24CN222	Course Title:	DESIGN OF ENERGY EFFICIENT BUILDINGS
Credits:	3	L – T – P	3-0-3

Course objectives:

To impart knowledge on the

- To understanding the concept of energy consumption in buildings and design a energy efficient building

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I INTRODUCTION	[9hours]
Climate adapted and climate rejecting buildings – Heat Transfer – Measuring Conduction – Thermal Storage – Measurement of Radiation – The Greenhouse Effect – Convection – Measuring latent and sensible heat – Psychrometry Chart – Thermal Comfort – Microclimate, Site Planning and Development – Temperature – Humidity – Wind – Optimum Site Locations – Sun Path Diagrams – Sun Protection – Types of Shading Devices – Design responses to energy conservation strategies.	

UNIT II PASSIVE SOLAR HEATING AND COOLING	[9hours]
General Principles of passive Solar Heating – Key Design Elements – Sunspace – Direct gain – Trombe Walls, Water Walls – Convective Air loops – Concepts – Case Studies – General Principles of Passive Cooling – Ventilation – Principles – Case studies – Courtyards – Roof Ponds – Cool Pools – Predicting ventilation in buildings – Window Ventilation Calculations – Room Organization Strategies for Cross and Stack Ventilation – Radiation – Evaporation and dehumidification – Wind Catchers – Mass Effect – Zoning – Load Control – Air Filtration and odor removal.	

UNIT III DAYLIGHTING AND ELECTRICAL LIGHTING	[9hours]
Materials, components and details – Insulation – Optical materials – Radiant Barriers – Glazing materials – Glazing Spectral Response – Day lighting – Sources and concepts –Building Design Strategies – Case Studies – Daylight apertures – Light Shelves – Codal requirements – Day lighting design – Electric Lighting – Light Distribution – Electric Lighting control for day lighted buildings – Switching controls – Coefficient of utilization – Electric Task Lighting – Electric Light Zones – Power Adjustment Factors.	

UNIT IVHEAT CONTROL AND VENTILATION	[9hours]
Hourly Solar radiation – Heat insulation – Terminology – Requirements – Heat transmission through building sections – Thermal performance of Building sections – Orientation of buildings – Building characteristics for various climates – Thermal Design of buildings – Influence of Design Parameters – Mechanical controls – Examples. Ventilation – Requirements – Minimum standards for ventilationVentilation Design – Energy Conservation in Ventilating systems – Design for Natural Ventilation Calculation of probable indoor wind speed.	

UNIT IVDESIGN FOR CLIMATIC ZONES	[9hours]
Energy efficiency – An Overview of Design Concepts and Architectural Interventions – Embodied Energy – Low Embodied Energy Materials – Passive Downdraft Evaporative Cooling – Design of Energy Efficient Buildings for Various Zones – Cold and cloudy – Cold and sunny – Composite – Hot and dry – Moderate – Warm and humid – Case studies of residences, office buildings and other buildings in each zones – Commonly used software packages in energy efficient building analysis and design - Energy Audit – Certification.	

TOTAL:45 PERIODS

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Explain environmental energy supplies on buildings	K2
CO2	Explain the passive solar heating, cooling system	K2
CO3	Choose the various aspects of day-lighting and electrical lighting in a building	K2
CO4	Identify and design building ventilation and heat control for in door comfort	K3
CO5	Plan a building for climatic zone and apply simulation programs of buildings toper form energy calculations	K3

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	40	40	40
Apply	30	30	30
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Reference Books:

1. Energy Conservation Building Code, Bureau of Energy Efficiency, New Delhi, 2018.
2. Brown, G.Z. and DeKay, M., Sun, Wind and Light - Architectural Design Strategies, John Wiley and Sons Inc,3rd Edition, 2014.
3. Handbook on Functional Requirements of Buildings Part 1 to 4 SP : 41 (S and T) 1995
4. Residential Energy: Cost Savings and Comfort for Existing Buildings by John Krigger and Chris Dorsi, Published by Saturn Resource Management, 2013.
5. Majumdar, M (Ed), Energy - Efficient Buildings in India, Tata Energy Research Institute, Ministry of Non-Conventional Energy Sources, 2009.

Activity-Based Learning /Practical-Based Learning:

1.http:/nptel.ac.in

2.http:/Swayam.gov.in

Course Code:	**24CN223**	**Course Title:**	**PERSONNEL MANAGEMENT IN CONSTRUCTION**
Credits:	**3**	**L – T – P**	**3-0-3**

Course objectives:
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. PowerPoint presentation 3. Lab experiment videos 4. Blended Mode of Learning 5. Experiential Learning 6. NPTEL and Other Videos 7. Smart Class Room 8. Flipped Class

UNIT - I MAN POWER PLANNING	**[9hours]**
Manpower Planning process , Organizing, Staffing, directing, and controlling – Estimation, manpower requirement – Factors influencing supply and demand of human resources – Role of HR manager – Personnel Principles.	

UNIT - II ORGANISATION	[9hours]
Organization – Span of Control – Organization Charts – Staffing Plan - Development and Operation of human resources - Managerial Staffing – Recruitment – Selection - Placement, Training and Development	

UNIT - III HUMAN BEHAVIOUR	[9hours]
Introduction to the field of people management - basic individual psychology; motivation - Job design and performance management - Managing groups at work - self-managing work teams - intergroup behaviour and conflict in organizations – Leadership - Behavioural aspects of decision-making; and communication for people management	

UNIT - IV WELFARE MEASURES	[9hours]
Compensation – Safety and health – GPF – EPF – Group Insurance – Housing - Pension – Laws related to welfare measures.	

UNIT - V MANAGEMENT AND DEVELOPMENT METHODS	[9hours]
Compensation - Wages and Salary, Employee Benefits, employee appraisal and assessment - Employee services - Safety and Health – Discipline and discharge - Special Human resource problems, Performance appraisal. - Employee hand book and personnel manual - Job descriptions and organization structure and human relations – Productivity of Human resources	

TOTAL:45 PERIODS

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Explain the various processes in manpower planning, organizational and welfare measures	K2
CO2	Identify the development and operation of human resources.	K2
CO3	Analyze the field of people management and intergroup behavior and conflict in organizations.	K4
CO4	Explain the welfare measures and Laws related to welfare measures.	K2
CO5	Illustrate the elements of management and development methods of the employee services.	K2

COs and POs Mapping:

COs	POs					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	**2**	
Remember	30	30	30
Understand	40	40	40
Apply	30	30	30
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Reference Books:

1. Matthias Zeuch., Handbook of Human Resources Administration, Springer, Berlin Heidelberg, First Edition, 2016.
2. Tyagi, A.K., Handbook on Energy Audits and Management, Tata Energy Research Institute, Bangalore, First Edition, 2003.
3. Rao, V.S.P. and Mamoria, C.B., Personnel Management (Text and Cases), Himalaya Publishing House, Bangalore, First Edition, 2019.
4. Dwivedi, R.S., Human Relations and Organisational Behaviour, Macmillian India Ltd., Noida, First Edition, 2008.

Web Links and Video Lectures (E-Resources):

Activity-Based Learning /Practical-Based Learning:

1.http://nptel.ac.in

2.http://Swayam.gov.in

Course Code:	**24CN224**	**Course Title:**	**COMPUTER APPLICATIONS IN CONSTRUCTION ENGINEERING AND PLANNING**
Credits:	**3**	**L – T – P**	**3-0-3**

Course objectives:

To impart knowledge on the

- To acquire knowledge on software requirements in construction process.
- To learn the various optimization techniques.
- To gain knowledge on inventory models.
- To acquire knowledge on project planning and scheduling.
- To understand the various problems in construction field.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I SOFTWARE APPLICATIONS	[9hours]
Overview of IT Applications in Construction – Construction process – Computerization in Construction – Computer aided Cost Estimation – Developing application with database software.	

UNIT II OPTIMIZATION TECHNIQUES	[9hours]
Linear, Dynamic, and Integer Programming - Branch and Bound Techniques – Application to Production Scheduling, Equipment Replacement, Material Transportation and Work Assignment Problems – Software applications.	

UNIT III INVENTORY MODELS	[9hours]
Deterministic: Economic order quantity (EOQ) model, EOQ with finite supply, EOQ with backorders, EOQ with constraints, All-units quantity discounts model. and Probabilistic Inventory Models - discrete and continuous demand - Software applications..	

UNIT IV SCHEDULING APPLICATION	[9hours]
Program Evaluation & Review Techniques and Critical Path Method – Advanced planning and scheduling concepts – computer application - Project cost considerations, Project duration, and updating and Resource allocation: Resource smoothening and leveling	

UNIT V SEQUENCING AND SIMULATION	[9hours]
Sequencing and replacement model: Sequencing problem -Simulation - Enterprises – Introduction to Enterprise Resource Planning(ERP) systems – Interaction of simulation tool with ERP –Simulation Analysis for ERP – Case Studies.	

TOTAL:45 PERIODS

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Outline the application with database software in construction engineering.	K2
CO2	Apply linear programing techniques in construction	K3
CO3	Summarize the various types of inventory model.	K2
CO4	Apply the scheduling knowledge in engineering projects.	K3
CO5	Solve problems using simulation and ERP systems.	K3

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	40	40	40
Apply	30	30	30
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Reference Books:

1. Tarek Hegazy, "Computer-Based Construction Project Management", Pearson New International Edition, 2013.
2. Billy E.Gillet., "Introduction to Operations Research – A Computer Oriented Algorithmic
   Approach", Mc Graw Hill, 2008.
3. Feigenbaum,L., "Construction Scheduling with Primavera Project Planner" Prentice Hall
   Inc.,2002.
4. Ming Sun and Rob Howard, "Understanding I.T. in Construction", Spon Press, Taylor and Francis Group, 2004.
5. Paulson, B.R., "Computer Applications in Construction", Mc Graw Hill, 1995

Activity-Based Learning /Practical-Based Learning:

1.http:/nptel.ac.in
2.http:/Swayam.gov.in

Course Code:	24CN241	Course Title:	QUALITY CONTROL AND ASSURANCE IN CONSTRUCTION
Credits:	3	L – T – P	3-0-3

Course objectives: To impart knowledge on the • To study the concepts of quality management in construction. • To study the concepts of quality systems. • To study the concepts of quality planning. • To study the concepts of quality assurance and control techniques in construction. • To study the concepts of quality improvement techniques.
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. PowerPoint presentation 3. Lab experiment videos 4. Blended Mode of Learning 5. Experiential Learning 6. NPTEL and Other Videos 7. Smart Class Room 8. Flipped Class

UNIT I- QUALITY MANAGEMENT	[9 hours]
Introduction – Definitions and Objectives – Factor Influencing Construction Quality - Responsibilities and Authority - Quality Plan - Quality Management Guidelines – Quality Circles	

UNIT II QUALITY SYSTEMS	[9 hours]
Introduction - Quality System Standard – ISO 9000 Family of Standards – Requirements – Preparing Quality System Documents – Quality Related Training – Implementing a Quality System – Third Party Certification	

UNIT III QUALITY PLANNING	[9 hours]
Quality Policy, Objectives and Methods in Construction Industry - Consumers Satisfaction, Ergonomics - Time of Completion - Statistical Tolerance – Taguchi"s Concept of Quality – Codes and Standards – Documents – Contract and Construction Programming – Inspection Procedures - Processes and Products – Total QA / QC Programme and Cost Implication	

UNIT IV QUALITY ASSURANCE AND CONTROL	[9 hours]
Objectives - Regularity Agent, Owner, Design, Contract and Construction Oriented Objectives, Methods -Techniques and Needs of QA/QC - Different Aspects of Quality - Appraisals, Factors Influencing Construction Quality - Critical, Major Failure Aspects and Failure Mode Analysis, -Stability Methods and Tools, Optimum Design - Reliability Testing, Reliability Coefficient and Reliability Prediction	

UNIT V QULAITY IMPROVEMENT TECHNIQUES	[9 hours]
Selection of New Materials - Influence of Drawings, Detailing, Specification, Standardization - Bid Preparation -Construction Activity, Environmental Safety, Social and Environmental Factors - Natural Causes and Speed of Construction - Life Cycle Costing - Value Engineering and Value Analysis	

TOTAL:45 PERIODS

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Explain the principles of Quality management	K2
CO2	Illustrate the basic in quality management system.	K2
CO3	Summarize the feasibility in planning in quality procedures.	K2
CO4	Explain the quality assuring and control systems	K2
CO5	Develop the quality techniques to be followed in improving the construction field.	K3

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	**2**	
Remember	40	40	40
Understand	40	40	40
Apply	20	20	20
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

REFERENCE BOOKS:

1. James Brien, J.o., Construction Inspection Handbook – Quality Assurance and Quality Control, Van Nostrand, New York, Third Edition, 2013.
2. Steven McCabe., Quality Improvement Techniques in Construction, Taylor & Francis, New York, Third Edition, 2014.
3. Ashford, J.L., The Management of Quality in Construction, CRC Press, Taylor & Francis Group, Oxfordshire ,Fourth Edition, 2020.
4. Clarkson Oglesby, H., Productivity Improvement in Construction, McGraw-Hill, New York, First Edition, 1989.

Course Code:	24CN242	Course Title:	RESOURCE MANAGEMENT AND CONTROL IN CONSTRUCTION
Credits:	**3**	**L – T – P**	**3-0-3**

Course objectives:

To impart knowledge on the

- To impart the concept resource planning
- To impart the concepts of labor management.
- To impart the concepts of material and equipment.
- To impart the concepts of time management.
- To impart the concepts of resource allocation and resource leveling in construction.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1.Chalk and Talk
2.PowerPoint presentation
3.Lab experiment videos
4.Blended Mode of Learning
5.Experiential Learning
6.NPTEL and Other Videos
7.Smart Class Room
8.Flipped Class

UNIT I- RESOURCE PLANNING	[9 hours]
Resource Planning, Procurement, Identification, Personnel, Planning for material, Labour, time schedule and cost control, Types of resources, manpower, Equipment, Material, Money, Time.	

UNIT II LABOUR MANAGEMENT	[9 hours]
Systems approach, Characteristics of resources, Utilization, measurement of actual resources required, Tools for measurement of resources, Labour, Classes of Labour, Cost of Labour, Labour schedule, optimum use Labour.	

UNIT III MATERIALS AND EQUIPMENT	[9 hours]
Material: Time of purchase, the quantity of material, sources, Transportation, Delivery, and Distribution Equipment: Planning and selecting by optimistic choice with respect to cost, Time, Source, and handling.	

UNIT IV TIME MANAGEMENT	[9 hours]
Personnel time, Management and planning, managing time on the project, forecasting the future, Critical path measuring the changes and their effects – Cash flow and cost control.	

UNIT V RESOURCE ALLOCATION AND LEVELLING	[9 hours]
Time-cost trade-off, Computer application – Resource levelling, resource list, resource allocation, Resource loading, Cumulative cost – Value Management.	

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Identify the different types of resources in a construction industry	K2
CO2	Analyze the labour productivity and the influencing factors	K4
CO3	Select the equipment output and the operation condition of construction equipment	K2
CO4	Explain the terms of cash inflow, cash outflow, and balance sheet	K2
CO5	Identify the time and cost-related information in a construction sector	K2

Course outcomes:

On completion of the course, the student will have the ability to:

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	40	40	40
Apply	30	30	30
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

REFERENCES:

1. Sharma, S C., Construction equipment management, Khanna publishers, Delhi, 2016
2. Kumar Neeraj Jha Construction project management, Pearson publishers, 2015.
3. Andrew, D., Szilagg, Hand Book of Engineering Management, 1982.
4. Oxley Rand Poslcit, Management Techniques applied to the Construction Industry, Granda Publishing Ltd., 1996.
5. Paul Netscher, Construction Project Management: Tips and Insights, Panet Publications, 2017.

Course Code:	**24CN243**	**Course Title:**	**SHORING, SCAFFOLDING AND FORMWORK**
Credits:	**3**	**L – T – P**	**3-0-3**

Course objectives:

To impart knowledge on the

- To disseminate knowledge about detailed planning.
- To impart knowledge about materials used in formwork.
- To learn design of formwork and shores.
- To disseminate knowledge about erection of form work.
- To impart knowledge about design of formwork for domes, shells, and tunnels

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1.Chalk and Talk
2.PowerPoint presentation
3.Lab experiment videos
4.Blended Mode of Learning
5.Experiential Learning
6.NPTEL and Other Videos
7.Smart Class Room
8.Flipped Class

UNIT I- PLANNING, SITE EQUIPMENT & PLANT FOR FORM WORK	**[9hours]**
Introduction - Forms for foundations, columns, beams walls etc., General objectives of formwork building - Planning for safety - Development of a Basic System - Key Areas of cost reduction - Planning examples. Overall Planning - Detailed planning - Standard units - Corner units - Pass units- Calculation of labour constants - Formwork hours - Labour Requirement - Overall programme - Detailed programme - Costing - Planning crane arrangements - Site layout plan - Transporting plant- Formwork beams - Scaffold frames - Framed panel formwork - Formwork accessories.	

UNIT II MATERIALS ACCESSORIES PROPRIETARY PRODUCTS & PRESSURES	**[9hours]**
Lumber - Types - Finish - Sheathing boards working stresses - Repetitive member stress - Plywood- Types and grades - Jointing Boarding - Textured surfaces and strength - Reconstituted wood - Steel - Aluminum - Hardware and	

fasteners - Nails in Plywood - Allowable withdrawal load and lateral load. Pressures on formwork - Examples - Vertical loads for design of slab forms - Uplift on shores - Laterals loads on slabs and walls.	
UNIT III DESIGN OF FORMS AND SHORES	**[9hours]**
Basic simplification - Beam formulae - Allowable stresses - Deflection, Bending - Lateral stability - Shear, Bearing - Design of Wall forms - Slab forms - Beam forms - Column forms - Examples in each. Simple wood stresses - Slenderness ratio - Allowable load vs length behaviour of wood shores- Form lining Design Tables for Wall formwork - Slab Formwork - Column Formwork - Slab props - Stacking Towers - Free standing and restrained - Rosett Shoring - Shoring Tower - Heavy Duty props	

UNIT IV BUILDING AND ERECTING THE FORM WORK	**[9hours]**
Carpentry Shop and job mill - Forms for Footings - Wall footings - Column footings - Sloped footing forms - Strap footing - Stepped footing - Slab form systems - Sky deck and Multiflex - Customized slab table - Standard Table module forms - Swivel head and uniportal head - Assembly sequence - Cycling with lifting fork - Moving with table trolley and table prop. Various causes of failures - ACI - Design deficiencies - Permitted and gradual irregularities	

UNIT V FORMS FOR DOMES AND TUNNELS, SLIP FORMS AND SCAFFOLDS	**[9hours]**
Hemispherical, Parabolic, Translational shells - Typical barrel vaults Folded plate roof details - Forms for Thin Shell roof slabs design considerations - Building the forms - Placing concrete - Form removed -Strength requirements -Tunnel forming components - Curb forms invert forms - Arch forms- Concrete placement methods - Cut and cover construction - Bulk head method - Pressures on tunnels - Continuous Advancing Slope method - Form construction - Shafts. Slip Forms – Principles -Types - advantages - Functions of various components - Planning -Desirable characteristics of concrete - Common problems faced - Safety in slip forms special structures built with slip form Technique - Types of scaffolds - Putlog and independent scaffold -Single pole scaffolds - Truss suspended - Gantry and system scaffolds.	

TOTAL:45 PERIODS

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Explain basic concepts and ideas related with detailed planning of framework	K2
CO2	Classify the materials accessories proprietary products and its pressures	K2
CO3	Make out the comprehensive design aspects of forms and shores	K2
CO4	Apply the knowledge of erecting forms for beams, slabs, columns, walls, and causes of failures.	K3
CO5	Explain the entire system of forms for domes and tunnels, slip forms and scaffolds	K2

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	40	40	40
Apply	30	30	30
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

REFERENCE BOOKS:

1. Austin, C.K.,Form work for Concrete ,Cleaver -HumePressLtd.,London,1996.
2. Hurd,M.K., Formwork for Concrete,Seventh Edition, American Concrete Institute, Detroit, 2016
3. MichaelP.Hurst, Construction Press, LondonandNewYork,2003.
4. Robert L. Peurifoy and Garold D. Oberlender, Formwork for Concrete Structures, McGraw - Hill, 2010.
5. Kumar NeerajJha, FormworkforConcreteStructures,2017

Course Code:	24CN244	Course Title:	SYSTEM INTEGRATION IN CONSTRUCTION
Credits:	3	L – T – P	3-0-3

Course objectives:

To impart knowledge on the

- To understand how the various systems that constitute a building design which are interwoven and integrated with a view to achieving a high-performance building;
- To understand about the various environmental factors.
- To understand about the various services.
- To understand about the various maintenance and safety planning.

Teaching-Learning Process:
Suggested strategies that teachers may use to effectively achieve the course outcomes: 1.Chalk and Talk 2.PowerPoint presentation 3.Lab experiment videos 4.Blended Mode of Learning 5.Experiential Learning 6.NPTEL and Other Videos 7.Smart Class Room 8.Flipped Class

UNIT I-STRUCTURALINTEGRATION	**[9 hours]**
Structural System, Systems for enclosing Buildings, Functional aesthetic system, Materials Selection and Specification.	

UNIT II ENVIRONMENTALFACTORS	**[9hours]**
Qualities of enclosure necessary to maintain a specified level of interior environmental quality – weather resistance – Thermal infiltration – Acoustic Control – Transmission reduction – Air quality – illumination – Relevant systems integration with structural systems.	

UNIT III SERVICES	**[9 hours]**
Plumbing—Electricity—Verticalcirculationandtheirinteraction—HeatingVentilationandAir- conditioning Systems in Buildings and mplementation techniques in High Rise Buildings.	

UNIT IVMAINTENANCE	**[9 hours]**
Component longevity in terms of operation performance and resistance to deleterious forces – Planning systems for least maintenance materials and construction—access for maintenance— Feasibility for replacement of damaged components —equal life elemental design—maintenance free exposed and finished surfaces.	

UNIT V SAFETYPLANNING	**[9 hours]**
Ability of systems to protect fire – Preventive systems – fire escape system design – Planning for pollutionfreeconstructionenvironmental—HazardfreeConstructionexecutionforHigh Rise Buildings	

TOTAL: 45 PERIODS

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Explain the various construction techniques and incorporate into the building process	K2
CO2	Explain the requirements and elements of HVAC, mechanical, electrical, hydraulic and transportation services in buildings	K2
CO3	Construct and integrate services into high-rise buildings	K3
CO4	Interpret the intricacies of physical installation of services and their critical sequence in the construction maintenance process.	K2
CO5	Explain the safety planning in construction of highrise building	K2

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	40	40	40
Apply	30	30	30
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

REFERENCES:

1. A.J.Elderand Martiz Vinden Barg,Handbook of Building Enclosure,McGraw-HillBook Company, 1983.
2. DavidV. Chadderton ,Building Services Engineering,TaylorandFrancis,2013.
3. Safety planning. JaneTaylorand GordonCooke, The Fire Precautions Actin Practices,1987
4. Peter R. Smithand WarrenG.Julian, Building Services, Applied Science PublishersLtd., London, 1993

Course Code:	24AC201	Course Title:	ENGLISH FOR RESEARCH PAPER WRITING
Credits:	0	L – T – P	2-0-0

Course objectives:

To impart knowledge on the

- Teach how to improve writing skills and level of readability
- Tell about what to write in each section
- Summarize the skills needed when writing a Title
- Infer the skills needed when writing the Conclusion
- Ensure the quality of paper at very first-time submission

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1.Chalk and Talk
2.PowerPoint presentation
3.Lab experiment videos
4.Blended Mode of Learning
5.Experiential Learning

UNIT I INTRODUCTION TO RESEARCH PAPER WRITING	[6 hours]
Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness	

UNIT II PRESENTATION SKILLS	[6 hours]
Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction	

UNIT III TITLE WRITING SKILLS	[6 hours]
Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check	

UNIT IV RESULT WRITING SKILLS	[6 hours]
Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions	

UNIT V VERIFICATION SKILLS	[6 hours]
Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first- time submission	

TOTAL: 30 PERIODS

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Understand that how to improve your writing skills and level of readability	K1
CO2	Learn about what to write in each section	K1
CO3	Understand the skills needed when writing a Title	K1
CO4	Understand the skills needed when writing the Conclusion	K1
CO5	Ensure the good quality of paper at very first-time submission	K2

REFERENCES

1. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011
2. Day R How to Write and Publish a Scientific Paper, Cambridge University Press 2006
3. Goldbort R Writing for Science, Yale University Press (available on Google Books) 2006
4. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book 1998.

Course Code:	24AC202	Course Title:	DISASTER MANAGEMENT
Credits:	0	L – T – P	2-0-0

Course objectives:

To impart knowledge on the

- Summarize basics of disaster
- Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Develop the strengths and weaknesses of disaster management approaches

Teaching-Learning Process:
Suggested strategies that teachers may use to effectively achieve the course outcomes:
1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning

UNIT I INTRODUCTION	[6 hours]
Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude	

UNIT II REPERCUSSIONS OF DISASTERS AND HAZARDS	[6 hours]
Economic Damage, Loss of Human and Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.	

UNIT III DISASTER PRONE AREAS IN INDIA	[6 hours]
Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics	

UNIT IV DISASTER PREPAREDNESS AND MANAGEMENT	[6 hours]
Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.	

UNIT V RISK ASSESSMENT	[6 hours]
Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People’s Participation in Risk Assessment. Strategies for Survival	

TOTAL: 30 PERIODS

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Ability to summarize basics of disaster	K2
CO2	Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.	K2
CO3	Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.	K2
CO4	Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.	K2
CO5	Ability to develop the strengths and weaknesses of disaster management approaches	K2

REFERENCES

1. Goel S. L., Disaster Administration And Management Text And Case Studies",Deep & Deep Publication Pvt. Ltd., New Delhi,2009.
2. NishithaRai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'NewRoyal book Company,2007.
3. Sahni, PardeepEt.Al. ," Disaster Mitigation Experiences And Reflections", Prentice Hall OfIndia, New Delhi,2001.

Course Code:	**24AC203**	**Course Title:**	**CONSTITUTION OF INDIA**
Credits:	**0**	**L – T – P**	**2-0-0**

Course objectives:

To impart knowledge on the

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional Role and entitlement to civil and economic rights as well as the emergence nation hood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolutionin1917and its impact on the initial drafting of the Indian Constitution.

Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1.Chalk and Talk 2.PowerPoint presentation 3.Lab experiment videos 4.Blended Mode of Learning 5.Experiential Learning

UNIT I HISTORY OF MAKING OF THE INDIAN CONSTITUTION	**[6 hours]**
History, Drafting Committee, (Composition & Working)	

UNIT II PHILOSOPHY OF THE INDIAN CONSTITUTION	**[6 hours]**
Preamble, Salient Features	

UNIT III CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES	**[6 hours]**
Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.	

UNIT IV ORGANS OF GOVERNANCE	**[6 hours]**
Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.	

UNIT V LOCAL ADMINISTRATION	**[6 hours]**
District's Administration head: Role and Importance Municipalities: Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy(Different departments), Village level:Role of Elected and Appointed officials, Importance of grass root democracy.	

UNIT VI	[6 hours]
Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.	

TOTAL: 30 PERIODS

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.	K2
CO2	Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.	K2
CO3	Discuss the circumstances surrounding the foundation of the Congress Socialist Party[CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.	K2
CO4	Discuss the passage of the Hindu Code Bill of 1956.	K2

REFERENCES

1. The Constitution of India,1950(Bare Act),Government Publication.
2. Dr.S.N.Busi, Dr.B. R.Ambedkar framing of Indian Constitution,1st Edition, 2015.
3. M.P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis,2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Course Code:	24AC204	Course Title:	நற்றமிழ் இலக்கியம்
Credits:	0	L – T – P	2-0-0

UNIT I சங்க இலக்கியம்	[6 hours]
1. தமிழனின் துவக்க நூல் தொல்காப்பியம் – எழுத்து சொல் பொருள் 2.அகநானூறு (82)- இயற்கை இன்னிசை அரங்கம் 3. குறிஞ்சிப்பாட்டின் மலர்காட்சி 4. புறநானூறு (95,195) போரை நிறுத்தி ஔவையார்	
UNIT II அறநெறித் தமிழ்	**[6 hours]**
1. அறநெறி வகுத்த திருவள்ளுவர் -அறம் வலியுறுத்தல், அன்புடைமை, ஒப்புரவறிதல், ஈகை, புகழ் 2. பிற அற நூல்கள் - இலக்கிய மருந்து - ஏலாதி சிறுபஞ்சமூலம், திரிகடுகம், ஆசாரக்கோவை (தூய்மையை வலியுறுத்தும் நூல்)	

UNIT III இரட்டைக்காப்பியங்கள்	[6 hours]
1. கண்ணகியின் புரட்சி சிலப்பதிகார வழக்குரை காதை சமூக சேவை இலக்கியம் மணிமேகலை சிறைக்கோட்டம் அறக்கோட்டமாகிய கதை	

UNIT IV அருள்நெறித் தமிழ்	[6 hours]
1. சிறுபாணாற்றுப்படை -பாரி முல்லைக்கு தேர் கொடுத்தது பேகன் மயிலுக்கு போர்வை கொடுத்தது அதியமான் ஔவைக்கு நெல்லி கொடுத்தது, அரசர் பண்புகள் 2. நற்றிணை- அன்னைக்குரிய புன்னை சிறப்பு 3. திருமந்திரம்(617,618)- இயமம் நியமம் விதிகள் 4. தர்மச்சாலையை நிறுவிய வள்ளலார் 5. புறநானூறு- சிறுவனே வள்ளலானான் 6. அகநானூறு (4) - வண்டு	

நற்றிணை(11) - நண்டு கலித்தொகை(11) - யானை, புறா ஐந்திணை 50(27) - மான் ஆகியவை பற்றிய செய்திகள்	
UNIT V நவீன தமிழ் இலக்கியம்	**[6 hours]**
1. உரைநடை தமிழ் - தமிழின் முதல் புதினம், - தமிழிலன் முதல் சிறுகதை , - கட்டுர இலக்கியம் , - பயண இலக்கியம், - நாடகம். 2, நாட்டு விடுதலைப் போராட்டமும் தமிழ் இலக்கியமும் 3. சமுதாய விடுதலையும் தமிழ் இலக்கியமும் 4. பெண் விடுதலையும் விளிம்பு நிலைநரின் மேம்பாட்டில் தமிழ் இலக்கியமும் 5. அறிவியல் தமிழ் 6. இணையத்தில் தமிழ் 7. சுற்றுச்சூழல் மேம்பாட்டில் தமிழ் இலக்கியம்	

TOTAL: 30 PERIODS

தமிழ் இலக்கிய வெளியீடுகள் புத்தகங்கள்

1. தமிழ் இணைய கல்விக்கழகம் (Tamil Virtual University) – www.tamilvu.org
2. தமிழ் விக்கிபீடியா (Tamil Wikipedia) -https://ta.wikipedia.org
3. தர்மபுர ஆதீன வெளியீடு
4. வாழ்வியல் களஞ்சியம் தமிழ் பல்கலைக்கழகம் தஞ்சாவூர்
5. தமிழ் கலைக்களஞ்சியம் தமிழ் வளர்ச்சித் துறை (thamilvalarchithurai.com)
6. அறிவியல் களஞ்சியம் தமிழ் பல்கலைக்கழகம் தஞ்சாவூர்

ROHINI COLLEGE OF ENGINEERING AND TECHNOLOGY

(AUTONOMOUS)

(Anjugramam-Kanyakumari Main Road, Palkulam,Variyoor P.O.-629 401, K.K.Dist.)

Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai

Accredited with A+ Grade by NAAC

M.E. Computer Science and Engineering

(M.E CSE)

Curriculum & Syllabus

(*2024-2025 Admitted Students Onwards*)

Vision Statement of RCET

To be an academic institute of continuous excellence towards education and research in rural regime and provide service to nation in terms of nurturing potentially higher social, ethical and engineering companion graduands.

Mission Statement of RCET

To foster and promote technically competent graduands by imparting the state of art Engineering education in rural regime.

To enunciate research assisted scientific learning by dissemination of knowledge towards science, agriculture, industry and national security.

Vision of the Department

To create young software professionals to compete the global challenges in the field of computer science and engineering and be researcher to meet the need of society.

Mission of the Department

- ✓ To provide quality education to develop software for real time problem in scientific and business application for various needs of industry.
- ✓ To provide learning ambience to enhance innovations, problem solving skill, leadership qualities, team spirit and ethical responsibility to serve the society.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1	To Produce Postgraduates With enhanced knowledge of real word engineering problems and to apply the knowledge of Computer science and Engineering to solve the problems
PEO2	To produce Postgraduates with the ability to analyze the requirements, understand the technical specification, design, offer an engineering solution, and create a novel product design.
PEO3	To Produce Postgraduates who will be function effectively as an individual, and enhance their leadership skills with ethical values and team spirit

PROGRAMME OUTCOMES (POs)

PO1	An ability to independently carry out research /investigation and development work to solve practical problems
PO2	An ability to write and present a substantial technical report/document
PO3	Students should be able to demonstrate a degree of mastery computer science and engineering. The mastery should be at a level higher than the requirements in the appropriate bachelor program.
PO4	Students should be able to Function effectively as an individual and have the booming carrier in academia, research and entrepreneurial endeavors.
PO5	Students should be able to demonstrate the knowledge for the sustainable development of the society.

CREDIT INFO		
Sl.No	Category	Credits
1	Foundation Courses (FC)	4
2	Professional Core Courses (PCC)	34
3	Professional Electives (PEC)	13
4	Research Methodology and IPR Courses (RMC)	2
5	Open Electives Courses (OEC)	3
6	Employability Enhancement Courses (EEC)	19
7	Audit Courses (AC)	-
	Total Credits	75

Foundation Courses (FC)							
Sl.no	Course Code	Course Title	Course Type	L	T	P	Credit
1	24CP101	Linear Algebra, Probability and Statistics	FC	3	1	0	4
Professional Core Courses (PCC)							
Sl.no	Course Code	Course Title	Course Type	L	T	P	Credit
1	24CP102	Advanced Data Structures and Algorithms	PCC	3	0	0	3
2	24CP103	Advanced Computer Networking and Design	PCC	3	0	0	3
3	24CP104	Advanced Operating Systems	PCC	3	0	0	3
4	24CP105	Database Practices	PCC	3	0	2	4
5	24CP131	Advanced Data Structures and Algorithms Laboratory	PCC	0	0	4	2
6	24CP201	Advanced Software Engineering	PCC	3	0	0	3
7	24CP202	Internet of Things	PCC	3	0	2	4
8	24CS203	Multicore Architecture and Programming	PCC	3	0	2	4
9	24CS204	Machine Learning	PCC	3	0	2	4
10	24CP252	Software Engineering Laboratory	PCC	0	0	2	1
11	24CP301	Security Practices	PCC	3	0	0	3

Professional Electives (PEC)							
Professional Elective I							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24CP205	Human Computer Interaction	PEC	3	0	0	3
2	24CP206	Cloud Computing Technologies	PEC	3	0	0	3
3	24CP207	Foundations of Data Science	PEC	3	0	0	3
4	24CP208	Wireless Communications	PEC	3	0	0	3
5	24CP209	Agile Methodologies	PEC	3	0	0	3
6	24CP210	Performance Analysis of Computer Systems	PEC	3	0	0	3
Professional Elective II							
7	24CP212	High Performance Computing for Big Data	PEC	3	0	0	3
8	24CP213	Autonomous Systems	PEC	3	0	0	3
9	24CP214	Web Analytics	PEC	3	0	0	3
10	24CP215	Cognitive Computing	PEC	3	0	0	3
11	24CP216	Quantum Computing	PEC	3	0	0	3
12	24CP217	Big Data Mining and Analytics	PEC	3	0	0	3
Professional Elective III							
13	24CP302	Mobile and Pervasive Computing	PEC	3	0	0	3
14	24CP303	Web Services and API Design	PEC	3	0	0	3
15	24CP304	Data Visualization Techniques	PEC	3	0	0	3
16	24CP305	Compiler Optimization Techniques	PEC	3	0	0	3
17	24CP306	Robotics	PEC	3	0	0	3
18	24CP307	Natural Language Processing	PEC	2	0	2	3
Professional Elective IV							
19	24CP309	Devops and Microservices	PEC	3	0	2	4
20	24CP310	Deep Learning	PEC	3	0	2	4
21	24CP311	Blockchain Technologies	PEC	3	0	2	4
22	24CP312	Embedded Software Development	PEC	3	0	2	4
23	24CP313	Full Stack Web Application Development	PEC	3	0	2	4
24	24CP314	Bioinformatics	PEC	3	0	2	4

Research Methodology and IPR Courses (PCC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24RM101	Research Methodology and IPR	RMC	2	0	0	2
Open Electives Courses (OEC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24CI341	Integrated Water Resources Management	OEC	3	0	0	3
2	24CI342	Water, Sanitation and Health	OEC	3	0	0	3
3	24CI343	Principles of Sustainable Development	OEC	3	0	0	3
4	24CI344	Environmental Impact Assessment	OEC	3	0	0	3
5	24TE342	Vibration and Noise Control Strategies	OEC	3	0	0	3
6	24TE341	Energy Conservation and Management in Domestic Sectors	OEC	3	0	0	3
7	24TE343	New Product Development	OEC	3	0	0	3
8	24CI345	Sustainable Management	OEC	3	0	0	3
9	24IS341	Micro and Small Business Management	OEC	3	0	0	3
10	24IS343	Intellectual Property Rights	OEC	3	0	0	3
11	24IS344	Ethical Management	OEC	3	0	0	3
12	24EM341	IoT for Smart Systems	OEC	3	0	0	3
13	24EM342	Smart Grid	OEC	3	0	0	3
14	24TE344	Design Thinking	OEC	3	0	0	3
15	24CM341	Medical Robotics	OEC	3	0	0	3
16	24EM343	Embedded Automation	OEC	3	0	0	3
17	24CI346	Environmental Sustainability	OEC	3	0	0	3
18	24TE345	Textile Reinforced Composites	OEC	3	0	0	3
19	24TE346	Nanocomposite Materials	OEC	3	0	0	3
20	24TE342	Electric Vehicle Technology	OEC	3	0	0	3
Employability Enhancement Courses (EEC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit

1	24CP251	Term Paper Writing and seminar	EEC	0	0	2	1
2	24CP351	Project Work I	EEC	0	0	12	6
3	24CP451	Project Work II	EEC	0	0	24	12
Audit Courses (AC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24AC101	English for Research Paper Writing	AC	2	0	0	0
2	24AC102	Disaster Management	MNC	2	0	0	0
3	24AC103	Constitution of India	MNC	2	0	0	0
4	24AC104	நற்றமிழ் இலக்கியம்	MNC	2	0	0	0

SCHEME OF INSTRUCTION FOR FIRST YEAR M.E.

I SEMESTER

S.no	Course code	Course Title	Category	L	T	P	C
THEORY COURSES							
1	24CP101	Linear Algebra, Probability and Statistics	FC	3	1	0	4
2	24RM101	Research Methodology and IPR	RMC	2	0	0	2
3	24CP102	Advanced Data Structures and Algorithms	PCC	3	0	0	3
4	24CP103	Advanced Computer Networking and Design	PCC	3	0	0	3
5	24CP104	Advanced Operating Systems	PCC	3	0	0	3
6	24AC1XX	Audit Course – I*	AC	2	0	0	0
THEORY COURSE WITH LABORATORY COMPONENT							
7	24CP105	Database Practices	PCC	3	0	2	4
LABORATORY COURSES							
8	24CP131	Advanced Data Structures and Algorithms Laboratory	PCC	0	0	4	2
TOTAL				19	1	6	21

*Audit Course is Optional

SEMESTER II

S.no	Course code	Course Title	Categor y	L	T	P	C
THEORY COURSES							
1	24CP201	Software and Data Engineering	PCC	3	0	0	3
2	24CP2XX	Professional Elective I	PEC	3	0	0	3
3	24CP2XX	Professional Elective II	PEC	3	0	0	3
4	24AC1XX	Audit Course – II*	AC	2	0	0	0
THEORY COURSE WITH LABORATORY COMPONENT							
5	24CP202	Internet of Things	PCC	3	0	2	4
6	24CS203	Multicore Architecture and Programming	PCC	3	0	2	4
7	24CS204	Machine Learning	PCC	3	0	2	4
LABORATORY COURSES							
8	24CP251	Term Paper Writing and seminar	EEC	0	0	2	1
9	24CP252	Software and Data Engineering Laboratory	PCC	0	0	2	1
TOTAL				20	0	10	23

*Audit Course is Optional

Course Code:	24CP101	Course Title:	Linear Algebra, Probability and Statistics
Credits:	**4**	**L – T – P**	3 – 1 – 0

Course objectives:

- To develop a working knowledge of the central ideas of Linear Algebra.
- To understand basic concepts of Probability theory and Random Variables, how to deal with multiple Random Variables.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To use the concepts of multivariate normal distribution and principal components analysis.

Teaching-Learning Process:

These are sample strategies which teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method does not mean only traditional method, but different type of teaching methods may be adopted to develop the outcomes.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Topics will be introduced in a multiple representation and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT I – Linear Algebra	[12 hours]

Vector spaces – norms – Inner Products – Eigenvalues using QR transformations – QR factorization – generalized eigenvectors – Canonical forms – singular value decomposition and applications – pseudo inverse – least square approximations.

UNIT II – Probability and Random Variables	[12 hours]

Probability – Axioms of probability – Conditional probability – Baye's theorem – Random variables – Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a random variable.

UNIT III – Two Dimensional Random Variables	**[12 hours]**
Joint distributions – Marginal and conditional distributions – Functions of two-dimensional random variables – Regression curve – Correlation.	

UNIT IV – Testing of Hypothesis	**[12 hours]**
Analysis of variance – One way and two way classifications – Completely randomized design – Randomized block design – Latin square design - 2^2 Factorial design.	

UNIT V – Multivariate Analysis	**[12 hours]**
Random vectors and matrices – Mean vectors and covariance matrices – Multivariate normal density and its properties – Principal components: Population principal components – Principal components from standardized variables.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Apply the concepts of Linear Algebra to solve real time problems.	K3
CO2	Apply the ideas of probability and random variables in solving engineering problems.	K3
CO3	Use two dimensional random variables and be equipped for a possible extension to multivariate analysis.	K3
CO4	Apply statistical tests in testing hypotheses on data	K3
CO5	Develop critical thinking based on empirical evidence and the scientific approach to knowledge development.	K3

COs and POs Mapping:

Course Outcomes	Programme Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2			
CO2	3	2	2			
CO3	2		1	1		
CO4	3	2	1	1		
CO5	3	3	2			

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Skill Assessment Components: Individual Assignment / Worksheet / Case Study / Mini Project

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	20	20	20
Understand	20	20	20
Apply	60	60	60
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

Reference Books:

1. Gupta.S.C., and Kapoor, V.K., "Fundamentals of Mathematical Statistics", 12th Edition, Sultan Chand and Sons, 2020.
2. Jay L. Devore, "Probability and statistics for Engineering and the Sciences", 8th Edition, Cengage Learning, 2014.
3. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", 9th Edition, Pearson Education, Asia, 2016.

4. Johnson, R.A. and Wichern, D. W. “Applied Multivariate Statistical Analysis”, 6th Edition, Pearson Education, Asia, 2012.
5. Rice, J.A. "Mathematical Statistics and Data Analysis", 3rd Edition, Cengage Learning, 2015.
6. Bronson, R., “Matrix Operation” Schaum’s outline series, Tata McGraw Hill, New York, 2011.

Web Links and Video Lectures (E-Resources):

1. Probability Distributions
   https://www.nptelvideos.com/lecture.php?id=14400
2. Sampling Distributions: :
   https://www.nptelvideos.com/lecture.php?id=14612
3. Testing of Hypothesis
   https://www.nptelvideos.com/lecture.php?id=14425

Equivalent NPTEL/SWAYAM Courses:

S.No.	Course Title	Course Instructor	Host Institute
1	Probability and Statistics	Prof. Somesh Kumar	IIT Kharagpur
2	Statistical Methods for Scientists and Engineers	Prof. Somesh Kumar	IIT Kharagpur

Course Code:	**24RM101**	**Course Title:**	**Research Methodology and IPR**
Credits:	**2**	**L – T – P**	**2-0-0**

Course Objectives:

To impart knowledge on the

- To addresses the issues inherent in selecting a research problem and discuss the techniques and tools to be employed in completing a research project
- To understand the basic concepts in research process and data collection
- To prepare report writing and framing Research proposals
- To develop an understanding of the ethical dimensions of conducting applied research.
- To demonstrate enhanced Scientific writing skills, academic writing, patenting and avoid the common mistakes in the field of research methodology.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Blended Mode of Learning
3. Project based Learning
4. Experiential Learning
5. NPTEL and Other Videos
6. Smart Class Room
7. Flipped Class

UNIT I – RESEARCH DESIGN	**[6 hours]**
Overview of research process and design, Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys.	

UNIT II – DATA COLLECTION AND SOURCES	**[6 hours]**
Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data - Preparing, Exploring, examining and displaying.	

UNIT III – DATA ANALYSIS AND REPORTING	[6 hours]
Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation.	

UNIT IV – INTELLECTUAL PROPERTY RIGHTS	[6 hours]
Intellectual Property – The concept of IPR, Evolution and development of concept of IPR, IPR development process, Trade secrets, utility Models, IPR & Biodiversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.	

UNIT V – PATENTS	[6 hours]
Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification, Types of patent application, process E-filing, Examination of patent, Grant of patent, Revocation, Equitable Assignments, Licenses, Licensing of related patents, patent agents, Registration of patent agents.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Search, select and critically analyze research articles and papers
CO2	Formulate and evaluate research questions.
CO3	Develop the ability to apply the methods while working on a research project work
CO4	Understand the ethical dimensions of conducting applied research
CO5	Develop the Scientific writing skills, academic writing and patents

COs and POs Mapping:

COs	**POs**					
	1	**2**	**3**	**4**	**5**	**6**
CO1	3	2	2	3	2	3
CO2	3	-	-	-	1	3

CO3	3	-	-	1	1	2
CO4	3	-	-	-	1	1
CO5	3	-	-	1	1	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0 Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	60
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	40	40	40
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. Cooper Donald R, Schindler Pamela S and Sharma JK, "Business Research Methods", Tata McGraw Hill Education, 11e (2012).
2. Catherine J. Holland, "Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets", Entrepreneur Press, 2007.
3. David Hunt, Long Nguyen, Matthew Rodgers, "Patent searching tools & techniques", Wiley, 2007.
4. The Institute of Company Secretaries of India, Statutory body under an Act of parliament, "Professional Programme Intellectual Property Rights, Law and practice", September 2013

Course Code:	24CP102	Course Title:	ADVANCED DATA STRUCTURES AND ALGORITHMS
Credits:	3	L – T – P	3-0-0

Course objectives:

To impart knowledge on the

- To understand the usage of algorithms in computing
- To learn and use hierarchical data structures and its operations
- To learn the usage of graphs and its applications
- To select and design data structures and algorithms that is appropriate for problems
- To study about NP Completeness of problems

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Interactive Simulations
4. Lab experiment videos
5. Blended Mode of Learning
6. Project based Learning
7. Experiential Learning
8. NPTEL and Other Videos
9. Smart Class Room
10. Flipped Class

UNIT I-ROLE OF ALGORITHMS IN COMPUTING & COMPLEXITY ANALYSIS	[9 hours]
Algorithms – Algorithms as a Technology -Time and Space complexity of algorithms Asymptotic analysis-Average and worst-case analysis-Asymptotic notation-Importance of efficient algorithms-Program performance measurement - Recurrences: The Substitution Method – The Recursion-Tree	

Method- Data structures and algorithms.

UNIT II-HIERARCHICAL DATA STRUCTURES	[9 hours]
Binary Search Trees: Basics – Querying a Binary search tree – Insertion and Deletion- Red Black trees: Properties of Red-Black Trees – Rotations – Insertion – Deletion -B-Trees: Definition of B - trees – Basic operations on B-Trees – Deleting a key from a B-Tree- Heap – Heap Implementation – Disjoint Sets - Fibonacci Heaps: structure – Mergeable-heap operations- Decreasing a key and deleting a node-Bounding the maximum degree	

UNIT III-GRAPHS	[9 hours]
Elementary Graph Algorithms: Representations of Graphs – Breadth-First Search – Depth-First Search – Topological Sort – Strongly Connected Components- Minimum Spanning Trees: Growing a Minimum Spanning Tree – Kruskal and Prim- Single-Source Shortest Paths: The Bellman-Ford algorithm – Single-Source Shortest paths in Directed Acyclic Graphs – Dijkstra‘s Algorithm; Dynamic Programming - All-Pairs Shortest Paths: Shortest Paths and Matrix Multiplication – The Floyd-Warshall Algorithm	

UNIT IV-ALGORITHM DESIGN TECHNIQUES	[9 hours]
Dynamic Programming: Matrix-Chain Multiplication – Elements of Dynamic Programming – Longest Common Subsequence- Greedy Algorithms: – Elements of the Greedy Strategy- An Activity-Selection Problem - Huffman Coding	

UNIT V NP COMPLETE AND NP HARD	[9 hours]
NP-Completeness: Polynomial Time – Polynomial-Time Verification – NP-Completeness and Reducibility – NP-Completeness Proofs – NP-Complete Problems.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Design data structures and algorithms to solve computing problems.

CO2	Choose and implement efficient data structures and apply them to solve problems.
CO3	Design algorithms using graph structure and various string-matching algorithms to solve real-life problems.
CO4	Design one’s own algorithm for an unknown problem.
CO5	Apply suitable design strategy for problem solving.

On completion of the course, the student will have the ability to: **COs and POs Mapping:**

COs	**POs**					
	1	**2**	**3**	**4**	**5**	**6**
CO1	3	2	2	3	1	3
CO2	3	1	-	-	2	3
CO3	3	-	1	1	-	2
CO4	3	2	1	-	2	1
CO5	3	3	1	1	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	60
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	40	40	40
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).

- All the fifteen questions have to be answered.

Reference Books:

.

1. S.Sridhar,” Design and Analysis of Algorithms”, Oxford University Press, 1st Edition, 2014.
2. Adam Drozdex, “Data Structures and algorithms in C++”, Cengage Learning, 4th Edition, 2013.
3. T.H. Cormen, C.E.Leiserson, R.L. Rivest and C.Stein, "Introduction to Algorithms", Prentice Hall of India, 3rd Edition, 2012.
4. Mark Allen Weiss, “Data Structures and Algorithms in C++”, Pearson Education, 3rd Edition, 2009
5. E. Horowitz, S. Sahni and S. Rajasekaran, “Fundamentals of Computer Algorithms”,University Press, 2nd Edition, 2008.
6. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, “Data Structures and Algorithms”,Pearson Education, Reprint 2003

Course Code:	**24CP103**	**Course Title:**	**ADVANCED COMPUTER NETWORKING AND DESIGN**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To understand the basic concepts of networks
- To explore various technologies in the wireless domain
- To study about 4G and 5G cellular networks
- To learn about Network Function Virtualization
- To understand the paradigm of Software defined networks

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Interactive Simulations
4. Lab experiment videos
5. Blended Mode of Learning
6. Project based Learning
7. Experiential Learning
8. NPTEL and Other Videos
9. Smart Class Room
10. Flipped Class

UNIT I – NETWORKING CONCEPTS	**9 hours]**
Peer To Peer Vs Client-Server Networks. Network Devices. Network Terminology. Network Speeds. Network throughput, delay. Osi Model. Packets, Frames, And Headers. Collision And Broadcast Domains. LAN Vs WAN. Network Adapter. Hub. Switch. Router. Firewall, IP addressing.	

UNIT II – WIRELESS NETWORKS	**[9 hours]**
Wireless access techniques- IEEE 802.11a, 802.11g, 802.11e, 802.11n/ac/ax/ay/ba/be, QoS – Bluetooth – Protocol Stack – Security – Profiles – zigbee	

UNIT III – MOBILE DATA NETWORKS	**[9 hours]**
4G Networks and Composite Radio Environment – Protocol Boosters – Hybrid 4G Wireless Networks Protocols – Green Wireless Networks – Physical Layer and Multiple Access – Channel Modelling for 4G – Concepts of 5G – channel access –air interface -Cognitive Radio- spectrum management – C-RAN architecture - Vehicular communications-protocol – Network slicing – MIMO, mmWave, Introduction to 6G.	

UNIT IV – SOFTWARE DEFINED NETWORKS	[9 hours]
SDN Architecture. Characteristics of Software-Defined Networking. SDN- and NFV-Related Standards. SDN Data Plane. Data Plane Functions. Data Plane Protocols. OpenFlow Logical Network Device. Flow Table Structure. Flow Table Pipeline. The Use of Multiple Tables. Group Table. OpenFlow Protocol. SDN Control Plane Architecture. Control Plane Functions. Southbound Interface. Northbound Interface. Routing. ITU-T Model. OpenDaylight. OpenDaylight Architecture. OpenDaylight Helium. SDN Application Plane Architecture. Northbound Interface. Network Services Abstraction Layer. Network Applications. User Interface.	

UNIT V – NETWORK FUNCTIONS VIRTUALIZATION	[9 hours]
Motivation-Virtual Machines –NFV benefits-requirements – architecture- NFV Infrastructure - Virtualized Network Functions - NFV Management and Orchestration- NFV Use Cases- NFV and SDN –Network virtualization – VLAN and VPN	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Explain basic networking concepts
CO2	Compare different wireless networking protocols
CO3	Describe the developments in each generation of mobile data networks
CO4	Explain and develop SDN based applications
CO5	Explain the concepts of network function virtualization

COs and POs Mapping:

COs	**POs**					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1	3	2	-	1	-

CO2	1	3	3	3	-	1
CO3	1	3	3	2	2	2
CO4	1	2	2	1	2	1
CO5	1	3	1	1	1	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	60
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	40	40	40
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. James Bernstein, “Networking made Easy”, 2018. (UNIT I)
2. HoudaLabiod, Costantino de Santis, HossamAfifi “Wi-Fi, Bluetooth, Zigbee and WiMax”, Springer 2007 (UNIT 2)
3. Erik Dahlman, Stefan Parkvall, Johan Skold, 4G: LTE/LTE-Advanced for Mobile Broadband, Academic Press, 2013 (UNIT 3)
4. Saad Z. Asif “5G Mobile Communications Concepts and Technologies” CRC press – 2019 (UNIT 3)
5. William Stallings “Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud” 1st Edition, Pearson Education, 2016.(Unit 4 and 5)
6. Thomas D.Nadeau and Ken Gray, SDN – Software Defined Networks, O‟Reilly

Publishers, 2013.
7. Guy Pujolle, "Software Networks", Second Edition, Wiley-ISTE, 2020

Course Code:	**24CP104**	**Course Title:**	**ADVANCED OPERATING SYSTEM**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To get a comprehensive knowledge of the architecture of distributed systems.
- To understand the deadlock and shared memory issues and their solutions in distributed environments.
- To know the security issues and protection mechanisms for distributed environments.
- To get a knowledge of multiprocessor operating systems and database operating systems.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Interactive Simulations
4. Lab experiment videos
5. Blended Mode of Learning
6. Project based Learning
7. Experiential Learning
8. NPTEL and Other Videos
9. Smart Class Room
10. Flipped Class

UNIT I – INTRODUCTION	**9 hours]**
Architectures of Distributed Systems - System Architecture types - issues in distributed operating systems - communication networks – communication primitives. Theoretical Foundations - inherent limitations of a distributed system – lamport's logical clocks – vector clocks – causal ordering of messages – global state – cuts of a distributed computation – termination detection.	

Distributed Mutual Exclusion – introduction – the classification of mutual exclusion and associated algorithms – a comparative performance analysis

UNIT II – DISTRIBUTED DEADLOCK DETECTION AND RESOURCE MANAGEMENT	[9 hours]
Distributed Deadlock Detection -Introduction - deadlock handling strategies in distributed systems –issues in deadlock detection and resolution – control organizations for distributed deadlock detection – centralized and distributed deadlock detection algorithms –hierarchical deadlock detection algorithms. Agreement protocols – introduction-the system model, a classification of agreement problems, solutions to the Byzantine agreement problem, applications of agreement algorithms. Distributed resource management: introduction-architecture – mechanism for building distributed file systems – design issues – log structured file systems.	

UNIT III – DISTRIBUTED SHARED MEMORY AND SCHEDULING	[9 hours]
Distributed shared memory-Architecture– algorithms for implementing DSM – memory coherence and protocols – design issues. Distributed Scheduling – introduction – issues in load distributing – components of a load distributing algorithm – stability – load distributing algorithms – performance comparison – selecting a suitable load sharing algorithm – requirements for load distributing -task migration and associated issues. Failure Recovery and Fault tolerance: introduction– basic concepts – classification of failures – backward and forward error recovery, backward error recovery- recovery in concurrent systems – consistent set of checkpoints – synchronous and asynchronous checkpointing and recovery – checkpointing for distributed database systems- recovery in replicated distributed databases	

UNIT IV – DATA SECURITY	[9 hours]
Protection and security -preliminaries, the access matrix model and its implementations. -safety in matrix model- advanced models of protection. Data security – cryptography: Model of cryptography, conventional cryptography- modern cryptography, private key cryptography, data encryption standard- public key cryptography – multiple encryption – authentication in distributed systems.	

UNIT V – MULTIPROCESSOR AND DATABASE OPERATING SYSTEM	[9 hours]
Multiprocessor operating systems - basic multiprocessor system architectures – interconnection networks for multiprocessor systems – caching – hypercube architecture. Multiprocessor Operating System - structures of multiprocessor operating system, operating system design issues- threads- process synchronization and scheduling. Database Operating systems :Introduction- requirements of a database operating system Concurrency control : theoretical aspects – introduction, database systems – a concurrency control model of database systems- the problem of concurrency control – serializability theory- distributed database systems, concurrency control algorithms – introduction, basic synchronization primitives, lock based algorithms-timestamp based algorithms, optimistic algorithms – concurrency control algorithms: data replication.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Understand and explore the working of Theoretical Foundations of OS.
CO2	Analyze the working principles of Distributed Deadlock Detection and resource management
CO3	Understand the concepts of distributed shared memory and scheduling mechanisms
CO4	Understand and analyze the working of Data security
CO5	Apply the learning into multiprocessor system architectures

COs and POs Mapping:

COs	**POs**					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1	3	2	2	1	3
CO2	2	2	3	2	1	-
CO3	1	1	-	3	2	1

CO4	1	1	2	1	2	2
CO5	-	-	-	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	60
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	40	40	40
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. Mukesh Singhal, Niranjan G.Shivaratri, "Advanced concepts in operating systems: Distributed, Database and multiprocessor operating systems", TMH, 2001
2. Andrew S.Tanenbaum, "Modern operating system", PHI, 2003
3. Pradeep K.Sinha, "Distributed operating system-Concepts and design", PHI, 2003.
4. Andrew S.Tanenbaum, "Distributed operating system", Pearson education, 2003.

Course Code:	**24CP105**	**Course Title:**	**DATABASE PRACTICES**
Credits:	**4**	**L – T – P**	**3-0-2**

Course objectives: To impart knowledge on the • Describe the fundamental elements of relational database management systems • Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL. • Understand query processing in a distributed database system • Understand the basics of XML and create well-formed and valid XML documents. • Distinguish the different types of NoSQL databases • To understand the different models involved in database security and their applications in real time world to protect the database and information associated with them
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. PowerPoint presentation 3. Interactive Simulations 4. Lab experiment videos 5. Blended Mode of Learning 6. Project based Learning 7. Experiential Learning 8. NPTEL and Other Videos 9. Smart Class Room 10. Flipped Class

UNIT I – RELATIONAL DATA MODEL	[15 hours]
Entity Relationship Model – Relational Data Model – Mapping Entity Relationship Model to Relational Model – Relational Algebra – Structured Query Language – Database Normalization.	

Practical Topics: • Data Definition Language • Create, Alter and Drop • Enforce Primary Key, Foreign Key, Check, Unique and Not Null Constraints • Creating Views • Data Manipulation Language • Insert, Delete, Update • Cartesian Product, Equi Join, Left Outer Join, Right Outer Join and Full Outer Join • Aggregate Functions • Set Operations • Nested Queries Transaction Control Language • Commit, Rollback and Save Points

UNIT II – DISTRIBUTED DATABASES, ACTIVE DATABASES AND OPEN DATABASE CONNECTIVITY	**[15 hours]**
Distributed Database Architecture – Distributed Data Storage – Distributed Transactions – Distributed Query Processing – Distributed Transaction Management – Event Condition Action Model – Design and Implementation Issues for Active Databases – Open Database Connectivity.	
Practical Topics: • Distributed Database Design and Implementation • Row Level and Statement Level Triggers • Accessing a Relational Database using PHP, Python and R	

UNIT III – XML DATABASES	**[15 hours]**
Structured, Semi structured, and Unstructured Data – XML Hierarchical Data Model – XML Documents – Document Type Definition – XML Schema – XML Documents and Databases – XML Querying – XPath – XQuery	
Practical Topics: • Creating XML Documents, Document Type Definition and XML Schema • Using a Relational Database to store the XML documents as text • Using a Relational Database to store the XML documents as data elements • Creating or publishing customized XML documents from pre-existing relational	

databases • Extracting XML Documents from Relational Databases • XML Querying

UNIT IV – NOSQL DATABASES AND BIG DATA STORAGE SYSTEMS	[15 hours]
NoSQL – Categories of NoSQL Systems – CAP Theorem – Document-Based NoSQL Systems and MongoDB – MongoDB Data Model – MongoDB Distributed Systems Characteristics – NoSQL Key-Value Stores – DynamoDB Overview – Voldemort Key-Value Distributed Data Store – Wide Column NoSQL Systems – Hbase Data Model – Hbase Crud Operations – Hbase Storage and Distributed System Concepts – NoSQL Graph Databases and Neo4j – Cypher Query Language of Neo4j – Big Data – MapReduce – Hadoop – YARN.	
Practical Topics: • Creating Databases using MongoDB, DynamoDB, Voldemort Key-Value Distributed Data Store Hbase and Neo4j. • Writing simple queries to access databases created using MongoDB, DynamoDB, Voldemort Key-Value Distributed Data Store Hbase and Neo4j.	

UNIT V – DATABASE SECURITY	[15 hours]
Database Security Issues – Discretionary Access Control Based on Granting and Revoking Privileges – Mandatory Access Control and Role-Based Access Control for Multilevel Security – SQL Injection – Statistical Database Security – Flow Control – Encryption and Public Key Infrastructures – Preserving Data Privacy – Challenges to Maintaining Database Security – Database Survivability – Oracle Label-Based Security.	
Practical Topics: • Implementing Access Control in Relational Databases	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Convert the ER-model to relational tables, populate relational databases and formulate SQL queries on data.

CO2	Understand and write well-formed XML documents
CO3	Be able to apply methods and techniques for distributed query processing.
CO4	Design and Implement secure database systems.
CO5	Use the data control, definition, and manipulation languages of the NoSQL databases

COs and POs Mapping:

On completion of the course, the student will have the ability to: **COs and POs Mapping:**

COs	**Pos**					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	2	1	3	1	2
CO2	2	2	-	2	1	1
CO3	3	1	2	1	-	1
CO4	3	2	2	1	1	1
CO5	2	3	1	1	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE) – Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment – I	40	40		
	Skill Assessment – II	40			
Continuous Internal	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		

Examination (CIE) – Laboratory					
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. R. Elmasri, S.B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson Education 2016.
2. Henry F. Korth, Abraham Silberschatz, S. Sudharshan, "Database System Concepts", Seventh Edition, McGraw Hill, 2019.
3. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems, Eighth Edition, Pearson Education, 2006
4. Raghu Ramakrishnan , Johannes Gehrke "Database Management Systems", Fourth Edition, McGraw Hill Education, 2015.
5. Harrison, Guy, "Next Generation Databases, NoSQL and Big Data" , First Edition, Apress publishers, 2015
6. Thomas Cannolly and Carolyn Begg, "Database Systems, A Practical Approach to Design, Implementation and Management", Sixth Edition, Pearson Education,2015

Course Code:	**24CP131**	**Course Title:**	**Advanced Data Structures and Algorithms Laboratory**
Credits:	**2**	**L – T – P**	**0-0-4**

Course objectives:

To impart knowledge on the

- To acquire the knowledge of using advanced tree structures
- To learn the usage of heap structures

- To understand the usage of graph structures and spanning trees
- To understand the problems such as matrix chain multiplication, activity selection and Huffman coding
- To understand the necessary mathematical abstraction to solve problems

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

S.No	Name of the Experiment
1.	Implementation of recursive function for tree traversal and Fibonacci
2.	Implementation of iteration function for tree traversal and Fibonacci
3.	Implementation of Merge Sort and Quick Sort
4.	Implementation of a Binary Search Tree
5.	Red-Black Tree Implementation
6.	Heap Implementation
7.	Fibonacci Heap Implementation
8.	Graph Traversals
9.	Spanning Tree Implementation
10.	Shortest Path Algorithms (Dijkstra's algorithm, Bellman Ford Algorithm)
11.	Implementation of Matrix Chain Multiplication
12.	Activity Selection and Huffman Coding Implementation

Hardware/Software Requirements

1	64-bit Open source Linux or its derivative
2	Open Source C++ Programming tool like G++/GCC

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Design and implement basic and advanced data structures extensively
CO2	Design algorithms using graph structures
CO3	Design and develop efficient algorithms with minimum complexity using design techniques.
CO4	Develop programs using various algorithms.
CO5	Choose appropriate data structures and algorithms, understand the ADT/libraries, and use it to design algorithms for a specific problem.

COs and POs Mapping:

COs	**POs**					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1	1	-	1	1	-
CO2	1	-	1	2	2	1
CO3	1	1	1	1	2	1
CO4	1	2	2	2	2	1
CO5	1	2	3	1	3	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**

Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	60
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Lab Exam	100	40	40	40
				Total	100

Reference Books:

1. Lipschutz Seymour, "Data Structures Schaum's Outlines Series", Tata McGraw Hill, 3rd Edition, 2014.
2. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.
3. http://www.coursera.org/specializations/data-structures-algorithms
4. http://www.tutorialspoint.com/data_structures_algorithms
5. http://www.geeksforgeeks.org/data-structures/

Course Code:	**24CP201**	**Course Title:**	**ADVANCED SOFTWARE ENGINEERING**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To understand the rationale for software development process models
- To understand why the architectural design of software is important;
- To understand the five important dimensions of dependability, namely, availability, reliability, safety, security, and resilience.
- To understand the basic notions of a web service, web service standards, and service- oriented architecture;
- To understand the different stages of testing from testing during development of a software system

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Interactive Simulations
4. Lab experiment videos
5. Blended Mode of Learning
6. Project based Learning
7. Experiential Learning
8. NPTEL and Other Videos
9. Smart Class Room
10. Flipped Class

UNIT I – SOFTWARE PROCESS &MODELING	[9 hours]
Prescriptive Process Models – Agility and Process – Scrum – XP – Kanban – DevOps – Prototype Construction – Prototype Evaluation – Prototype Evolution – Modelling – Principles – Requirements Engineering – Scenario-based Modelling – Class-based Modelling – Functional Modelling – Behavioural Modelling.	

UNIT II – SOFTWARE DESIGN	[9 hours]
Design Concepts – Design Model – Software Architecture – Architectural Styles – Architectural Design – Component-Level Design – User Experience Design – Design for Mobility – Pattern- Based Design.	

UNIT III – SYSTEM DEPENDABILITY AND SECURITY	[9 hours]
Dependable Systems – Dependability Properties – Sociotechnical Systems – Redundancy and Diversity – Dependable Processes – Formal Methods and Dependability – Reliability Engineering – Availability and Reliability – Reliability Requirements – Fault-tolerant Architectures – Programming for Reliability – Reliability Measurement – Safety Engineering – Safety-critical Systems – Safety Requirements – Safety Engineering Processes – Safety Cases – Security Engineering – Security and	

Dependability – Safety and Organizations – Security Requirements – Secure System Design – Security Testing and Assurance – Resilience Engineering – Cybersecurity – Sociotechnical Resilience – Resilient Systems Design

UNIT IV – SERVICE-ORIENTED SOFTWARE ENGINEERING, SYSTEMS ENGINEERING AND REAL-TIME SOFTWARE ENGINEERING	**[9 hours]**
Service-oriented Architecture – RESTful Services – Service Engineering – Service Composition – Systems Engineering – Sociotechnical Systems – Conceptual Design – System Procurement – System Development – System Operation and Evolution – Real-time Software Engineering – Embedded System Design – Architectural Patterns for Real-time Software – Timing Analysis – Real-time Operating Systems.	

UNIT V – SOFTWARE TESTING AND SOFTWARE CONFIGURATION MANAGEMENT	**[9 hours]**
Software Testing Strategy – Unit Testing – Integration Testing – Validation Testing System Testing – Debugging – White-Box Testing – Basis Path Testing – Control Structure Testing – Black-Box Testing – Software Configuration Management (SCM) – SCM Repository – SCM Process – Configuration Management for Web and Mobile Apps.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Identify appropriate process models based on the Project requirements
CO2	Understand the importance of having a good Software Architecture.
CO3	Understand the five important dimensions of dependability, namely, availability, reliability, safety, security, and resilience.
CO4	Understand the basic notions of a web service, web service standards, and service-oriented architecture;
CO5	Be familiar with various levels of Software testing

COs and POs Mapping:

COs	**Pos**

	1	2	3	4	5	6
CO1	1	1	-	1	1	-
CO2	1	-	1	2	2	1
CO3	1	1	1	1	2	1
CO4	1	2	2	2	2	1
CO5	1	2	3	1	3	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) – Theory	CIE – I	100	50	100	60
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	40	40	40
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. Software Engineering: A Practitioner's Approach, 9th Edition. Roger Pressman and Bruce Maxim, McGraw-Hill 2019.
2. Software Engineering, 10th Edition, Ian Somerville, Pearson Education Asia 2016.
3. Software Architecture In Practice, 3rd Edition, Len Bass, Paul Clements and Rick Kazman, Pearson India 2018
4. An integrated approach to Software Engineering, 3rd Edition, Pankaj Jalote, Narosa Publishing House, 2018
5. Fundamentals of Software Engineering, 5th Edition, Rajib Mall, PHI Learning Private Ltd, 2018

Course Code:	**24CP202**	**Course Title:**	**INTERNET OF THINGS**
Credits:	**4**	**L – T – P**	**3-0-2**

Course objectives: To impart knowledge on the • To Understand the Architectural Overview of IoT • To Understand the IoT Reference Architecture and Real World Design Constraints • To Understand the various IoT levels • To understand the basics of cloud architecture • To gain experience in Raspberry PI and experiment simple IoT application on it
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Chalk and Talk 2. PowerPoint presentation 3. Interactive Simulations 4. Lab experiment videos 5. Blended Mode of Learning 6. Project based Learning 7. Experiential Learning 8. NPTEL and Other Videos 9. Smart Class Room 10. Flipped Class

UNIT I – INTRODUCTION	**[9 hours]**
Internet of Things- Domain Specific IoTs - IoT and M2M-Sensors for IoT Applications–Structure ofIoT– IoT Map Device- IoT System Management with NETCONF-YANG	
Practical Topics: 1. Develop an application for LED Blink and Pattern using Arduino or Raspberry Pi	

UNIT II – IoT ARCHITECTURE, GENERATIONS AND PROTOCOLS	**[9 hours]**
IETF architecture for IoT - IoT reference architecture -First Generation – Description & Characteristics–Advanced Generation – Description & Characteristics–Integrated IoT Sensors – Description & Characteristics	

Practical Topics:

1. Develop an application for LED Pattern with Push Button Control using Arduinoor Raspberry Pi

UNIT III – IoT PROTOCOLS AND TECHNOLOGY	**[9 hours]**
SCADA and RFID Protocols - BACnet Protocol -Zigbee Architecture - 6LowPAN - CoAP -Wireless Sensor Structure–Energy Storage Module–Power Management Module–RF Module–Sensing Module	
Practical Topics: 1. Develop an application for LM35 Temperature Sensor to display temperature values using arduino or Raspberry Pi 2. Develop an application for Forest fire detection end node using Raspberry Pi device and sensor	

UNIT IV – CLOUD ARCHITECTURE BASICS	**[9 hours]**
The Cloud types; IaaS, PaaS, SaaS.- Development environments for service development; Amazon, Azure, Google Appcloud platform in industry	
Practical Topics: 1. Develop an application for home intrusion detection web application	

UNIT V – IOT PROJECTS ON RASPBERRY PI	**[9 hours]**
Building IOT with RASPBERRY PI- Creating the sensor project - Preparing Raspberry Pi - Clayster libraries – Hardware Interacting with the hardware - Interfacing the hardware- Internal representationof sensor values - Persisting data - External representation of sensor values - Exporting sensor data	
Practical Topics: 1. Develop an application for Smart parking application using python and Django for web application	

Laboratory Component: **[30 hours]**

All 6 experiments have to be completed from the following list of experiments.

S.No.	**Name of the Experiment**
1	Develop an application for LED Blink and Pattern using Arduino or Raspberry Pi

2	Develop an application for LED Pattern with Push Button Control using Arduino or Raspberry Pi
3	Develop an application for LM35 Temperature Sensor to display temperature values using arduino or Raspberry Pi
4	Develop an application for Forest fire detection end node using Raspberry Pi device and sensor
5	Develop an application for home intrusion detection web application
6	Develop an application for Smart parking application using python and Django for web application

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Understand the various concept of the IoT and their technologies
CO2	Develop the IoT application using different hardware platforms
CO3	Implement the various IoT Protocols.
CO4	Understand the basic principles of cloud computing
CO5	Develop and deploy the IoT application into cloud environment

COs and POs Mapping:

COs	**POs**					
	1	**2**	**3**	**4**	**5**	**6**
CO1	**1**	**1**	2	1	1	**3**
CO2	**3**	**2**	1	2	3	**2**
CO3	**1**	**1**	2	1	3	**3**
CO4	**2**	**3**	2	1	2	**2**
CO5	**1**	**2**	1	2	1	**1**

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final marks</th></tr>
<tr><td rowspan="5">Continuous Internal Examination (CIE) - Theory</td><td>CIE – I</td><td>100</td><td rowspan="2">50</td><td rowspan="5">100</td><td rowspan="5">25</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>MCQ</td><td>20</td><td>10</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td rowspan="2">Continuous Internal Examination (CIE) - Laboratory</td><td>Continuous Assessment</td><td>75</td><td>75</td><td rowspan="2">100</td><td rowspan="2">25</td></tr>
<tr><td>Model Lab Exam</td><td>25</td><td>25</td></tr>
<tr><td rowspan="2">End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>35</td><td rowspan="2">50</td><td rowspan="2">50</td></tr>
<tr><td>Lab Exam</td><td>100</td><td>15</td></tr>
<tr><td colspan="5">Total</td><td>100</td></tr>
</table>

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. Arshdeep Bahga, Vijay Madisetti, Internet of Things: A hands-on approach, Universities Press, 2015
2. Dieter Uckelmann, Mark Harrison, Florian Michahelles (Eds), Architecting the Internet of Things, Springer, 2011
3. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015
4. Ovidiu Vermesan Peter Friess, 'Internet of Things – From Research and Innovation to Market Deployment', River Publishers, 2014
5. N. Ida, Sensors, Actuators and Their Interfaces: A Multidisciplinary Introduction, 2nd EditionScitech Publishers, 2014
6. Reese, G. (2009). Cloud Application Architectures: Building Applications and Infrastructure

in the Cloud. Sebastopol, CA: O'Reilly Media, Inc. (2009)

Course Code:	**24CS203**	**Course Title:**	**MULTICORE ARCHITECTURE AND PROGRAMMING**
Credits:	**4**	**L – T – P**	**3-0-2**

Course objectives:

To impart knowledge on the

1. To understand the need for multi-core processors, and their architecture.
2. To understand the challenges in parallel and multithreaded programming.
3. To learn about the various parallel programming paradigms,
4. To develop multicore programs and design parallel solutions.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Interactive Simulations
4. Lab experiment videos
5. Blended Mode of Learning
6. Project based Learning
7. Experiential Learning
8. NPTEL and Other Videos
9. Smart Class Room
10. Flipped Class

UNIT I – MULTI-CORE PROCESSORS	**[9 hours]**
Single core to Multi-core architectures – SIMD and MIMD systems – Interconnection networks – Symmetric and Distributed Shared Memory Architectures – Cache coherence – Performance Issues – Parallel program design.	

Practical Topics:

1.Write a simple Program to demonstrate an OpenMP Fork-Join Parallelism.

2. Create a program that computes a simple matrix-vector multiplication b=Ax, either in C/C++. Use OpenMP directives to make it run in parallel.

UNIT II – PARALLEL PROGRAM CHALLENGES	**[9 hours]**
Performance – Scalability – Synchronization and data sharing – Data races – Synchronization primitives (mutexes, locks, semaphores, barriers) – deadlocks and livelocks – communication between threads (condition variables, signals, message queues and pipes).	

Practical Topics:

1. Create a program that computes the sum of all the elements in an array A (C/C++) or a program that finds the largest number in an array A. Use OpenMP directives to make it run in parallel.
2. Write a simple Program demonstrating Message-Passing logic using OpenMP.

UNIT III – SHARED MEMORY PROGRAMMING WITH OpenMP	**[9 hours]**
OpenMP Execution Model – Memory Model – OpenMP Directives – Work-sharing Constructs – Library functions – Handling Data and Functional Parallelism – Handling Loops – Performance Considerations.	

Practical Topics:

1. Implement the All-Pairs Shortest-Path Problem (Floyd's Algorithm) Using OpenMP.
2. Implement a program Parallel Random Number Generators using Monte Carlo Methods in OpenMP.

UNIT IV – DISTRIBUTED MEMORY PROGRAMMING WITH MPI	**[9 hours]**
MPI program execution – MPI constructs – libraries – MPI send and receive – Point-to-point and Collective communication – MPI derived datatypes – Performance evaluation	

Practical Topics:

1.Write a Program to demonstrate MPI-broadcast-and-collective-communication in C.

2.Write a Program to demonstrate MPI-scatter-gather-and-all gather in C.

UNIT V – PARALLEL PROGRAM DEVELOPMENT	**[9 hours]**
Case studies – n-Body solvers – Tree Search – OpenMP and MPI implementations and comparison.	
Practical Topics: 1.Write a Program to demonstrate MPI-send-and-receive in C. 2.Write a Program to demonstrate by performing-parallel-rank-with-MPI in C.	

Laboratory Component: **[30 hours]**

All 10 experiments have to be completed from the following list of experiments.

S.No.	**Name of the Experiment**
1	Write a simple Program to demonstrate an OpenMP Fork-Join Parallelism.
2	Create a program that computes a simple matrix-vector multiplication b=Ax, either in C/C++. Use OpenMP directives to make it run in parallel.
3	Create a program that computes the sum of all the elements in an array A (C/C++) or a program that finds the largest number in an array A. Use OpenMP directives to make it run in parallel.
4	Write a simple Program demonstrating Message-Passing logic using OpenMP.
5	Implement the All-Pairs Shortest-Path Problem (Floyd's Algorithm) Using OpenMP.
6	Implement a program Parallel Random Number Generators using Monte Carlo Methods in OpenMP.
7	Write a Program to demonstrate MPI-broadcast-and-collective-communication in C.
8	Write a Program to demonstrate MPI-scatter-gather-and-all gather in C.
9	Write a Program to demonstrate MPI-send-and-receive in C.
10	Write a Program to demonstrate by performing-parallel-rank-with-MPI in C.

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Describe multicore architectures and identify their characteristics and challenges.
CO2	Identify the issues in programming Parallel Processors.

CO3	Write programs using OpenMP and MPI.
CO4	Design parallel programming solutions to common problems.
CO5	Compare and contrast programming for serial processors and programming for parallel processors.

COs and POs Mapping:

COs	**POs**					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1	2	3	4	5	6
CO2	1	1	1	2	1	2
CO3	2	1	-	-	2	2
CO4	1	-	2	1	1	2
CO5	2	1	1	1	2	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		

End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

Reference Books:

- Peter S. Pacheco, "An Introduction to Parallel Programming, Morgan-Kauffman/Elsevier, 2021.
- Darryl Gove, "Multicore Application Programming for Windows, Linux, and Oracle Solaris, Pearson, 2011 (unit 2)
- Michael J Quinn, "Parallel programming in C with MPI and OpenMP, Tata McGraw Hill,2003.
- Victor Alessandrini, Shared Memory Application Programming, 1st Edition, Concepts and Strategies in Multicore Application Programming, Morgan Kaufmann, 2015.
- Yan Solihin, Fundamentals of Parallel Multicore Architecture, CRC Press, 2015.

Course Code:	**24CS204**	**Course Title:**	**MACHINE LEARNING**
Credits:	**4**	**L – T – P**	**3-0-2**

Course objectives: To impart knowledge on the 1. To understand the concepts and mathematical foundations of machine learning and types of problems tackled by machine learning 2. To explore the different supervised learning techniques including ensemble methods 3. To learn different aspects of unsupervised learning and reinforcement learning 4. To learn the role of probabilistic methods for machine learning 5. To understand the basic concepts of neural networks and deep learning
Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Interactive Simulations
4. Lab experiment videos
5. Blended Mode of Learning
6. Project based Learning
7. Experiential Learning
8. NPTEL and Other Videos
9. Smart Class Room
10. Flipped Class

UNIT I – INTRODUCTION AND MATHEMATICAL FOUNDATIONS	[9 hours]
What is Machine Learning? Need –History – Definitions – Applications - Advantages, Disadvantages & Challenges -Types of Machine Learning Problems – Mathematical Foundations - Linear Algebra & Analytical Geometry -Probability and Statistics- Bayesian Conditional Probability -Vector Calculus & Optimization - Decision Theory - Information theory	
Practical Topics: 1. Implement a Linear Regression with a Real Datases (https://www.kaggle.com/harrywang/housing). Experiment with different features in building a model. Tune the model's hyperparameters. 2. Implement a binary classification model. That is, answers a binary question such as "Are houses in this neighborhood above a certain price?"(use data from exercise 1). Modify the classification threshold and determine how that modification influences the model. Experiment with different classification metrics to determine your model's effectiveness.	

UNIT II – SUPERVISED LEARNING	[9 hours]
Introduction-Discriminative and Generative Models -Linear Regression - Least Squares -Under-fitting /Overfitting -Cross-Validation – Lasso Regression- Classification - Logistic Regression- Gradient Linear Models -Support Vector Machines –Kernel Methods -Instance based Methods - K-Nearest Neighbors - Tree based Methods –Decision Trees –ID3 – CART - Ensemble Methods –Random Forest - Evaluation of Classification Algorithms	

Practical Topics:

1. Classification with Nearest Neighbors. In this question, you will use the scikit-learn's KNN classifier to classify real vs. fake news headlines. The aim of this question is for you to read the scikit-learn API and get comfortable with training/validation splits. Use California Housing Dataset.
2. In this exercise, you'll experiment with validation sets and test sets using the dataset. Split a training set into a smaller training set and a validation set. Analyze deltas between training set and validation set results. Test the trained model with a test set to determine whether your trained model is overfitting. Detect and fix a common training problem.

UNIT III – UNSUPERVISED LEARNING AND REINFORCEMENT LEARNING	**[9 hours]**
Introduction - Clustering Algorithms -K – Means – Hierarchical Clustering - Cluster Validity - Dimensionality Reduction –Principal Component Analysis – Recommendation Systems - EM algorithm. Reinforcement Learning – Elements -Model based Learning – Temporal Difference Learning	

Practical Topics:

1. Implement the k-means algorithm using https://archive.ics.uci.edu/ml/datasets/Codon+usage dataset
2. Implement the Naïve Bayes Classifier using https://archive.ics.uci.edu/ml/datasets/Gait+Classification dataset

UNIT IV – PROBABILISTIC METHODS FOR LEARNING	**[9 hours]**
Introduction -Naïve Bayes Algorithm -Maximum Likelihood -Maximum Apriori -Bayesian Belief Networks -Probabilistic Modelling of Problems -Inference in Bayesian Belief Networks – Probability Density Estimation - Sequence Models – Markov Models – Hidden Markov Models	

UNIT V – NEURAL NETWORKS AND DEEP LEARNING	**[9 hours]**
Neural Networks – Biological Motivation- Perceptron – Multi-layer Perceptron – Feed Forward Network – Back Propagation-Activation and Loss Functions- Limitations of Machine Learning – Deep Learning– Convolution Neural Networks – Recurrent Neural Networks – Use cases	

Laboratory Component: **[30 hours]**

All experiments have to be completed from the following list of experiments.

S.No	Name of the Experiment
1.	Implement a Linear Regression with a Real Dataset (https://www.kaggle.com/harrywang/housing). Experiment with different features in building a model. Tune the model's hyperparameters.
2.	Implement a binary classification model. That is, answers a binary question such as "Are houses in this neighborhood above a certain price?"(use data from exercise 1). Modify the classification threshold and determine how that modification influences the model. Experiment with different classification metrics to determine your model's effectiveness
3.	Classification with Nearest Neighbors. In this question, you will use the scikit-learn's KNN classifier to classify real vs. fake news headlines. The aim of this question is for you to read the scikit-learn API and get comfortable with training/validation splits. Use California Housing Dataset
4.	In this exercise, you'll experiment with validation sets and test sets using the dataset. Split a training set into a smaller training set and a validation set. Analyze deltas between training set and validation set results. Test the trained model with a test set to determine whether your trained model is overfitting. Detect and fix a common training problem
5.	Implement the k-means algorithm using https://archive.ics.uci.edu/ml/datasets/Codon+usage dataset
6.	Implement the Naïve Bayes Classifier using https://archive.ics.uci.edu/ml/datasets/Gait+Classification dataset
7.	Project - (in Pairs) Your project must implement one or more machine learning algorithms and apply them to some data. • Your project may be a comparison of several existing algorithms, or it may propose a new algorithm in which case you still must compare it to at least one other approach. • You can either pick a project of your own design, or you can choose from the set of pre-defined projects • You are free to use any third-party ideas or code that you wish as long as it is publicly available. • You must properly provide references to any work that is not your own in the write-up.

	• Project proposal You must turn in a brief project proposal. Your project proposal should describe the idea behind your project. You should also briefly describe software you will need to write, and papers (2-3) you plan to read.

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Understand and outline problems for each type of machine learning
CO2	Design a Decision tree and Random forest for an application
CO3	Implement Probabilistic Discriminative and Generative algorithms for an application and analyze the results.
CO4	Use a tool to implement typical Clustering algorithms for different types of applications.
CO5	Design and implement an HMM for a Sequence Model type of application and identify applications suitable for different types of Machine Learning with suitable justification Understand and outline problems for each type of machine learning

COs and POs Mapping:

COs	**POs**					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1	2	1	3	1	1
CO2	2	3	1	2	1	2
CO3	1	1	2	1	-	2
CO4	2	2	-	-	-	3
CO5	3	3	1	1	1	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. Stephen Marsland, "Machine Learning: An Algorithmic Perspective", Chapman & Hall/CRC, 2nd Edition, 2014.
2. Kevin Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012
3. Ethem Alpaydin, "Introduction to Machine Learning", Third Edition, Adaptive Computation and Machine Learning Series, MIT Press, 2014
4. Tom M Mitchell, "Machine Learning", McGraw Hill Education, 2013.
5. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", First Edition, Cambridge University Press, 2012.
6. Shai Shalev-Shwartz and Shai Ben-David, "Understanding Machine Learning: From Theory to Algorithms", Cambridge University Press, 2015

7. Christopher Bishop, “Pattern Recognition and Machine Learning”, Springer, 2007.
8. Hal Daumé III, “A Course in Machine Learning”, 2017 (freely available online)
9. Trevor Hastie, Robert Tibshirani, Jerome Friedman, “The Elements of Statistical Learning”, Springer, 2009 (freely available online)
10. Aurélien Géron , Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts,
11. Tools, and Techniques to Build Intelligent Systems 2nd Edition, o'reilly, (2017)

Course Code:	**24CP251**	**Course Title:**	**TERM PAPER WRITING AND SEMINAR**
Credits:	**1**	**L – T – P**	**0-0-2**

In this course, students will develop their scientific and technical reading and writing skills that they need to understand and construct research articles. A term paper requires a student to obtain information from a variety of sources (i.e., Journals, dictionaries, reference books) and then place it in logically developed ideas. The work involves the following steps:

1. Selecting a subject, narrowing the subject into a topic
2. Stating an objective.
3. Collecting the relevant bibliography (atleast 15 journal papers)
4. Preparing a working outline.
5. Studying the papers and understanding the authors contributions and critically analysing each paper.
6. Preparing a working outline
7. Linking the papers and preparing a draft of the paper.
8. Preparing conclusions based on the reading of all the papers.
9. Writing the Final Paper and giving final Presentation

Please keep a file where the work carried out by you is maintained. Activities to be carried out

Activity	**Instructions**	**Submission week**	**Evaluation**
Selection of area of interest and Topic Stating an Objective	You are requested to select an area of interest, topic and state an objective	2nd week	**3 %** Based on clarity of thought, current relevance and clarity in writing

Collecting Information aboutyour area & topic	1. List 1 Special Interest Groups or professional society 2. List 2 journals 3. List 2 conferences, symposia orworkshops 4. List 1 thesis title 5. List 3 web presences (mailing lists, forums, news sites) 6. List 3 authors who publish regularly in your area 7. Attach a call for papers (CFP) from your area.	3rd week	**3%** (the selected information must bearea specific and of international and national standard)
Collection of Journal papers in the topic in the context of the objective – collect 20 & then filter	• You have to provide a complete list of references you will be using- Basedon your objective - Search various digital libraries and Google Scholar • When picking papers to read - try to: Pick papers that are related to each other in some ways and/or that are in the same field so that you can write a meaningful survey out of them, • Favour papers from well-known journals and conferences, • Favour “first” or “foundational” papers in the field (as indicated in other people’s survey paper), • Favour more recent papers, • Pick a recent survey of the field so you can quickly gain an overview, • Find relationships with respect to each other and to your topic area (classification scheme/categorization) • Mark in the hard copy of papers whether complete work or section/sections of the paper are being considered	4th week	**6%** (the list of standard papers and reason for selection)
Reading and notes for first 5 papers	Reading Paper Process • For each paper form a Table answering the following	5th week	**8%** (the table given should indicate your

	questions: • What is the main topic of the article? • What was/were the main issue(s) the author said they want to discuss? • Why did the author claim it was important? • How does the work build on other's work, in the author's opinion? • What simplifying assumptions does the author claim to be making? • What did the author do? • How did the author claim they were going to evaluate their work and compare it to others? • What did the author say were the limitations of their research? • What did the author say were the important directions for future research? Conclude with limitations/issues not addressed by the paper (from the perspective of your survey)		understanding of the paper and the evaluation is based on your conclusions about each paper)
Reading and notes for next 5 papers	Repeat Reading Paper Process	6th week	**8%** (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)
Reading and notesfor final 5 papers	Repeat Reading Paper Process	7th week	**8%** (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)

Draft outline 1 and Linking papers	Prepare a draft Outline, your survey goals, along with a classification / categorization diagram	8th week	**8%** (this component will be evaluated based on the linking and classification among the papers)
Abstract	Prepare a draft abstract and give a presentation	9th week	**6%** (Clarity, purpose and conclusion) **6%** Presentation & Viva Voce
Introduction Background	Write an introduction and background sections	10th week	**5%**(clarity)
Sections of the paper	Write the sections of your paper based on the classification / categorization diagram in keeping with the goals of your survey	11thweek	**10%** (this component will be evaluated based on the linking and classification among the papers)
Your conclusions	Write your conclusions and future work	12th week	**5%** (conclusions – clarity and your ideas)
Final Draft	Complete the final draft of your paper	13th week	**10%** (formatting, English, Clarity and linking) **4%** Plagiarism Check Report
Seminar	A brief 15 slides on your paper	14th & 15th week	**10%** (based on presentation and Viva-voce)

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	60
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Lab Exam	100	40	40	40
				Total	100

Course Code:	**24CP252**	**Course Title:**	**Software Engineering Laboratory**
Credits:	**1**	**L – T – P**	**0-0-2**

Course objectives:

To impart knowledge on the

- To impart state-of-the-art knowledge on Software Engineering and UML in an interactive manner through the Web.
- Present case studies to demonstrate practical applications of different concepts.
- Provide a scope to students where they can solve small, real-life problems.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

S.No	Name of the Experiment
1.	Write a Problem Statement to define a title of the project with bounded scope of project
2.	Select relevant process model to define activities and related task set for assigned project
3.	Prepare broad SRS (Software Requirement Specification) for the above selected projects
4.	Prepare USE Cases and Draw Use Case Diagram using modelling Tool
5.	Develop the activity diagram to represent flow from one activity to another for software development
6.	Develop data Designs using DFD Decision Table & ER Diagram.
7.	Draw class diagram, sequence diagram, Collaboration Diagram, State Transition Diagram for the assigned project
8.	Write Test Cases to Validate requirements of assigned project from SRS Document
9.	Evaluate Size of the project using function point metric for the assigned project
10.	Estimate cost of the project using COCOMO and COCOCMOII for the assigned project
11.	Use CPM/PERT for scheduling the assigned project

12.	Use timeline Charts or Gantt Charts to track progress of the assigned project

Hardware/Software Requirements

1	64-bit Open source Linux or its derivative
2	Open Source C++ Programming tool like G++/GCC

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Can produce the requirements and use cases the client wants for the software being Produced.
CO2	Participate in drawing up the project plan. The plan will include at least extent and work assessments of the project, the schedule, available resources, and risk management can model and specify the requirements of mid-range software and their architecture
CO3	Create and specify such a software design based on the requirement specification that the software can be implemented based on the design..
CO4	Can assess the extent and costs of a project with the help of several different assessment methods.

COs and POs Mapping:

COs	**POs**					
	1	**2**	**3**	**4**	**5**	**6**
CO1	3	3	3	3	3	3
CO2	2	3	3	3	2	2
CO3	3	1	2	2	1	2
CO4	2	3	1	2	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	60
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Lab Exam	100	40	40	40
				Total	100

Course Code:	24CP205	Course Title:	HUMAN COMPUTER INTERACTION
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To learn the foundations of Human Computer Interaction
- Understanding Interaction Styles and to become familiar with the design technologies forindividuals and persons with disabilities.
- To understand the process of Evaluation of Interaction Design.
- To clarify the significance of task analysis for ubiquitous computing
- To get insight on web and mobile interaction.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Interactive Simulations
4. Lab experiment videos
5. Blended Mode of Learning
6. Project based Learning
7. Experiential Learning
8. NPTEL and Other Videos
9. Smart Class Room
10. Flipped Class

UNIT I – FOUNDATIONS OF HCI	[9 hours]
Context of Interaction –Ergonomics - Designing Interactive systems – Understanding Users-cognition and cognitive frameworks, User Centred approaches Usability, Universal Usability, Understanding and conceptualizing interaction, Guidelines, Principles and Theories. Importance of User Interface: Definition-Importance of good design-Benefits of good design-Human-centered development and Evaluation-Human Performance models-A Brief history of screen design.	

UNIT II – INTERACTION STYLES	[9 hours]
GUI: Popularity of graphics - The concept of direct manipulation - Graphical system - Characteristics - Web user - Interface Popularity - Characteristics and Principles of User Interface. Understanding interaction styles, Direct Navigation and Immersive environments, Fluid navigation, Expressive Human and Command Languages, Communication and Collaboration Advancing theuser experience, Timely user Experience, Information search, Data Visualization Design process:Human Interaction with computers - Importance of Human Characteristics - Human Consideration -Human Interaction Speeds and Understanding Business Junctions.	

UNIT III – EVALUATION OF INTERACTION	[9 hours]
Evaluation Techniques- assessing user experience- usability testing – Heuristic evaluation and walkthroughs, analytics predictive models. Cognitive models, Socio-organizational issues and stakeholder requirements, Communication and collaboration models	

UNIT IV - MODELS AND THEORIES	[9 hours]
Task analysis, dialog notations and design, Models of the system, Modeling rich interaction, Ubiquitous computing	

UNIT V - WEB AND MOBILE INTERACTION	[9 hours]
Hypertext, Multimedia and WWW, Designing for the web Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Use Transitions-Lookup patterns-Feedback patterns Mobile apps, Mobile navigation, content and control idioms, Multi-touch gestures, Inter- app integration, Mobile web	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Understand the basics of human computer interactions via usability engineering and cognitive modeling.
CO2	Understand the basic design paradigms, complex interaction styles.
CO3	Understand the models and theories for user interaction

CO4	Examine the evaluation of interaction designs and implementations.
CO5	Elaborate the above issues for web and mobile applications

COs and POs Mapping:

COs	**POs**					
	1	**2**	**3**	**4**	**5**	**6**
CO1	**3**	**3**	3	3	3	**3**
CO2	**1**	**-**	1	2	2	**1**
CO3	**2**	**3**	2	2	-	**1**
CO4	**2**	**3**	1	2	-	**2**
CO5	**2**	**2**	3	3	3	**3**

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	60
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	40	40	40
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven Jacobs, NiklasElmqvist, “Designing the User Interface: Strategies for Effective Human-Computer Interaction”, Sixth Edition, Pearson Education, 2016.
2. Alan Dix, Janet Finlay, G D Abowd and Russel Beale, "Human Computer Interaction", Pearson Education, Third Edition, 2004.
3. Helen Sharp Jennifer Preece Yvonne Rogers, “Interaction Design: Beyond Human-Computer Interaction”, Wiley, 5th Edition, 2019.
4. Alan Cooper,RobertReimann, David Cronin, Christopher Noessel,“About Face: The Essentials of Interaction Design”, 4th Edition, Wiley, 2014.
5. Donald A. Norman, “Design of Everyday Things”, MIT Press, 2013.
6. Wilbert O Galitz, "The Essential Guide to User Interface Design", Third Edition, Wiley India Pvt., Ltd., 2007.
7. Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven Jacobs, NiklasElmqvist, “Designing the User Interface: Strategies for Effective Human-Computer Interaction”, Sixth Edition, Pearson Education, 2016.
8. Alan Dix, Janet Finlay, G D Abowd and Russel Beale, "Human Computer Interaction", Pearson Education, Third Edition, 2004.

Course Code:	24CP206	Course Title:	CLOUD COMPUTING TECHNOLOGIES
Credits:	3	L – T – P	3-0-0

Course objectives:

To impart knowledge on the

- To gain expertise in Virtualization, Virtual Machines and deploy practical virtualization solution
- To understand the architecture, infrastructure and delivery models of cloud computing.
- To explore the roster of AWS services and illustrate the way to make applications in AWS
- To gain knowledge in the working of Windows Azure and Storage services offered by Windows Azure
- To develop the cloud application using various programming model of Hadoop and Aneka

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – VIRTUALIZATION AND VIRTUALIZATION INFRASTRUCTURE	[6 hours]
Basics of Virtual Machines - Process Virtual Machines – System Virtual Machines –Emulation – Interpretation – Binary Translation - Taxonomy of Virtual Machines. Virtualization –Management Virtualization –– Hardware Maximization – Architectures – Virtualization Management – Storage Virtualization – Network Virtualization- Implementation levels of virtualization – virtualization structure – virtualization of CPU, Memory and I/O devices – virtual clusters and Resource Management – Virtualization for data center automation	

UNIT II – CLOUD PLATFORM ARCHITECTURE	[12 hours]
Cloud Computing: Definition, Characteristics - Cloud deployment models: public, private, hybrid, community – Categories of cloud computing: Everything as a service: Infrastructure, platform, software- A Generic Cloud Architecture Design – Layered cloud Architectural Development –	

Architectural Design Challenges

UNIT III – AWS CLOUD PLATFORM - IAAS	[9 hours]
Amazon Web Services: AWS Infrastructure- AWS API- AWS Management Console - Setting up AWS Storage - Stretching out with Elastic Compute Cloud - Elastic Container Service for Kubernetes- AWS Developer Tools: AWS Code Commit, AWS Code Build, AWS Code Deploy, AWS Code Pipeline, AWS code Star - AWS Management Tools: Cloud Watch, AWS Auto Scaling, AWS control Tower, Cloud Formation, Cloud Trail, AWS License Manager	

UNIT IV – PAAS CLOUD PLATFORM	[9 hours]
Windows Azure: Origin of Windows Azure, Features, The Fabric Controller – First Cloud APP in Windows Azure- Service Model and Managing Services: Definition and Configuration, Service runtime API- Windows Azure Developer Portal- Service Management API- Windows Azure Storage Characteristics-Storage Services- REST API- Blops	

UNIT V – PROGRAMMING MODEL	[9 hours]
Introduction to Hadoop Framework - Mapreduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job –Developing Map Reduce Applications - Design of Hadoop file system –Setting up Hadoop Cluster- Aneka: Cloud Application Platform, Thread Programming, Task Programming and Map-Reduce Programming in Aneka	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Employ the concepts of virtualization in the cloud computing
CO2	Identify the architecture, infrastructure and delivery models of cloud computing
CO3	Develop the Cloud Application in AWS platform
CO4	Apply the concepts of Windows Azure to design Cloud Application
CO5	Develop services using various Cloud computing programming models

COs and POs Mapping:

COs	**POs**

	1	2	3	4	5	6
CO1	-	-	-	2	2	1
CO2	2	3	1	-	-	1
CO3	3	-	3	-	1	3
CO4	-	-	-	2	-	3
CO5	3	2	-	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. Bernard Golden, Amazon Web Service for Dummies, John Wiley & Sons, 2013.
2. Raoul Alongi, AWS: The Most Complete Guide to Amazon Web Service from Beginner to Advanced Level, Amazon Asia- Pacific Holdings Private Limited, 2019.
3. Sriram Krishnan, Programming: Windows Azure, O’Reilly,2010.

4. Rajkumar Buyya, Christian Vacchiola, S.Thamarai Selvi, Mastering Cloud Computing , MCGraw Hill Education (India) Pvt. Ltd., 2013.

5. Danielle Ruest, Nelson Ruest, ―Virtualization: A Beginner‟s Guide‖, McGraw-Hill Osborne Media, 2009.
6. Jim Smith, Ravi Nair , "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
7. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010
8. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", McGraw-Hill Osborne Media, 2009.
9. Tom White, "Hadoop: The Definitive Guide", Yahoo Press, 2012.

Course Code:	**24CP207**	**Course Title:**	**Foundations of Data Science**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To apply fundamental algorithms to process data.
- Learn to apply hypotheses and data into actionable predictions.
- Document and transfer the results and effectively communicate the findings using visualization techniques.
- To learn statistical methods and machine learning algorithms required for Data Science.
- To develop the fundamental knowledge and understand concepts to become a data science professional.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – INTRODUCTION TO DATA SCIENCE	**[9 hours]**
Data science process – roles, stages in data science project – working with data from files – working with relational databases – exploring data – managing data – cleaning and sampling for modeling and validation – introduction to NoSQL.	

UNIT II – MODELING METHODS	**[9 hours]**
Choosing and evaluating models – mapping problems to machine learning, evaluating clustering models, validating models – cluster analysis – K-means algorithm, Naïve Bayes – Memorization Methods – Linear and logistic regression – unsupervised methods.	

UNIT III – INTRODUCTION TO R	**[9 hours]**
Reading and getting data into R – ordered and unordered factors – arrays and matrices – lists and data	

frames – reading data from files – probability distributions – statistical models in R - manipulating objects – data distribution.

UNIT IV – MAP REDUCE	[9 hours]
Introduction – distributed file system – algorithms using map reduce, Matrix-Vector Multiplication by Map Reduce – Hadoop - Understanding the Map Reduce architecture - Writing Hadoop MapReduce Programs - Loading data into HDFS - Executing the Map phase - Shuffling and sorting - Reducing phase execution.	

UNIT V – DATA VISUALIZATION	[9 hours]
Documentation and deployment – producing effective presentations – Introduction to graphical analysis – plot() function – displaying multivariate data – matrix plots – multiple plots in one window - exporting graph using graphics parameters - Case studies.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Obtain, clean/process and transform data
CO2	Analyze and interpret data using an ethically responsible approach
CO3	Use appropriate models of analysis, assess the quality of input, derive insight from results, and investigate potential issues
CO4	Apply computing theory, languages and algorithms, as well as mathematical and statistical models, and the principles of optimization to appropriately formulate and use data analyses.
CO5	Formulate and use appropriate models of data analysis to solve business-related challenges.

COs and POs Mapping:

COs	**POs**					
	1	**2**	**3**	**4**	**5**	**6**
CO1	3	2	3	-	2	2
CO2	-	-	2	3	-	-
CO3	1	-	-	-	3	3

CO4	2	1	-	3	-	-
CO5	1	-	3	3	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final marks</th></tr>
<tr><td rowspan="5">Continuous Internal Examination (CIE)</td><td>CIE – I</td><td>100</td><td rowspan="2">50</td><td rowspan="5">100</td><td rowspan="5">40</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>MCQ</td><td>20</td><td>10</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td>End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>60</td><td>60</td><td>60</td></tr>
<tr><td colspan="5">Total</td><td>100</td></tr>
</table>

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. Nina Zumel, John Mount, "Practical Data Science with R", Manning Publications, 2014.
2. Mark Gardener, "Beginning R - The Statistical Programming Language", John Wiley & Sons, Inc., 2012.
3. W. N. Venables, D. M. Smith and the R Core Team, "An Introduction to R", 2013.
4. Tony Ojeda, Sean Patrick Murphy, Benjamin Bengfort, Abhijit Dasgupta, "Practical Data Science Cookbook", Packt Publishing Ltd., 2014.
5. Nathan Yau, "Visualize This: The FlowingData Guide to Design, Visualization, and Statistics", Wiley, 2011

Course Code:	24CP208	Course Title:	WIRELESS COMMUNICATIONS
Credits:	3	L – T – P	3-0-0

Course objectives:

To impart knowledge on the

- To understand the basic concepts in cellular communication.
- To learn the characteristics of wireless channels.
- To understand the impact of digital modulation techniques in fading.
- To get exposed to diversity techniques in wireless communication.
- To acquire knowledge in multicarrier systems.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – CELLULAR CONCEPTS	[9 hours]
Frequency Reuse – Channel Assignment Strategies – Handoff Strategies – Interference and system capacity- Co-Channel Interference- Adjacent Channel Interference – Trunking and Grade of service – Improving coverage & capacity in cellular systems-Cell Splitting- Sectoring- Repeaters for Range Extension-Microcell Zone Concept.	

UNIT II – THE WIRELESS CHANNEL	[9 hours]
Overview of wireless systems – Physical modeling for wireless channels – Time and Frequency coherence – Statistical channel models – Capacity of wireless Channel- Capacity of Flat Fading Channel – Channel Side Information at Receiver – Channel Side Information at Transmitter and Receiver –Capacity comparisons – Capacity of Frequency Selective Fading channels.	

UNIT III – PERFORMANCE OF DIGITAL MODULATION OVER WIRELESS CHANNELS	[9 hours]
Performance of flat fading and frequency selective fading – Impact on digital modulation techniques –- Outage Probability– Average Probability of Error — Combined Outage and Average Error Probability – Doppler Spread – Inter symbol Interference.	

UNIT IV – DIVERSITY TECHNIQUES	[9 hours]
Realization of Independent Fading Paths – Receiver Diversity – Selection Combining – Threshold Combing – Maximal-Ratio Combining – Equal - Gain Combining – Capacity with Receiver diversity – Transmitter Diversity – Channel known at Transmitter – Channel unknown at Transmitter – The Alamouti Scheme– Transmit & Receive Diversity-MIMO Systems	

UNIT V – MULTICARRIER MODULATION	[9 hours]
Data Transmission using Multiple Carriers – Multicarrier Modulation with Overlapping Sub channels – Mitigation of Subcarrier Fading – Discrete Implementation of Multicarrier Modulation – Peak to average Power Ratio- Frequency and Timing offset	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Design solutions for cellular communication
CO2	Determine the capacity of wireless channels
CO3	Analyze the performance of the digital modulation techniques in fading channels
CO4	Apply various diversity techniques in wireless communication
CO5	Design multicarrier systems in wireless communication.

COs and POs Mapping:

COs	**POs**					
	1	**2**	**3**	**4**	**5**	**6**
CO1	-	-	2	2	3	2

CO2	3	2	3	-	-	-
CO3	2	-	-	2	3	3
CO4	3	3	-	2	3	3
CO5	2	3	3	2	3	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final marks</th></tr>
<tr><td rowspan="5">Continuous Internal Examination (CIE)</td><td>CIE – I</td><td>100</td><td rowspan="2">50</td><td rowspan="5">100</td><td rowspan="5">40</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>MCQ</td><td>20</td><td>10</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td>End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>60</td><td>60</td><td>60</td></tr>
<tr><td colspan="5">Total</td><td>100</td></tr>
</table>

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. Theodore.S. Rappaport, “Wireless Communications: Principles and Practice", 2nd Edition, Pearson Education, India, 2010.
2. Andrea Goldsmith, “Wireless Communications”, Cambridge University Press, 2005.

3. David Tse and Pramod Viswanath, "Fundamentals of Wireless Communication", Wiley Series in Telecommunications, Cambridge University Press, 2005.
4. Saad Z. Asif, "5G Mobile Communications Concepts and Technologies" CRC press – 2019.
5. Keith Q. T. Zhang, "Wireless Communications: Principles, Theory and Methodology" 1st edition, John Wiley & Sons, 2016.
6. Ramjee Prasad, "OFDM for Wireless Communication Systems", Artech House, 2004.
7. Boris Lublinsky, Kevin T. Smith, Alexey Yakubovich, "Professional Hadoop Solutions",John Wiley & Sons Inc., 2013.

Suggested Skill Activities:

1. Survey on various features of cellular networks
2. Study the nature of cellular networks
3. A comparative study on the performance of different digital modulation techniques
4. Perform a review of various diversity techniques in wireless communication
5. Presentation on design of multicarrier systems for 5G

Course Code:	**24CP209**	**Course Title:**	**AGILE METHODOLOGIES**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To learn the fundamental principles and practices associated with each of the agile development methods
- To apply the principles and practices of agile software development on a project of interest and relevance to the student.
- To provide a good understanding of software design and a set of software technologies and APIs.
- To do a detailed examination and demonstration of Agile development and testing techniques.
- To understand Agile development and testing

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – AGILE SOFTWARE DEVELOPMENT	**[9 hours]**
Basics and Fundamentals of Agile Process Methods, Values of Agile, Principles of Agile, stakeholders, Challenges. Lean Approach: Waste Management, Kaizen and Kanban, add process and products add value. Roles related to the lifecycle, differences between Agile and traditional plans, differences between Agile plans at different lifecycle phases. Testing plan links between testing, roles and key techniques, principles, understand as a means of assessing the initial status of a project/ How Agile helps to build quality	

UNIT II – AGILE AND SCRUM PRINCIPLES	**[9 hours]**
Agile Manifesto, Twelve Practices of XP, Scrum Practices, Applying Scrum. Need of scrum, working of scrum, advanced Scrum Applications, Scrum and the Organization, scrum values.	

UNIT III – AGILE PRODUCT MANAGEMENT	**[9 hours]**
Communication, Planning, Estimation Managing the Agile approach Monitoring progress, Targeting and motivating the team, Managing business involvement, Escalating issue. Quality, Risk, Metrics and Measurements, Managing the Agile approach Monitoring progress, Targeting and motivating the team, Managing business involvement and Escalating issue	

UNIT IV – AGILE REQUIREMENTS AND AGILE TESTING	**[9 hours]**
User Stories, Backlog Management. Agile Architecture: Feature Driven Development. Agile Risk Management: Risk and Quality Assurance, Agile Tools. Agile Testing Techniques, Test-Driven Development, User Acceptance Test.	

UNIT V – AGILE REVIEW AND SCALING AGILE FOR LARGE PROJECTS	**[9 hours]**
Agile Metrics and Measurements, The Agile approach to estimating and project variables, Agile Measurement, Agile Control: the 7 control parameters. Agile approach to Risk, The Agile approach to Configuration Management, The Atern Principles, Atern Philosophy, The rationale for using Atern, Refactoring, Continuous integration, Automated Build Tools. Scrum of Scrums, Team collaborations, Scrum, Estimate a Scrum Project, Track Scrum Projects, Communication in Scrum Projects, Best Practices to Manage Scrum.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Analyze existing problems with the team, development process and wider organization
CO2	Apply a thorough understanding of Agile principles and specific practices
CO3	Select the most appropriate way to improve results for a specific circumstance or need
CO4	Judge and craft appropriate adaptations to existing practices or processes depending upon analysis of typical problems
CO5	Evaluate likely successes and formulate plans to manage likely risks or problems

COs and POs Mapping:

COs	**POs**					
	1	**2**	**3**	**4**	**5**	**6**

CO1	3	1	3	-	2	3
CO2	2	-	3	3	1	3
CO3	3	-	-	-	3	3
CO4	2	-	1	2	3	3
CO5	1	3	-	-	2	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final marks</th></tr>
<tr><td rowspan="5">Continuous Internal Examination (CIE)</td><td>CIE – I</td><td>100</td><td rowspan="2">50</td><td rowspan="5">100</td><td rowspan="5">40</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>MCQ</td><td>20</td><td>10</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td>End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>60</td><td>60</td><td>60</td></tr>
<tr><td colspan="5" align="right">Total</td><td>100</td></tr>
</table>

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. Robert C. Martin ,Agile Software Development, Principles, Patterns, and Practices Alan Apt Series (2011)
2. Succeeding with Agile : Software Development Using Scrum, Pearson (2010)
3. David J. Anderson and Eli Schragenheim, “Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Prentice Hall, 2003.

4. Hazza and Dubinsky, “Agile Software Engineering, Series: Undergraduate Topics in Computer Science, Springer, 2009.

5. Craig Larman, “Agile and Iterative Development: A Managers Guide, Addison-Wesley, 2004.
6. Kevin C. Desouza, “Agile Information Systems: Conceptualization, Construction, and Management, Butterworth-Heinemann, 2007.

Course Code:	24CP210	Course Title:	PERFORMANCE ANALYSIS OF COMPUTER SYSTEMS
Credits:	3	L – T – P	3-0-0

Course objectives:

To impart knowledge on the

- To understand the mathematical foundations needed for performance evaluation of computer systems
- To understand the metrics used for performance evaluation
- To understand the analytical modeling of computer systems
- To enable the students to develop new queuing analysis for both simple and complex systems
- To appreciate the use of smart scheduling and introduce the students to analytical techniques for evaluating scheduling policies

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – OVERVIEW OF PERFORMANCE EVALUATION	[9 hours]
Need for Performance Evaluation in Computer Systems – Overview of Performance Evaluation Methods – Introduction to Queuing – Probability Review – Generating Random Variables for Simulation – Sample Paths, Convergence and Averages – Little‘s Law and other Operational Laws –Modification for Closed Systems	

UNIT II – MARKOV CHAINS AND SIMPLE QUEUES	[9 hours]
Discrete-Time Markov Chains – Ergodicity Theory – Real World Examples – Google, Aloha – Transition to Continuous-Time Markov Chain – M/M/1.	

UNIT III – MULTI-SERVER AND MULTI-QUEUE SYSTEMS	[9 hours]
Server Farms: M/M/k and M/M/k/k – Capacity Provisioning for Server Farms – Time Reversibility and Burke‘s Theorem – Networks of Queues and Jackson Product Form – Classed and Closed Networks of Queues	

UNIT IV – REAL-WORLD WORKLOADS	[9 hours]
Case Study of Real-world Workloads – Phase-Type Distributions and Matrix-Alalytic Methods – Networks with Time-Sharing Servers – M/G/1 Queue and the Inspection Paradox – Task Assignment Policies for Server Farms.	

UNIT V – SMART SCHEDULING IN THE M/G/1	[9 hours]
Performance Metrics – Scheduling Non-Preemptive and Preemptive Non-Size-Based Policies - . Scheduling Non-Preemptive and Preemptive Size-Based Policies – Scheduling - SRPT and Fairness.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Identify the need for performance evaluation and the metrics used for it
CO2	Distinguish between open and closed queuing networks
CO3	Apply Little‘e law and other operational laws to open and closed systems
CO4	Use discrete-time and continuous-time Markov chains to model real world systems
CO5	Develop analytical techniques for evaluating scheduling policies

COs and POs Mapping:

COs	POs					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1	1	1	1	1	1
CO2	2	2	3	2	2	1
CO3	2	2	2		2	

CO4	1		3		3	1
CO5	2	2	2	1	2	

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final marks</th></tr>
<tr><td rowspan="5">Continuous Internal Examination (CIE)</td><td>CIE – I</td><td>100</td><td rowspan="2">50</td><td rowspan="5">100</td><td rowspan="5">40</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>MCQ</td><td>20</td><td>10</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td>End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>60</td><td>60</td><td>60</td></tr>
<tr><td colspan="5">Total</td><td>100</td></tr>
</table>

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. K. S. Trivedi, “Probability and Statistics with Reliability, Queueing and Computer Science Applications‖, John Wiley and Sons, 2001.
2. Krishna Kant, “Introduction to Computer System Performance Evaluation‖, McGraw-Hill, 1992.
3. Lieven Eeckhout, “Computer Architecture Performance Evaluation Methods‖, Morgan and Claypool Publishers, 2010.
4. Mor Harchol - Balter, “Performance Modeling and Design of Computer Systems –Queueing Theory in Action‖, Cambridge University Press, 2013.
5. Paul J. Fortier and Howard E. Michel, “Computer Systems Performance Evaluation and Prediction‖, Elsevier, 2003.

6. Raj Jain, “The Art of Computer Systems Performance Analysis: Techniques forExperimental Design, Measurement, Simulation and Modeling‖, Wiley-Interscience, 1991.
7. Raj Jain, Art of Computer Systems Performance Analysis: Techniques For Experimental Design Measurements Simulation and Modeling,2nd edition, wiley, 2015

Course Code:	24CP212	Course Title:	HIGH PERFORMANCE COMPUTING FOR BIG DATA
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To learn the fundamental concepts of High Performance Computing.
- To learn the network & software infrastructure for high performance computing.
- To understand real time analytics using high performance computing.
- To learn the different ways of security perspectives and technologies used in HPC.
- To understand the emerging big data applications.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – INTRODUCTION	[9 hours]
The Emerging IT Trends- IOT/IOE-Apache Hadoop for big data analytics-Big data into big insights and actions – Emergence of BDA discipline – strategic implications of big data – BDA Challenges – HPC paradigms – Cluster computing – Grid Computing – Cloud computing – Heterogeneous computing – Mainframes for HPC - Supercomputing for BDA – Appliances for BDA.	

UNIT II – NETWORK & SOFTWARE INFRASTRUCTURE FOR HIGH PERFORMANCE BDA	[9 hours]
Design of Network Infrastructure for high performance BDA – Network Virtualization – Software Defined Networking – Network Functions Virtualization – WAN optimization for transfer of big data –started with SANs- storage infrastructure requirements for storing big data – FC SAN – IP SAN – NAS – GFS – Panasas – Luster file system – Introduction to cloud storage	

UNIT III – REAL TIME ANALYTICS USING HIGH PERFORMANCE COMPUTING	[9 hours]
Technologies that support Real time analytics – MOA: Massive online analysis – GPFS: General parallel file system – Client case studies – Key distinctions – Machine data analytics – operational analytics – HPC Architecture models – In Database analytics – In memory analytics	

UNIT IV – SECURITY AND TECHNOLOGIES	[9 hours]
Security, Privacy and Trust for user – generated content: The challenges and solutions – Role of real time big data processing in the IoT – End to End Security Framework for big sensing data streams – Clustering in big data.	

UNIT V – EMERGING BIG DATA APPLICATIONS	[9 hours]
Deep learning Accelerators – Accelerators for clustering applications in machine learning - Accelerators for classification algorithms in machine learning – Accelerators for Big data Genome Sequencing	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Understand the basics concepts of High Performance computing systems
CO2	Apply the concepts of network and software infrastructure for high performance computing
CO3	Use real time analytics using high performance computing.
CO4	Apply the security models and big data applications in high performance computing
CO5	Understand the emerging big data applications.

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	2	3	1	-	-
CO2	-	-	2	3	2	3

CO3	1	-	1	-	1	3
CO4	3	1	-	-	3	-
CO5	1	-	-	2	3	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. Pethuru Raj, Anupama Raman, Dhivya Nagaraj and Siddhartha Duggirala, "High- Performance Big-Data Analytics: Computing Systems and Approaches", Springer, 1st Edition, 2015.
2. "Big Data Management and Processing", Kuan-Ching Li , Hai Jiang, Albert Y. Zomaya, CRC Press,1st Edition,2017.
3. "High Performance Computing for Big Data: Methodologies and Applications", Chao wang ,CRC Press,1st Edition,2018
4. "High-Performance Data Mining And Big Data Analytics" , Khosrow Hassibi, Create Space Independent Publishing Platform,!st Edition,2014

5. "High performance computing: Modern systems and practices", Thomas Sterling, Matthew Anderson, Morgan Kaufmann publishers,1st Edition,2017

WEB REFERENCES:

1. https://www.hpcwire.com/

ONLINE RESOURCES:

1. http://hpc.fs.uni-lj.si/sites/default/files/HPC_for_dummies.pdf
2. https://www.nics.tennessee.edu/computing-resources/what-is-hpc

Course Code:	24CP213	Course Title:	AUTONOMOUS SYSTEMS
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To impart knowledge on the functional architecture of autonomous vehicles
- To impart knowledge on Localization and mapping fundamentals
- To impart knowledge on process end effectors and robotic controls
- To learn Robot cell design, Robot Transformation and Sensors
- To learn Micro/Nano Robotic Systems

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – INTRODUCTION AND FUNCTIONAL ARCHITECTURE	[9 hours]
Functional architecture - Major functions in an autonomous vehicle system, Motion Modeling - Coordinate frames and transforms, point mass model, Vehicle modeling (kinematic and dynamic bicycle model - two-track models), Sensor Modeling - encoders, inertial sensors, GPS.	

UNIT II – PERCEPTION FOR AUTONOMOUS SYSTEMS	[9 hours]
SLAM - Localization and mapping fundamentals, LIDAR and visual SLAM, Navigation – Global path planning, Local path planning, Vehicle control - Control structures, PID control, Linear quadratic regulator, Sample controllers	

UNIT III – ROBOTICS INTRODUCTION, END EFFECTORS AND CONTROL	[9 hours]
Robot anatomy-Definition, law of robotics, Simple problems Specifications of Robot-Speed of Robot-Robot joints and links-Robot classifications-Architecture of robotic systems, Mechanical grippers-Slider crank mechanism, Screw type, Rotary actuators, cam type-Magnetic grippers- Vacuum	

grippers-Air operated grippers-Gripper force analysis-Gripper design-Simple problems- Robot controls-Point to point control, Continuous path control, Intelligent robotControl system for robot joint-Control actions-Feedback devices-Encoder, Resolver, LVDTMotion Interpolations- Adaptive control.

UNIT IV – ROBOT TRANSFORMATIONS, SENSORS AND ROBOT CELL DESIGN	**[9 hours]**
Robot kinematics-Types- 2D, 3D Transformation-Scaling, Rotation, Translation- Homogeneous coordinates, multiple transformation-Simple problems. Sensors in robot – Touch sensors-Tactile, Robot work cell design and control-Sequence control, Operator interface, Safety monitoring devices in Robot-Mobile robot working principle, actuation using MATLAB, NXT Software	

UNIT V – MICRO/NANO ROBOTICS SYSTEM	**[9 hours]**
Micro/Nano robotics system overview-Scaling effect-Top down and bottom up approach Actuators of Micro/Nano robotics system-Nano robot communication techniques-Fabrication of micro/nano grippers-Wall climbing micro robot working principles-Biomimetic robot-Swarm robot-Nano robot in targeted drug delivery system.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Understand architecture and modeling of autonomous systems
CO2	Employ localization mapping techniques for autonomous systems
CO3	Design solutions for autonomous systems control.
CO4	Analyze Robot Transformations, Sensors and Cell Design.
CO5	Explain the working principles of Micro/Nano Robotic system.

COs and POs Mapping:

COs	**POs**					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1	2	3	2	3	3
CO2	2	1	2	3	2	2

CO3	1	2	2	-	1	1
CO4	2	1	2	2	2	-
CO5	3	-	-	1	-	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. S.R. Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education.,2009
2. Mikell P Groover & Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, Industrial Robotics, Technology programming and Applications, McGraw Hill, 2012.
3. Karsten Berns, Ewald Puttkamer, Springer, Autonomous Land Vehicles: Steps towards Service Robots, 2009
4. Sebastian Thrun, Wolfram Burgard, Dieter Fox., Probabilistic robotics. MIT Press, 2005
5. Steven M. LaValle., Planning algorithms, Cambridge University Press, 2006
6. Daniel Watzenig and Martin Horn (Eds.), Automated Driving: Safer and More Efficient Future Driving, Springer, 2017
7. Markus Maurer, Autonomous driving: technical, legal and social aspects. Springer, 2016
8. Jha, Theory, Design and Applications of Unmanned Aerial Vehicles, CRC Press, 2016

Course Code:	**24CP214**	**Course Title:**	**WEB ANALYTICS**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To understand the Web analytics platform, and their evolution.
- To learn about the various Data Streams Data.
- To learn about the benefits of surveys and capturing of data
- To understand Common metrics of web as well as KPI related concepts.
- To learn about the various Web analytics versions.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – INTRODUCTION	**[9 hours]**
Definition, Process, Key terms: Site references, Keywords and Key phrases; building block terms: Visit characterization terms, Content characterization terms, Conversion metrics; Categories: Offsite web, on site web; Web analytics platform, Web analytics evolution, Need for web analytics, Advantages, Limitations..	

UNIT II – DATA COLLECTION	**[9 hours]**
Click stream Data: Web logs, Web Beacons, JavaScript tags, Packet Sniffing; Outcomes Data: E-commerce, Lead generation, Brand/Advocacy and Support; Research data: Mindset, Organizational structure, Timing; Competitive Data: Panel-Based measurement, ISP-based measurement, Search Engine data.	

UNIT III – QUALITATIVE ANALYSIS	[9 hours]
Heuristic evaluations: Conducting a heuristic evaluation, Benefits of heuristic evaluations; Site Visits: Conducting a site visit, Benefits of site visits; Surveys: Website surveys, Post-visit surveys, creating and running a survey, Benefits of surveys. Capturing data: Web logs or JavaScript's tags, Separate data serving and data capture, Type and size of data, Innovation, Integration, Selecting optimal web analytic tool, Understanding click stream data quality, Identifying unique page definition, Using cookies, Link coding issues.	

UNIT IV – WEB METRICS	[9 hours]
Common metrics: Hits, Page views, Visits, Unique visitors, Unique page views, Bounce, Bounce rate, Page/visit, Average time on site, New visits; Optimization (e-commerce, non e-commerce sites): Improving bounce rates, Optimizing adwords campaigns; Real time report, Audience report, Traffic source report, Custom campaigns, Content report, Google analytics, Introduction to KPI, characteristics, Need for KPI, Perspective of KPI, Uses of KPI. Relevant Technologies: Internet & TCP/IP, Client / Server Computing, HTTP (Hypertext Transfer Protocol), Server Log Files & Cookies, Web Bugs.	

UNIT V – WEB ANALYTICS 2.0	[9 hours]
Web analytics 1.0, Limitations of web analytics 1.0, Introduction to analytic 2.0, Competitive intelligence analysis : CI data sources, Toolbar data, Panel data ,ISP data, Search engine data, Hybrid data, Website traffic analysis: Comparing long term traffic trends, Analyzing competitive site overlap and opportunities. Google Analytics: Brief introduction and working, Adwords, Benchmarking, Categories of traffic: Organic traffic, Paid traffic; Google website optimizer, Implementation technology, Limitations, Performance concerns, Privacy issues.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Understand the Web analytics platform, and their evolution.
CO2	Use the various Data Streams Data.
CO3	Know how the survey of capturing of data will benefit.
CO4	Understand Common metrics of web as well as KPI related concepts
CO5	Apply various Web analytics versions in existence

COs and POs Mapping:

COs	POs					
	1	**2**	**3**	**4**	**5**	**6**
CO1	3	-	3	2	3	2
CO2	2	2	3	1	1	1
CO3	3	-	3	2	2	2
CO4	1	2	3	1	1	1
CO5	2	-	3	2	2	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. Clifton B., Advanced Web Metrics with Google Analytics, Wiley Publishing, Inc.2nd ed, 2012.
2. Kaushik A., Web Analytics 2.0, The Art of Online Accountability and Science of Customer Centricity, Wiley Publishing, Inc. 1st ed, 2010.
3. Sterne J., Web Metrics: Proven methods for measuring web site success, John Wiley and Sons, 2002

Course Code:	**24CP215**	**Course Title:**	**COGNITIVE COMPUTING**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To familiarize Use the Innovation Canvas to justify potentially successful products.
- To learn various ways in which to develop a product idea.
- To understand about how Big Data can play vital role in Cognitive Computing
- To know about the business applications of Cognitive Computing
- To get into all applications of Cognitive Computing

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – FOUNDATION OF COGNITIVE COMPUTING	**[9 hours]**
Foundation of Cognitive Computing: cognitive computing as a new generation, the uses of cognitive systems, system cognitive, gaining insights from data, Artificial Intelligence as the foundation of cognitive computing, understanding cognition Design Principles for Cognitive Systems: Components of a cognitive system, building the corpus, bringing data into cognitive system, machine learning, hypotheses generation and scoring, presentation, and visualization services	

UNIT II – NATURAL LANGUAGE PROCESSING IN COGNITIVE SYSTEMS	**[9 hours]**
Natural Language Processing in support of a Cognitive System: Role of NLP in a cognitive system, semantic web, Applying Natural language technologies to Business problems Representing knowledge in Taxonomies and Ontologies: Representing knowledge, Defining Taxonomies and Ontologies, knowledge representation, models for knowledge representation, implementation considerations.	

UNIT III – BIG DATA AND COGNITIVE COMPUTING	[9 hours]
Relationship between Big Data and Cognitive Computing: Dealing with human-generated data, defining big data, architectural foundation, analytical data warehouses, Hadoop, data in motion and streaming data, integration of big data with traditional data Applying Advanced Analytics to cognitive computing: Advanced analytics is on a path to cognitive computing, Key capabilities in advanced analytics, using advanced analytics to create value, Impact of open source tools on advanced analytics	

UNIT IV – BUSINESS IMPLICATIONS OF COGNITIVE COMPUTING	[9 hours]
Preparing for change ,advantages of new disruptive models , knowledge meaning to business, difference with a cognitive systems approach , meshing data together differently, using business knowledge to plan for the future , answering business questions in new ways , building business specific solutions , making cognitive computing a reality , cognitive application changing the market The process of building a cognitive application: Emerging cognitive platform, defining the objective, defining the domain, understanding the intended users and their attributes, questions and exploring insights, training and testing	

UNIT V – APPLICATION OF COGNITIVE COMPUTING	[9 hours]
Building a cognitive health care application: Foundations of cognitive computing for healthcare, constituents in healthcare ecosystem, learning from patterns in healthcare Data, Building on a foundation of big data analytics, cognitive applications across the health care eco system, starting with a cognitive application for healthcare, using cognitive applications to improve health and wellness, using a cognitive application to enhance the electronic medical record Using cognitive application to improve clinical teaching	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Explain applications in Cognitive Computing
CO2	Describe Natural language processor role in Cognitive computing.
CO3	Explain future directions of Cognitive Computing
CO4	Evaluate the process of taking a product to market
CO5	Comprehend the applications involved in this domain

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	1	3	2	-	2	-
CO2	2	-	3	1	3	-
CO3	1	2	-	-	3	-
CO4	-	-	2	2	1	1
CO5	2	2	1	-	1	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. Judith H Hurwitz, Marcia Kaufman, Adrian Bowles, “Cognitive computing and Big Data Analytics”, Wiley, 2015
2. Robert A. Wilson, Frank C. Keil, “The MIT Encyclopedia of the Cognitive Sciences”, The MIT Press, 1999.
3. Noah D. Goodman, Joshua B. Tenenbaum, The ProbMods Contributors, “Probabilistic Models of Cognition”, Second Edition, 2016, https://probmods.org/.

Course Code:	24CP216	Course Title:	QUANTUM COMPUTING
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To introduce the building blocks of Quantum computers and highlight the paradigm change between conventional computing and quantum computing
- To understand the Quantum state transformations and the algorithms
- To understand entangled quantum subsystems and properties of entangled states
- To explore the applications of quantum computing

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – QUANTUM BUILDING BLOCKS	[9 hours]
The Quantum Mechanics of Photon Polarization, Single-Qubit Quantum Systems, Quantum State Spaces, Entangled States, Multiple-Qubit Systems, Measurement of Multiple-Qubit States, EPR Paradox and Bell’s Theorem, Bloch sphere	

UNIT II – QUANTUM STATE TRANSFORMATIONS	[9 hours]
Unitary Transformations, Quantum Gates, Unitary Transformations as Quantum Circuits, Reversible Classical Computations to Quantum Computations, Language for Quantum Implementations	

UNIT III – QUANTUM ALGORITHMS	[9 hours]
Computing with Superpositions, Quantum Subroutines, Quantum Fourier Transformations, Shor’s Algorithm and Generalizations, Grover’s Algorithm and Generalizations	

UNIT IV – ENTANGLED SUBSYSTEMS AND ROBUST QUANTUM COMPUTATION	[9 hours]
Quantum Subsystems, Properties of Entangled States, Quantum Error Correction, Graph states and codes, CSS Codes, Stabilizer Codes, Fault Tolerance and Robust Quantum Computing	

UNIT V – QUANTUM INFORMATION PROCESSING	[9 hours]
Limitations of Quantum Computing, Alternatives to the Circuit Model of Quantum Computation, Quantum Protocols, Building Quantum, Computers, Simulating Quantum Systems, Bell states. Quantum teleportation. Quantum Cryptography, no cloning theorem	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Understand the basic principles of quantum computing
CO2	Gain knowledge of the fundamental differences between conventional computing and quantum computing
CO3	Understand several basic quantum computing algorithms.
CO4	Understand the classes of problems that can be expected to be solved well by quantum computers.
CO5	Simulate and analyze the characteristics of Quantum Computing Systems

COs and POs Mapping:

COs	**POs**					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1	2	3	-	1	-
CO2	1	2	3	-	2	-
CO3	-	1	3	2	3	2
CO4	2	-	2	2	1	3
CO5	3	-	1	2	3	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final marks</th></tr>
<tr><td rowspan="5">Continuous Internal Examination (CIE)</td><td>CIE – I</td><td>100</td><td rowspan="2">50</td><td rowspan="5">100</td><td rowspan="5">40</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>MCQ</td><td>20</td><td>10</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td>End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>60</td><td>60</td><td>60</td></tr>
<tr><td colspan="5">Total</td><td>100</td></tr>
</table>

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. John Gribbin, Computing with Quantum Cats: From Colossus to Qubits, 2021
2. William (Chuck) Easttom, Quantum Computing Fundamentals, 2021
3. Parag Lala, Quantum Computing, 2019
4. Eleanor Rieffel and Wolfgang Polak, QUANTUM COMPUTING A Gentle Introduction, 2011
5. Nielsen M. A., Quantum Computation and Quantum Information, Cambridge University Press.2002
6. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. I: Basic Concepts, Vol II: Basic Tools and Special Topics, World Scientific. 2004
7. Pittenger A. O., An Introduction to Quantum Computing Algorithms 2000

Course Code:	24CP217	Course Title:	BIG DATA MINING AND ANALYTICS
Credits:	3	L – T – P	3-0-0

Course objectives:

To impart knowledge on the

- To understand the computational approaches to Modeling, Feature Extraction
- To understand the need and application of Map Reduce
- To understand the various search algorithms applicable to Big Data
- To analyze and interpret streaming data
- To learn how to handle large data sets in main memory and learn the various clustering techniques applicable to Big Data

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – DATA MINING AND LARGE SCALE FILES	[9 hours]
Introduction to Statistical modeling – Machine Learning – Computational approaches to modeling – Summarization – Feature Extraction – Statistical Limits on Data Mining - Distributed File Systems – Map-reduce – Algorithms using Map Reduce – Efficiency of Cluster Computing Techniques.	

UNIT II – SIMILAR ITEMS	[9 hours]
Nearest Neighbor Search – Shingling of Documents – Similarity preserving summaries – Locality sensitive hashing for documents – Distance Measures – Theory of Locality Sensitive Functions – LSH Families – Methods for High Degree of Similarities.	

UNIT III – MINING DATA STREAMS	[9 hours]
Stream Data Model – Sampling Data in the Stream – Filtering Streams – Counting Distance Elements in a Stream – Estimating Moments – Counting Ones in Window – Decaying Windows.	

UNIT IV – LINK ANALYSIS AND FREQUENT ITEMSETS	[9 hours]
Page Rank –Efficient Computation - Topic Sensitive Page Rank – Link Spam – Market Basket Model – A-priori algorithm – Handling Larger Datasets in Main Memory – Limited Pass Algorithm – Counting Frequent Item sets.	

UNIT V – CLUSTERING	[9 hours]
Introduction to Clustering Techniques – Hierarchical Clustering –Algorithms – K-Means – CURE – Clustering in Non -– Euclidean Spaces – Streams and Parallelism – Case Study: Advertising on the Web – Recommendation Systems.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Design algorithms by employing Map Reduce technique for solving Big Data problems
CO2	Design algorithms for Big Data by deciding on the apt Features set
CO3	Design algorithms for handling petabytes of datasets.
CO4	Design algorithms and propose solutions for Big Data by optimizing main memory consumption.
CO5	Design solutions for problems in Big Data by suggesting appropriate clustering techniques

COs and POs Mapping:

COs	**POs**					
	1	**2**	**3**	**4**	**5**	**6**
CO1	-	-	-	2	3	**3**
CO2	-	-	-	-	2	**2**
CO3	-	-	-	2	3	**3**

CO4	**1**	**-**	2	2	3	**3**
CO5	**2**	**3**	2	2	3	**3**

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. Jure Leskovec, AnandRajaraman, Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 3rd Edition, 2020.
2. Jiawei Han, MichelineKamber, Jian Pei, “Data Mining Concepts and Techniques”, Morgan Kaufman Publications, Third Edition, 2012.
3. Ian H.Witten, Eibe Frank “Data Mining – Practical Machine Learning Tools and Techniques”, Morgan Kaufman Publications, Third Edition, 2011.
4. David Hand, HeikkiMannila and Padhraic Smyth, “Principles of Data Mining”, MIT PRESS, 2001.

Item No: 01:19 Annexure XVII

ROHINI COLLEGE OF ENGINEERING AND TECHNOLOGY

(AUTONOMOUS)

(Anjugramam-Kanyakumari Main Road, Palkulam,Variyoor P.O.-629 401, K.K.Dist.)

Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai

Accredited with A+ Grade by NAAC

Department of Management Studies

(MBA)

Curriculum & Syllabus

(*2024-2025 Admitted Students Onwards*)

Proceedings of the 1st Academic Council [29.06.2024]

Vision Statement of RCET

To be an academic institute of continuous excellence towards education and research in rural regime and provide service to nation in terms of nurturing potentially higher social, ethical and engineering companion graduands.

Mission Statement of RCET

To foster and promote technically competent graduands by imparting the state of art Engineering education in rural regime.

To enunciate research assisted scientific learning by dissemination of knowledge towards science, agriculture, industry and national security.

Vision of the Department

To be a nurturing milieu for Learning, disseminating, managerial knowledge (in rural regime) and to secure nation by providing socially and ethically prudent management graduates.

Mission of the Department

To foster career-oriented socially and ethically sensible innovative, management graduates with the aid of methodologies to equip student's professional life skills

To engage in research stimulating management intelligence in graduates thereby promoting socio economic & cultural development of the Nation.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

1. To have a thorough understanding of the core aspects of the business
2. To provide the learners with the management tools to identify, analyze & create business opportunities as well as solves business problems.
3. To prepare them to have a holistic approach towards management functions.
4. To inspire and make them practice ethical standards in business.

PROGRAMME OUTCOMES (POs)

On successful completion of the programme,

1. Apply knowledge of management theories and practices to solve business problems
2. Foster analytical and critical thinking abilities for data-based decision making
3. Ability to develop value-based leadership ability
4. Ability to understand, analyze and communicate global, economic, legal and ethical aspects of business.
5. Ability to lead themselves and others in the achievement of organizational goals, contributing effectively to a team environment
6. Ability to develop entrepreneurial thinking and business acumen
7. Ability to foster research skills and their applications in the respective domain.

MASTER OF BUSINESS ADMINISTRATION

REGULATIONS-2024

CHOICE BASED CREDIT SYSTEMS

CURRICULUM FOR I-IV SEMESTER

SEMESTER - I

Sl.No.	Course Code	Course Title	Category	L	T	P	C
1	24MG101	Data Analysis For Managers	PCC	3	0	2	4
2	24MG102	Organizational Behaviour	PCC	3	0	0	3
3	24MG103	Economics for Managers	PCC	3	0	0	3
4	24MG104	Legal Aspects of Business	PCC	3	0	0	3
5	24MG105	Accounting for Decision Making	PCC	3	0	0	3
6	24MG106	Marketing Management	PCC	3	0	0	3
7	24MG107	Operations Management	PCC	3	0	0	3
8	24MG131	Managerial Skill Development –I	EEC	0	0	4	2
9	24MG151	Organization Structure Training	EEC	0	0	4	2
10	24MG152	Business Ethics (Seminar)	EEC	0	0	2	1
TOTAL				21	0	12	27

MASTER OF BUSINESS ADMINISTRATION

REGULATIONS-2024

CHOICE BASED CREDIT SYSTEMS

CURRICULUM FOR I-IV SEMESTER

SEMESTER - II

Sl.No.	Course Code	Course Title	Category	L	T	P	C
1	24MG201	Innovation and entrepreneurship	PCC	3	0	2	4
2	24MG202	Business Models for Digital Economy	PCC	3	0	0	3
3	24MG203	People Management	PCC	3	0	0	3
4	24MG204	Financial Management	PCC	3	0	0	3
5	24MG205	Navigating Business Research Methods	PCC	3	0	0	3
6	24MG206	Optimization techniques	PCC	3	0	2	4
7	24MG207	Introduction to AI & ML	PCC	3	0	0	3
8	24MG208	Total Quality Management	PCC	3	0	0	3
9	24MG231	Managerial Skill Development – II	SEC	0	0	4	2
10	24MG232	Business Lab	EEC	0	0	2	1
TOTAL				24	0	10	29

MASTER OF BUSINESS ADMINISTRATION

REGULATIONS-2024

CHOICE BASED CREDIT SYSTEMS

CURRICULUM FOR I-IV SEMESTER

SEMESTER - III

Sl.No.	Course Code	Course Title	Category	L	T	P	C
1	24MG301	Strategic Management	PCC	3	0	0	3
2	24MG302	International Business	PCC	3	0	0	3
3		Professional Elective I	PEC	3	0	0	3
4		Professional Elective II	PEC	3	0	0	3
5		Professional Elective III	PEC	3	0	0	3
6		Professional Elective IV	PEC	3	0	0	3
7		Professional Elective V	PEC	3	0	0	3
8		Professional Elective VI	PEC	3	0	0	3
9	24MG351	Innovation Management Lab	EEC	0	0	4	2
10	24MG352	Summer Internship	EEC	0	0	2	2
TOTAL				24	0	6	27

MASTER OF BUSINESS ADMINISTRATION

REGULATIONS-2024

CHOICE BASED CREDIT SYSTEMS

CURRICULUM FOR I-IV SEMESTER

SEMESTER - IV

Sl.No.	Course Code	Course Title	Category	L	T	P	C
1	24MG451	Project Work	EEC	0	0	24	12
TOTAL				0	0	24	12

Course Code:	**24MG101**	**Course Title:**	**Data Analysis For Managers**
Credits:	**4**	**L – T – P**	**3 – 0 – 2**

Course objectives:

The syllabus is designed to provide the basic tools of statistical techniques mainly for the purpose of hypothesize the engineering problems and obtaining solutions.

- To learn the applications of statistics in business decision making.
- To understand the concepts and applications of analysis of variance in business, to interpret samples and obtain the inferences by using the testing of hypothesis methods.
- To apply non–parameter test in business decision making to analyze the interpolation techniques, correlation and regression in business applications.

Teaching-Learning Process:

These are sample strategies which teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method does not mean only traditional method, but different type of teaching methods may be adopted to develop the outcomes.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Topics will be introduced in a multiple representation and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT I – STATISTICS, PROBABILITY AND RANDOM VARIABLE	**9+3**

Statistics: Definition, Uses and limitation - Descriptive Measures: Central Tendency -Mean, Median and Mode - Measure of Dispersion: Range, inter-quartile deviation, quartile deviation, Mean deviation, standard deviation and Co-efficient of variation - Probability: Basic definitions and rules, Conditional Probability - Probability Distributions: Binomial, Poisson and Normal (simple problems).

Applications: Baye's Theorem, Statistical distributions using R software

Practical exercise:

Central tendency and Measures of dispersion using SPSS

UNIT II – Sampling Distribution and Estimation	9+3
Introduction to sampling distributions - sampling distribution of mean and proportion - central limit theorem - sampling techniques - Estimation: Point and Interval estimates for population parameters of large sample and small samples - determining the sample size. **Applications:** Cluster Sampling	

UNIT III – TESTING OF HYPOTHESIS –PARAMETRIC TESTS	9+3
Hypothesis testing - one sample and two sample tests for means and proportions of large samples (z-test) - one sample and two sample tests for means of small samples (t-test) - Two sample tests for variance (F-test) **Applications:** ANOVA: one and two way **Practical exercise:** 1. One Sample t-Test 2. Independent Sample t-Test 3. One way ANOVA	
UNIT IV – TESTING OF HYPOTHESIS – NON PARAMETRIC TESTS	**9+3**
Chi-square tests for independence of attributes and goodness of fit - Sign test for paired data - Rank sum test : Mann – Whitney U test and Kruskal Wallis test - One sample run test **Applications:** Kolmogorov-Smirnov – test for goodness of fit. **Practical exercise:** 1. Mann –Whitney Test (Two Independent Test) 2. Kruskal Wallis (K – Independent Sample Test)	
UNIT V – CORRELATION, REGRESSION AND TIME SERIES	**9+3**
Correlation: scatter diagram, Types of correlation - coefficient of correlation - - Regression – Estimation of Regression line – Relationship between Regression and Correlation - Time Series: Components, models of time series - Trend analysis - moving averages. **Applications:** Spearman Rank correlation, Method of Least Squares. **Practical exercise:** 1. Correlation Analysis 2. Regression Analysis	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Apply the probability distributions in business decision making.	K3
CO2	Use the sampling techniques to analyze the management decisions	K3
CO3	Apply the concept of testing of hypothesis for small and large samples in Real life Problems	K3
CO4	Apply non-parametric test to draw meaningful conclusions.	K3
CO5	Use simple Correlation and Regression models to analyze the underlying relationships between the variables through hypothesis testing.	K3

COs and POs Mapping:

COs	**Pos**						
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	1	2	1	2	1	-	1
CO2	3	2	1	-	1	1	-
CO3	3	3	2	1	-	1	2
CO4	2	3	2	-	1	1	-
CO5	1	3	2	1	1	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment – I	40	40		
	Skill Assessment – II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester	Theory Exam	100	35	50	50

Examination (ESE)	Lab Exam	100	15		
Total					100

Skill Assessment Components: Individual Assignment / Worksheet / Case Study / Mini Project

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and five (either or) 13 marks question as one from each Unit
- All the thirteen-mark questions have to be answered.
- One either or questions as Case analysis.

Text Books:

1. Hansa Lysander Manohar, "Data Analysis and Business Modeling using Microsoft Excel" PHI, 2017Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
2. Richard I. Levin, David S. Rubin, Sanjay Rastogi Masood Husain Siddiqu, Statistics for Management, Pearson Education, 7th Edition, 2016.

Reference Books:

1. Aczel A.D. and Sounderpandian J., "Complete Business Statistics", 6th edition, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2012.
2. Bali. N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
3. Anderson D.R., Sweeney D.J. and Williams T.A., Statistics for business and economics, 11th edition, Thomson (South – Western) Asia, Singapore, 2012.
4. N. D. Vohra, Business Statistics, Tata McGraw Hill, 2012.
5. Ken Black, Applied Business Statistics, 7th Edition, Wiley India Edition, 2012.
6. David M. Levine et al, "Statistics for Managers using MS Excel",6th Edition, Pearson, 2010.

Web Links and Video Lectures (E-Resources):

1. Sampling Distributions: https://www.nptelvideos.com/lecture.php?id=14612
2. Parametric Methods: https://www.nptelvideos.com/lecture.php?id=14613

3. Non parametric Methods:
   https://www.nptelvideos.com/lecture.php?id=14632

Equivalent NPTEL / SWAYAM Courses:

S.No.	Course Title	Course Instructor	Host Institute
1	Non-Parametric Statistical Inference	Prof. Niladri Chatterjee	IIT Delhi
2	Regression Analysis	Prof. Soumen Maity	IIT Madras
3	Descriptive Statistics with R Software	Prof. Prashant Jha Prof. Shalabh	IIT Kanpur

Course Code:	**24MG102**	**Course Title:**	**Organizational Behavior**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- Basic concepts of management in order to aid in understanding how an organization functions, and in understanding the complexity and wide variety of issues managers face in today's business firms.
- Fundamentals of managing business and to understand individual and group behavior at work place so as to improve the effectiveness of an organization. The course will use and focus on Indian experiences, approaches and cases.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Interactive Simulations
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – NATURE AND THEORIES OF MANAGEMENT	**9**
Evolution of management Thought-Classical, Behavioral and Management Science Approaches Management- meaning, levels, management as an art or science, Managerial functions and Roles, Evolution of Management Theory- Classical era- Contribution of F.W.Taylor, Henri Fayol, NeoClassical-Mayo & Hawthorne Experiments. • Modern era – system & contingency approach Managerial Skills	

UNIT II – PLANNING AND ORGANISING	**9**
Planning - Steps in Planning Process - Scope and Limitations - Forecasting and types of Planning - Characteristics of a sound Plan - Management by Objectives (MBO) - Policies and Strategies – Scope and Formulation - Decision Making - Types, Techniques and Processes. Organising - Authority and Responsibility Relationships - Delegation of Authority and Decentralization - Interdepartmental Coordination - Mechanistic Vs Adoptive Structures - Formal and Informal Organization. Control: meaning, function, Process and types of Control, Techniques of Controlling-Traditional, Modern.	
UNIT III – INDIVIDUAL BEHAVIOUR	**9**
Meaning of Organizational behavior, contributing disciplines, importance of organizational behavior, Perception and Learning - Personality and Individual Differences - Motivation theories and Job Performance - Values, Attitudes and Beliefs - Communication Types-Process - Barriers – Making Communication Effective.	
UNIT IV – GROUP BEHAVIOUR	**9**
Groups and Teams: Definition, Difference between groups and teams, Stages of Group Development, Group Cohesiveness, Types of teams, Group Dynamics - Leadership - Styles - Approaches – Power and Politics - Organizational Climate and Culture, Conflict: concept, sources, Types, Stages of conflict,	

Management of conflict Organizational Change and Development- Emerging Aspects of Organizational Behavior	
UNIT V – ORGANISATIONAL STRUCTURE AND DESIGN	**9**
Fundamentals - Importance and Elements, forms, structure, processes, and systems- Major Components and Best Organizational Design, models and Frameworks-Types of Organizational Design-Traditional Organizational Structures, Contemporary Organizational Structures-Organizational Design Principles-Organizational Change and Adaptation- Technology and Organizational Design, its impact	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	**Outline** the knowledge about various management concepts and skills required in the business world.	**K2**
CO2	**Summarize** the knowledge about various functions of management in a real time management context.	**K2**
CO3	**Identify** the complexities associated with management of individual behavior in the organizations	**K3**
CO4	**Develop** the skillset to have manage group behavior in Organizations.	**K3**
CO5	Critically assess and **compare** organizational design related choices in various types of organizations to gain competitive advantage	K4

COs and POs Mapping:

CO	**POs**						
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	2	1	1	-	-	-	-
CO2	2	1	2	1	1	-	1
CO3	-	1	2	1	-	2	-
CO4	-	1	2	2	1	2	1
CO5	2	1	-	1	1	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
	CIE – I	100			

Continuous Internal Examination (CIE) – Theory	CIE – II	100	50	100	40
	MCQ	20	10		
	Skill Assessment – I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
Total					100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and five (either or) 13 marks question as one from each unit
- All the thirteen-mark questions have to be answered.
- One either or questions as Case analysis.

Text Books:

1. Harold Koontz and Heinz Weihrich, Essentials of Management: An International, Innovation, And Leadership Perspective, 10th edition, Tata McGraw-Hill Education, 2015.
2. Stephen P. Robbins, Timothy A.Judge, Organisational Behavior, PHI Learning / Pearson Education, 16th edition, 2014.

Reference Books:

1. Andrew J. Dubrin, Essentials of Management, Thomson Southwestern, 10th edition, 2016.
2. Samuel C. Certo and S.Trevis Certo, Modern Management: Concepts and Skills, Pearson education, 15th edition, 2018.
3. Charles W.L Hill and Steven L McShane, „Principles of Management, McGraw Hill Education, Special Indian Edition, 2017.
4. Fred Luthans, Organisational Behavior, McGraw Hill, 12th Edition, 2013.
5. Don Hellriegel, Susan E. Jackson and John W,Jr Slocum, Management: A competency-Based Approach, Thompson South Western,11th edition, 2008.
6. Heinz Weihrich, Mark V Cannice and Harold Koontz, Management- A global entrepreneurial perspective, Tata McGraw Hill, 12th edition, 2008.
7. McShane, Mary V. Glinow, Organizational Behavior, 8th Edition, Tata Mc Graw Hill, 2017.
8. Nelson, Quick, Khandelwal. ORGB – An innovative approach to learning and teaching. Cengage learning. 2nd edition. 2012
9. Robert Konopaske, John M Ivancevich, Michael T Matteson, Oranizational Behavior and

Management, 11th edition, Tata McGraw Hill, 2017.

10. Udai Pareek, Understanding Organisational Behavior, 3rd Edition, Oxford Higher Education, 2011.
11. Jerald Greenberg, Behavior in Organizations, PHI Learning. 10th edition. 2011.

Web Links and Video Lectures (E-Resources):

1. Organizational Behavior - https://onlinecourses.nptel.ac.in/noc20_mg51/preview
2. Management Concepts - https://archive.nptel.ac.in/courses/110/106/110106145/
3. Organizational Design - https://onlinecourses.nptel.ac.in/noc23_mg57/preview

Suggested Skill Activities:

1. **Trust-Building Exercises**: Engage in activities such as trust falls, the human knot, or escape room challenges to foster trust and improve teamwork.
2. **Role-Playing Scenarios**: Create scenarios where participants must resolve conflicts in the workplace, such as disputes between colleagues or handling a difficult customer.
3. **Leadership Simulation Games**: Use simulation games where participants take on leadership roles and must navigate complex situations and make strategic decisions.
4. **Active Listening Workshops**: Conduct workshops that include exercises like paraphrasing, summarizing, and reflecting to practice active listening.
5. **Designing Motivational Programs**: Have participants design and present programs or initiatives aimed at improving employee motivation and engagement within an organization.
6. **Decision-Making Workshops**: Conduct workshops that include decision-making exercises, such as scenario analysis, pros and cons lists, and group decision-making tasks.
7. **Cross-Cultural Communication Exercises**: Engage in activities that simulate cross-cultural interactions, such as role-playing different cultural scenarios or discussing case studies.

Course Code:	**24MG103**	**Course Title:**	**Economics For Mangers**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- Explore the concept of scarcity and its impact on economic choices
- Analyze market dynamics and their effects on societal goals and objectives.
- Utilize economic models to analyze market structures and their efficiency
- Assess the impact of fiscal policy on macroeconomic equilibrium and stability.
- Demonstrate the relationship between monetary policy and economic performance

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Interactive Simulations
2. Blended Mode of Learning
3. Experiential Learning
4. NPTEL and Other Videos
5. Smart Class Room
6. Flipped Class

UNIT I – INTRODUCTION	9
The themes of economics – scarcity and efficiency – Goals and Objective of macro Economics – society's capability – Tools of Macro Economics policy – Key Concept of Macro Economics – economic growth & stability – Micro economies and Macro economies – GDP and NDP its important – Two sector model -Three Sector Model - four sector Model.	

UNIT II – CONSUMER AND PRODUCER BEHAVIOR	9
Market – Demand and Supply – Determinants – Market equilibrium – elasticity of demand and supply – consumer behavior – consumer equilibrium – Approaches to consumer behavior – Production – Short-run and long-run Production Function – Returns to scale – economies Vs diseconomies of scale - – Analysis of cost – Short-run and long-run cost function – Relation between Production and cost function. (Case Study on cost analysis in decision making for firm –relation to price & production strategies live event.) – Coupling.	
UNIT III – PRODUCT AND FACTOR MARKET	**9**
Product market – perfect and imperfect market – different market structures – Firm's equilibrium and supply – Market efficiency – Economic costs of imperfect competition – factor market – Land, Labour and capital – Demand and supply – determination of factor price – Interaction of product and factor market – General equilibrium and efficiency of competitive markets. (Case study How have recent innovations, such as electric vehicles and autonomous driving technology, reshaped the competitive landscape in the automotive industry)	
UNIT IV – PERFORMANCE OF AN ECONOMY – MACRO ECONOMICS	**9**
Macro-economic aggregates – circular flow of macroeconomic activity – National income determination– Aggregate demand and supply – Macroeconomic equilibrium –Components of aggregate demand and national income – multiplier effect – Demand side management – Fiscal policy in theory. (case study Analyze the circular flow of macroeconomic activity in the context of the pandemic's impact on production, consumption, and investment)	

UNIT V – AGGREGATE SUPPLY AND THE ROLE OF MONEY	9
Short-run and Long-run supply curve – Unemployment and its impact – Okun's law – Inflation and theimpact – reasons for inflation – Demand Vs Supply factors –Inflation Vs Unemployment tradeoff – Phillips curve –short- run and long-run –Supply side Policy and management- Money market- Demandand supply of money – money-market equilibrium and national income – the role of monetary policy.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Apply the managerial skills and competencies necessary to make company decisions grounded in fundamental microeconomic principles.	K3
CO2	Apply Problem solving ability to improve the Performance of individual firm by analyzing the microeconomic environment of the firm	K3
CO3	Examine the differences in interactions between the product and factor markets.	K4
CO4	Analyze the economic stability using demand side management strategies & fiscal policy tool	K4
CO5	Interpret economic dynamics, including aggregate supply, unemployment, inflation, and monetary policy, through the lens of real-world case studies.	K3

COs and POs Mapping:

Cos	**Pos**						
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	2	2	1	-	1	-	-
CO2	2	3	2	-	-	-	1
CO3	3	1	2	1	1	2	-
CO4	3	3	1	2	1	1	-
CO5	2	2	-	1	-	1	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final marks</th></tr>
<tr><td rowspan="5">Continuous Internal Examination (CIE) – Theory</td><td>CIE – I</td><td>100</td><td rowspan="2">50</td><td rowspan="5">100</td><td rowspan="5">40</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>MCQ</td><td>20</td><td>10</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td>End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>60</td><td>60</td><td>60</td></tr>
<tr><td colspan="5">Total</td><td>100</td></tr>
</table>

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and five (either or) 13 marks question as one from each unit.
- All the thirteen-mark questions have to be answered.
- One either or questions as Case analysis.

Text Books:

1. Varshney & Maheswari: *Managerial Economics*, Sultan Chand, 2009. 2. S.A. Siddiqui & A.S. Siddiqui
2. S.A. Siddiqui & A.S. Siddiqui, Managerial Economics and Financial Analysis, New Age international Publishers, Hyderabad 2013

Reference Books:

1. Paul A. Samuelson, William D. Nordhaus, Sudip Chaudhuri and Anindya Sen, Economics,19th edition, Tata McGraw Hill, New Delhi, 2011
2. William Boyes and Michael Melvin, Textbook of economics, Biztantra, 7 th edition 2008.
3. N. Gregory Mankiw, Principles of Economics, 8 th edition, Thomson learning, New Delhi,2017.
4. Richard Lipsey and Alec Chrystal, Economics, 13th edition, Oxford,

University Press,New Delhi, 2015.

5. Karl E. Case and Ray C. Fair, Principles of Economics, 12th edition, Pearson, EducationAsia, New Delhi, 2017.
6. Panneerselvam. R, Engineering Economics, 2 nd Edition, PHI Learning, 2014

Web Links and Video Lectures (E-Resources):

1. https://youtu.be/vLPpF0hunwc
2. https://youtu.be/6fNcnW-nGUk

Activity-Based Learning /Practical-Based Learning:

1. http://nptel.ac.in
2. https://swayam.gov.in

Suggested Skill Activities:

1. Experiment on Decision Making (Conduct experiments where students make choices under different conditions (e.g., risk, uncertainty, limited information)
2. Designing Nudges (Present designs and explain the psychological principles behind them
3. Cap-and-Trade Simulation (Trade permits to meet emission targets, balancing economic and environmental goals)
4. Analyse the economic impact of pollution (Students research a specific type of pollution and calculate its economic cost (e.g., healthcare costs, lost productivity).)

Course Code:	**24MG104**	**Course Title:**	**Legal Aspects of Business**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

- The objective of this course is to familiarize the students with various laws that will help them to refine their understanding of how law affects the different aspects of business.
- Develop insights regarding the laws related to business environment
- To enable students to understand the provisions in Consumer Protection Act and Cyber laws.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Blended Mode of Learning
2. Experiential Learning
3. NPTEL and Other Videos
4. Smart Class Room
5. Flipped Class

UNIT I –COMMERCIAL LAW	9
The Indian Contract Act 1872: Definition of contract, essentials elements and types of contract, Formation of a contract, performance – Discharge – Breach of contract and its remedies, – Contract of Agency: Nature of agency, Creation and types of agents, Authority and liability of Agent and principal: Rights and duties of principal and agents, termination of agency.	

UNIT II – THE SALE OF GOODS ACT 1930	9
The sale of goods act 1930: Nature of Sales contract, Classification of goods, Sale and agreement to sell, Conditions and Warranties, performance of sales contracts, Rights of an unpaid seller – An overview of Negotiable Instruments Act 1881, Introduction to GST & laws relating to GST	
UNIT III –COMPANY LAW	**9**
The Company Act 1956: Major principles – Nature and types of companies, Formation, Memorandum and Articles of Association, Prospectus, Power, duties and liabilities of Directors, winding up of companies, Amendments of Companies Act 2013 – Competition Act 2002.	
UNIT IV – INDUSTRIAL LAW	**9**
An Overview of Factories Act, provisions regarding the health, safety and welfare of the workers – Payment of Wages Act – Payment of Bonus Act – Industrial Disputes Act.	
UNIT V – CONSUMER PROTECTION ACT AND INTRODUCTION OF CYBER LAWS	**9**
Consumer Protection Act – Consumer rights, Procedures for Consumer grievances redressal, Types of consumer redressal Machineries and Forums – Cybercrimes, Cyber Laws, IT Act 2000 and 2002, Introduction of IPR – Copy rights, Trade marks, Patent Act, Right to Information Act 2005	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Apply the essential elements of a valid contract to develop a legally enforceable business contract.	K3
CO2	Explain the sale and purchase of goods, contractual obligations and provide remedies for breach of contract.	K2
CO3	Analyze the different case laws by identifying the statutes and regulations of Companies act.	K4
CO4	Demonstrate the provisions relating to health, safety and welfare of the workers to comprehend the industrial law.	K2
CO5	Examine the importance of consumer protection law and its implementation through consumer dispute redressal commission.	K4

COs and POs Mapping:

CO	**Pos**						
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	2	1	-	1	2	1	2
CO2	1	-	2	-	-	-	-
CO3	2	1	3	2	-	-	1
CO4	1	-	1	-	1	-	-
CO5	1	3	1	1	-	2	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**

<table>
<tr><td rowspan="5">Continuous Internal Examination (CIE)</td><td>CIE – I</td><td>100</td><td rowspan="2">50</td><td rowspan="5">100</td><td rowspan="5">40</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>MCQ</td><td>20</td><td>10</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td>End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>60</td><td>60</td><td>60</td></tr>
<tr><td colspan="5">Total</td><td>100</td></tr>
</table>

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and five (either or) 13 marks questions each from one unit.
- All the fifteen questions have to be answered.
- One either or question as case analysis.

Reference Books:

1. N. D. Kapoor, Elements of Mercantile Law, Sultan Chand and Company, India, 2017.
2. P. K. Goel, Business Law for Managers, Biztantatara Publishers, India, 2017.
3. Akhileshwar Pathak, Legal Aspects of Business, Tata McGraw Hill,, 6th Edition 2018.
4. Ravinder Kumar, Legal Aspects of Business, New Delhi: Cengage Learning, 4 th edition, 2016.

5 Sinha P.K, Dr. Vinod Singhania, Text Book of Indirect Tax, Taxman Publication, New Delhi

6. Taxmann, GST Manual with GST Law Guide & Digest of Landmark Rulings, 11th Edition, 2019
7. P. P. S. Gogna, Mercantile Law, S. Chand & Co. Ltd., India, Fourth Edition, 2015.
8. Dr. Vinod K. Singhania, Direct Taxes Planning and Management, 11 th, 2007.
9. Richard Stim, Intellectual Property- Copy Rights, Trade Marks, and Patents, Cengage Learning,15 th edition 2017.
10. Daniel Albuquerque, Legal Aspect of Business, Oxford,2 nd edition, 2017

Web Links and Video Lectures (E-Resources):

1. https://onlinecourses.swayam2.ac.in/cec21_mg02/preview

2. https://onlinecourses.nptel.ac.in/noc22_mg52/preview
3. https://archive.nptel.ac.in/courses/110/105/110105159/

Suggested Skill Activities:

1. **Contract Drafting and Review Workshops**: Participants draft and review contracts, focusing on key elements such as terms, conditions, and clauses.
2. **Compliance Audits**: Conduct mock compliance audits where participants review company policies and practices to ensure they align with relevant laws and regulations.
3. **Leadership Simulation Games**: Use simulation games where participants take on leadership roles and must navigate complex situations and make strategic decisions.
4. **IP Case Studies**: Analyze real-world cases involving intellectual property disputes, including trademarks, patents, and copyrights.
5. **Designing Motivational Programs**: Have participants design and present programs or initiatives aimed at improving employee motivation and engagement within an organization.
6. **Employment Law Role-Playing**: Simulate scenarios involving employment law issues such as wrongful termination, discrimination, and harassment.
7. **Cross-Cultural Communication Exercises**: Engage in activities that simulate cross-cultural interactions, such as role-playing different cultural scenarios or discussing case studies.
8. Facilitate discussions on ethical dilemmas in business, encouraging participants to explore the legal and ethical implications of different decisions.

Course Code:	**24MG105**	**Course Title:**	**Accounting For Decision Making**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- Acquire a reasonable knowledge in accounts analysis and evaluate financial statements

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

- White board and pen
- Interactive Simulations
- Blended Mode of Learning
- Project based Learning
- Experiential Learning
- NPTEL and Other Videos
- Smart Class Room
- Flipped Class

UNIT I – FINANCIAL ACCOUNTING	**9**
Introduction to Financial, Cost and Management Accounting — Generally accepted accounting principles– Double Entry System — Preparation of Journal, Ledger and Trial Balance Preparation of Final Accounts: Trading, Profit and Loss Account and Balance Sheet - Reading the financial statements	
UNIT II – ANALYSIS OF FINANCIAL STATEMENTS	**9**
Financial ratio analysis, Interpretation of ratio for financial decisions- DuPont Ratios — Comparative statements - common size statements. Cash flow (as per Accounting Standard 3) and Funds flow statement analysis — Trend Analysis.	
UNIT III – COST ACCOUNTING	**9**
Cost Accounts — Classification of costs — Job cost sheet — Job order costing — Process costing — (excluding Interdepartmental Transfers and equivalent production) – Joint and By Product Costing – Activity Based Costing, Target Costing.	

UNIT IV – MARGINAL COSTING	9
Marginal Costing and profit planning — Cost, Volume, Profit Analysis — Break Even Analysis — Decision making problems -Make or Buy decisions -Determination of sales mix - Exploring new markets - Add or drop products -Expand or contract.	
UNIT V – BUDGETING AND VARIANCE ANALYSIS	**9**
Budgetary Control – Sales, Production, Cash flow, fixed and flexible budget – Standard costing and Variance Analysis – (excluding overhead costing) -Accounting standards and accounting disclosure practices in India.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Apply the financial accounting principles and practices, including GAAP, the double-entry system, preparation of final accounts, and interpretation of financial statements, through real-world case studies.	K3
CO2	Examining skills in financial statement analysis through ratio interpretation, including DuPont Ratios, comparative and common size statements, along with cash flow and funds flow statement analysis, utilizing trend analysis techniques for live event	K3
CO3	Analyze and categorize costs, evaluate job cost sheets, apply job order and process costing, assess joint and by-product costing, implement activity-based costing, and apply target costing techniques for effective cost management and decision-making	K4
CO4	Analyze marginal costing, CVP analysis, break-even analysis, and decision-making problems to optimize profit planning and strategic decisions."	K4
CO5	Apply budgetary control, prepare various budgets, perform standard costing and variance analysis, and implement Indian accounting standards for effective financial management."	K3

COs and POs Mapping:

COs	POs						
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	2	1	2	-	1	-	2
CO2	3	3	2	-	-	-	-
CO3	2	2	2	1	1	1	-

CO4	3	3	2	1	1	1	1
CO5	2	2	-	1	-	1	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
Total					100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. M.Y. Khan & P.K. Jain, Management Accounting, Tata McGraw Hill, 8 th edtion, 2018.
2. T.S. Reddy & A. Murthy, Financial Accounting, Margham Publications, 2014

Reference Books:

1. R. Narayanaswamy, Financial Accounting, PHI, sixth edition, 2017.
2. Jan Williams, Susan Haka, Mark S bettner, Joseph V Carcello, Financial and Managerial Accounting - The basis for business Decisions, 18th edition, Tata McGraw Hill Publishers, 2017
3. Charles T. Horngren, Gary L.Sundem, David Burgstahler, Jeff Schatzberg, Introduction to Management Accounting, PHI Learning, 2014 , 16th edition.
4. Earl K. Stice& James D.Stice, Financial Accounting, Reporting and Analysis, 8th edition, Cengage

Learining, 2015.

5. N.M. Singhvi, Ruzbeh J.Bodhanwala, Management Accounting – Text and cases,3 rd edition PHI Learning, 2018.
6. Ashish K. Battacharya, Introduction to Financial Statement Analysis, Elsiever, 2012.

Web Links and Video Lectures (E-Resources):

1. Basics of financial accounting: https://youtu.be/-UEFVv_LwSs
2. Three financial statements: https://youtu.be/rsWQeJJNO6U
3. Journal : https://youtu.be/osEVVhp1H3Y

Suggested Skill Activities:

1. Cash flow statement
2. Reading financial statement
3. Financial statement analysis
4. Ratio analysis
5. Preparation and analysis of cost sheet
6. Marginal costing:
7. Budget and budgetary control
8. Standard costing and variance analysis

Course Code:	24MG106	**Course Title:**	**Marketing Management**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

- To understand the changing business environment and the fundamental premise underlying market driven strategies.
- To identify the indicators of management thoughts and practices.
- To acquire understanding in marketing theories and its application in business practice
- To enhance the knowledge of consumer/ buyer behavior model.
- To acquire knowledge in marketing research and understand trends in digital marketing

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Field study
2. Interactive Simulations
3. Lab experiment videos
4. Blended Mode of Learning
5. Project based Learning
6. Experiential Learning
7. NPTEL and Other Videos
8. Smart Class Room
9. Flipped Class

UNIT I – INTRODUCTION	**9**
Defining Marketing − Core concepts in Marketing—Evolution of Marketing – Marketing Planning Process − Scanning Business environment: Internal and External − Value chain – Core Competencies—PESTEL−SWOT Analysis− Marketing interface with other functional areas—Production, Finance, Human Relations Management, Information System− Marketing global environment—International Marketing−Rural Marketing−Prospects and Challenges	

UNIT II – MARKETING STRATEGY	**9**
Marketing strategy formulations – Key Drivers of Marketing Strategies – Strategies for Industrial Marketing – Consumer Marketing – Services marketing – Competition Analysis – Analysis of consumer and industrial markets – Influence of Economic and Behavioral Factors – Strategic Marketing Mix components.	
UNIT III –MARKETING MIX DECISIONS	**9**
Product planning and development – Product life cycle – New product Development and Management – Defining Market Segmentation – Targeting and Positioning – Brand Positioning and Differentiation – Channel Management – Managing Integrated Marketing Channels – Managing Retailing, Wholesaling and Logistics	
UNIT IV – BUYER BEHAVIOUR	**9**
Understanding Industrial and Consumer Buyer Behavior – Influencing factors – Buyer Behaviour Models – Online buyer behaviour – Building and measuring customer satisfaction Customer relationships management – Customer acquisition, Retaining, Defection – Creating Long Term Loyalty Relationships.	
UNIT V – MARKETING RESEARCH & TRENDS IN MARKETING	**9**
Marketing Information System – Marketing Research Process – Concepts and applications: Product – Advertising – Promotion – Online marketing trends – digital marketing – pillars of digital marketing, overview of content marketing, video marketing, Affiliate marketing, SEO SEM,	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Relate the knowledge of contemporary marketing theories to the demands of business and management practice	K2
CO2	Compare the marketing strategies for consumer and industrial marketing.	K3
CO3	Choose marketing mix elements and manage integrated marketing channels.	K3
CO4	Discover the nature of consumer Buying behavior.	K3
CO5	Apply the market knowledge to advertise a product with understanding in marketing research and new trends in the digital arena of marketing.	K3

COs and POs Mapping:

COs	POs						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	3	2	-	1	1	-
CO2	2	1	-	1	1	2	2
CO3	3	2	1	1	-	2	-
CO4	2	1	2	-	-	1	2
CO5	1	2	1	1	-	2	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0-Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
Total					100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and five (either or) 13 marks question as one from each Unit
- All the thirteen mark questions have to be answered.
- One either or questions as Case Analysis.

Text Books:

1. Philip T. Kotler and Kevin Lane Keller, Marketing Management, Prentice Hall India, 15th Edition,2017.
2. K.S.Chandrasekar,"Marketing management-Text and Cases",Tata McGraw Hill Education,2012

Reference Books:

1. Lamb, Hair, Sharma, Mc Daniel– Marketing – An Innovative approach to learning and teaching- A south Asian perspective,Cengage Learning,2012.
2. Paul Baines, Chris Fill, Kelly Page, Marketing, Asian edition, Oxford University Press,5 th edition, 2019.
3. Ramasamy,V.S, Namakumari,S, Marketing Management: Global Perspective Indian Context, Macmillan Education, New Delhi, 6 th edition, 2018.
4. A.NAG, Marketing successfully-AProfessionalPerspective,Macmillan2008.
5. Micheal R.Czinkota, MasaakiKotabe, Marketing Management, VikasThomson Learning, 2nd edition 2006.
6. Philip Kotler,GayArmstrong, PrafullaAgnihotri, Principles of marketing, 7thedition, 2018.

Web Links and Video Lectures (E-Resources):

1. http://www.digimat.in/nptel/courses/video/110104068/L01.html -Marketing Management PTEL course
2. http://digimat.in/nptel/courses/video/110104068/L40.html Market segmentation
3. https://youtu.be/1Ps3s9VLRKE -Market branding strategies
4. https://youtu.be/stk2mDJa45c - Marketing products and services
5. https://youtu.be/szYfUzSclUg -Marketing management
6. https://youtu.be/2SvAwS3hQqw -Evolution of marketing
7. https://youtu.be/crsC1q1R_aA - Advantages of brand

Suggested Skill Activities:

1. Visit a local market (rural market) and study how transactions are implemented. Write a report about the products sold in the market, demand and supply aspect of the product.
2. Visit to a department stores, observe, present a report how products are displayed and about the ambience of the departmental store.
3. Visit a chain of stores or franchise or branch of an organization at your locality. Compare the same with a chain of stores or franchise or branch of an organization in a metropolitan city.
4. Create a Google form to know the mindset of the students of your class about any (FMCG products) and present the analysis in a report format.
5. Interview any five marketing personnel about their job and marketing concepts in real time happening. Prepare a report (with photographs) of the same and bring out the insights of marketing at your locality.
6. Prepare a MOTS-Moment of Truth Survey/Opinion poll for gathering customer preference, taste and opinion for any product or service.

Course Code:	**24MG107**	**Course Title:**	**Operations Management**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

- To provide a broad introduction to the field of operations management and explain the concepts, strategies, tools and techniques for managing the transformation process that can lead to competitive advantage.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – INTRODUCTION TO OPERATIONS MANAGEMENT	**9**
Operations Management – Nature, Importance, historical development, transformation processes, differences between services and goods, a system perspective, functions, challenges, current priorities, recent trends. Operations Strategy – Strategic fit, framework. Productivity; World-class manufacturing practices	
UNIT II – OPERATIONS AND THE VALUE CHAIN	**9**
Capacity Planning – Long range, Types, Developing capacity alternatives, tools for capacity planning. Facility Location – Theories, Steps in Selection, Location Models. Sourcing and procurement – Strategic sourcing, make or buy decision, procurement process, managing vendors.	
UNIT III – DESIGNING OPERATIONS	**9**
Product Design – Criteria, Approaches. Product development process – stage-gate approach – Tools for efficient development. Process – Design, strategy, types, analysis. Facility Layout – Principles, Types, Planning tools and techniques.	
UNIT IV – PLANNING AND CONTROL OF OPERATIONS	**9**
Demand Forecasting – Need, Types, Objectives and Steps – Overview of Qualitative and Quantitative methods. Operations planning – Resource planning – Inventory Planning and Control. Theory of constraints – Bottlenecks, capacity constrained resources, synchronous manufacturing	
UNIT V – SCHEDULING AND PROJECT MANAGEMENT	**9**
Project Management – Nature, Constraints in Projects, Project Life Cycle – Scheduling Techniques, PERT, CPM; Scheduling – Process, Techniques, shop floor control – Flow shop scheduling – Johnson's Algorithm – Gantt charts – Personnel scheduling in services.	

[45 hours]

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Describe the evolution of operations management practices and world-class manufacturing processes.	K2
CO2	Categorize the capacity requirements of facilities and processes in long and short terms run of organization.	K4
CO3	Compare the product development and design processes implemented in different organizations.	K2
CO4	Use quality management tools and practices in a real-time situation.	K3

CO5	Classify quality-related decisions about products and processes using scheduling and project management.	K2

COs and POs Mapping:

Cos	POs						
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	3	2	1	1	2	-	1
CO2	2	2	1	2	2	-	-
CO3	1	2	1	-	2	-	2
CO4	2	2	1	1	2	-	2
CO5	3	2	1	1	2	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE) – Theory	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
Total					100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and five (either or) 13 marks questions as one from each unit.
- All the thirteen mark questions have to be answered.
- One either or questions as case analysis.

Text Books:

1. Operations Management: Process and Supply Chains, Eleventh Edition, Lee J. Krajewski, Manoj K. Malhotra, Larry P. Ritzman & Samir K. Srivastava, Pearson.
2. Heizer, H., & Render, B. (11th e). Principles of operations management. Pearson Education.

Reference Books:

1. Richard B. Chase, Ravi Shankar, F. Robert Jacobs, Operations and Supply Chain Management, McGraw Hill Education (India) Pvt. Ltd, 14th Edition, 2014.
2. Mahadevan B, Operations management: Theory and practice. Pearson Education India; 2015.William J Stevenson, Operations Management, Tata McGraw Hill, 9th Edition, 2009.
3. Russel and Taylor, Operations Management, Wiley, 5th Edition, 2006.
4. Norman Gaither and Gregory Frazier, Operations Management, South Western Cengage Learning,9 th edition, 2015.
5. Cecil C. Bozarth, Robert B. Handfield, Introduction to Operations and Supply Chain Management, Pearson, 4th Edition, 2016.
6. Panneerselvam. R, Production and Operations Management, 3rd Edition,. PHI Learning.

Web Links and Video Lectures (E-Resources):

1. Introduction to Operations Management :
   https://www.youtube.com/watch?v=DEuzzLled6k
2. Operations Management - Basic:
   https://www.youtube.com/watch?v=_VJkKZFuRvE
3. Production and Operations Management:

http://digimat.in/nptel/courses/video/110107141/L01.html

4. Operations Management: https://www.youtube.com/watch?v=Hcjoh92gr1A
5. Capacity Planning: https://www.youtube.com/watch?v=FHauhdppEDA

Suggested Skill Activities:

1. MBA Crystal Ball Games : Virtual hands-on business experience and the fundamental challenges involved in business and management
2. Just A Minute (JAM): This is an individual management activity. In this activity, student has to speak for 1 minute on a given topic spontaneously. This activity aims at evaluating the communication skills, spontaneity and time management skills of the students
3. Extempore: This is an individual management activity. In this activity, students are supposed to speak for 5 minutes on a given topic spontaneously. The objective of this activity is to examine the competencies like presence of mind, flow of thoughts, speaking skills and the way of presenting ideas in a limited time under pressure.
4. Floor Crossing: Basically, it is an individual activity. In this activity, students are given a topic and on the given topic, students are supposed to speak on merits and demerits. The main objective of this activity is to evaluate the communication skills, subject knowledge and the way of presenting ideas in a limited time.
5. Operations Warfare: Operations warfare is an interesting activity in the area of Operations Management. The main objective of this activity is to develop the cooperation and coordination among the team members within the team. On the other hand, this activity enhances creativity and innovation among the team members in presenting a concept in operations management.
6. Business Plan Contest: Basically, Business Plan contest is a group activity. Students have to present their business plans as a team. In this activity students would be given the opportunity to exhibit their ideas and proposals with regard to their proposed business through presenting thoughts in a limited time.

Course Code:	**24MG131**	**Course Title:**	**Managerial Skill Development –I**
Credits:	**2**	**L – T – P**	**0-0-4**

Course objectives:

- To develop knowledge, skills and attitude among the students which create in them industry readiness.
- To improvise students listening skills and to make them understand the dynamics of effective listening.
- To develop students awareness about real time happening in business and current events.
- To help students improve their communication skills in all contexts of business process.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Field survey
2. Interview
3. Group Discussions
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class
9. Interaction with industrialist
10. Observing professionals

UNIT I –LISTENING	**10**
Focuses on Listening: Definition, Characteristics of a good listener, Types of listening, Barriers to effective listening. Flip classes on Tedex talk	
UNIT II – CURRENT BUSINESS EVENTS	**10**
Focuses on Current affairs: Awareness about finance, banking, economical and corporate trends. Collect NEWS form Newspaper, journals, magazines, business e-articles relevant to business, banking, economical at present.	

Discussion about the current events with knowledge about the static general information **Static Content:** Basic information about the present topic discussed/topic in NEWS	
UNIT III – INTER PERSONAL COMMUNICATION	**10**
Communication and understanding self. Ego states in communication, converting challenges into Opportunities in negotiations. Presentations & ways of dealing with difference of opinion. Personal grooming and time management.	
UNIT IV – TEAM WORK/ TEAM BUILDING	**10**
Focuses on group formation, functioning and group decision making. Understanding on group conflict & diversity. Group communication and group cohesiveness.	
UNIT V –LEADERSHIP	**10**
Focuses on leading team, influencing and persuading as a leader Definition Etiquette, real time examples, –polite behavior in profession & group.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Develop good listening skill and make use of the skill for his/her betterment in communication.	K3
CO2	Develop the knowledge about the current business happenings and relate it to the managerial concepts.	K3
CO3	Utilize the understanding about different ego states and discover the effective ways of communication.	K2
CO4	Build a team , create cohesiveness and utilize the cohesiveness for the betterment of the team.	K3
CO5	Motivate as a leader and as an active team player.	K4

COs and POs Mapping:

COs	Pos						
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	3	2	-	-	-	1	2
CO2	2	-	2	-	-	-	1
CO3	1	1	2	-	-	-	-
CO4	-	-	3	-	-	-	-
CO5	1	1	1	-	-	-	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE)	Continuous Assessment	75	75	100	60
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Lab Exam	100	40	40	40
TOTAL					100

Reference Books:

1. Darren Hardy (2021). The Compound Effect, Manjul Publishing House, Macmillan.
2. Greg McKeown, (2021). Essentialism: The Disciplined Pursuit of Less, Virgin Books.
3. Scott H. Young (2019).Ultralearning: Accelerate Your Career, Master Hard Skills and Outsmart the Competition, HarperCollins

Web Links and Video Lectures (E-Resources):

1-10 sessions **Listening**	**Practical component:** 1. Listen to Tedex (India) talks and discuss about the topic spoken. 2. Interview any Business Personality/writers in India of your choice or watch an elaborate interview of a business personality. Create a Power Point Presentation on same personality and include following heads: • Short Life story of the personality • Achievements • How he/she overcome Challenges /Constraints • Your Learning
11-20 **Current Business Events**	**Practical Component:** Refer the editorial pages of the last week of any business newspaper and present the topic. Go through the contents and organize your findings under the following heads: Subject matter (Economics, finance, legal, HR, Marketing etc.) Static information about the topic. Target audience of the various columns Presentation and organization of contents Vocabulary, phrases & idioms that you have learnt.
21-30 **Interpersonal Effectiveness**	**Practical Component: Observation, analysis & report preparation.** Make a visit to a Rural area (shops or panchayat) or Urban area (offices/ government organizations/ institution/departmental stores) and observe how people communicate while conducting business transactions. Record their articulations while communicating and prepare a report about the different ego states in the conversation.
31-40 **Team Building**	**Practical component:** Impromptu topic will be given to the team of 6-7 members. Collage preparation and oral presentation of the same have to be done by the students.
41-50	**Practical Component:**

Leadership & Group Dynamics	Interview & Role-play Interview ten marketing executives/Officials who travel outstation frequently. Understand the problems they face in communication during these visits and how they manage these issues. Make checklist of Strategies and tactics that can be used when you travel outstation for business works, to deal with communication issues. Prepare a role-play based on any issue faced by the interviewee and enact it. BOOK REVIEW (Any One) -YOU CAN WIN by ShivKhera , Who Moved my Cheese, Fish, Psychology of Money
51-60 Business Etiquettes	**Practical Component:** Mock interview by expert panel. Hands on training on management of Linked in id/Social media.

Course Code:	24MG151	**Course Title:**	**Organization Structure Training**
Credits:	**2**	**L – T – P**	**0-0-4**

ORGANIZATION STRUCTURE TRAINING – minimum of 15 days of internship. The report along with the company certificate should be submitted within the two weeks of the reopening date of 2nd semester. The report should be around 40 pages. The report should be sent to the Controller of Examinations by the HOD through the Principal, before the last working day of the 2nd Semester.

Course Code:	24MG152	**Course Title:**	**Business Ethics Seminar**
Credits:	**1**	**L – T – P**	**0-0-2**

Course objectives:

- To enable the learners to have exposure on business ethics and ethical business perspectives.

Business Ethics	**2**
The following is the list of topics suggested for preparation and presentation by students twice during t semester. This will be evaluated by the faculty member(s) handling the course and the final marks are consolidat at the end of the semester. No end semester examination is required for this course. 1) Individual Culture and Ethics 2) Ethical codes of conduct and value Systems 3) Loyalty and Ethical Behaviour, Ethical decision making 4) Ethical business issues and solutions 5) Corporate Social Responsibilities of Business	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Make use of knowledge in of business ethics and offer solutions in ethical perspectives.	K3
CO2	Apply the basic concepts of Indian ethos and value systems at work.	K3
CO3	Develop professionally efficient and skilful value systems and culture.	K3
CO4	Plan ethically to manage business towards well-being of the society.	K3
CO5	Take part in socially effective undertaking in business responsibilities.	K4

COs and POs Mapping:

COs	POs						
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**P07**
CO1	2	3	-	1	-	1	2
CO2	3	1	3	2	2	-	1
CO3	2	-	3	3	-	-	1
CO4	-	-	1	3	1	-	-
CO5	1	2	1	2	-	-	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE)	Seminar-I	50	50	100	100
	Seminar-II	50	50		
TOTAL					100

Course Code:	24MG201	Course Title:	Innovation and Entrepreneurship Development
Credits:	4	L – T – P	3-0-2

Course objectives:

- To equip and develop the learner's entrepreneurial skills and qualities essential to undertake business.
- To impart the learner's entrepreneurial competencies needed for managing business efficiently and effectively.
- To acquire knowledge about innovation models and apply appropriately in business practice
- To enhance the ability of resource mobilization to launch a business
- To acquire knowledge about evaluating and monitoring of business effectiveness.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Field study/survey
2. Interview with experts
3. Experiential learning
4. Interactive Simulations
5. Blended Mode of Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – INNOVATION	9

Innovation- radical vs evolutionary, – Introduction to TRIZ methodology of Inventive Problem Solving – The essential factors – Innovator's solution – Creating and sustaining successful growth – Disruptive Innovation model – Segmentive Models – New market disruption – Managing the Strategy Development Process – Entrepreneurial Tools for Creativity and Innovation.

UNIT II – ENTREPRENEURAL COMPETENCE & ENVIRONMENT	9

Entrepreneurship concept – Entrepreneurship as a Career – Entrepreneurial Personality – Characteristics of Successful Entrepreneurs – Knowledge and Skills of an Entrepreneur. Business

Environment – Role of Family and Society – Entrepreneurship Development Training, government & Other Support Organizational Services.	
UNIT III – BUSINESS PLAN PREPARATION	**9**
Sources of Product for Business – Prefeasibility Study – Criteria for Selection of Product – Ownership – Capital Budgeting – Project Profile Preparation – Matching Entrepreneur with the Project Feasibility Report Preparation and Evaluation Criteria.	
UNIT IV – LAUNCHING OF SMALL BUSINESS	**9**
Finance and Human Resource Mobilization – Operations Planning – Market and Channel Selection – Growth Strategies – Product Launching – Overview about Incubation, Venture capital, Start – ups.	
UNIT V – MANAGEMENT OF SMALL BUSINESS	**9**
Monitoring and Evaluation of Business – Business Sickness – Prevention and Rehabilitation of Business Units – Effective Management of small Business – Case Studies.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Relate the knowledge acquired about radical and disruptive innovation models of innovation in business practice.	K3
CO2	Choose a business venture after analyzing the entrepreneurial environment.	K3
CO3	Prepare business plans and feasible reports.	K3
CO4	Create and choose the ways of launching a business venture with required resource mobilization.	K3
CO5	Infer the effectiveness of business through evaluation and monitors growth and development.	K4

COs and POs Mapping:

Cos	**POS**						
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**P07**
CO1	3	1	2	1		3	-
CO2	1	3	2	-	-	-	1
CO3	3	2	3	1	2	1	1
CO4	1	1	2	2	1	1	2
CO5	2	2	-	1	-	1	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0-Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) – Theory	CIE – I	100	50	100	25
	CIE – II	100			
	Case Analysis	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) – Laboratory	Continuous Assessment of activities	100	100	100	25
End Semester Examination (ESE)	Theory Exam	100	50	50	50
Total					100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and five (either or) 13 marks question as one from each Unit
- All the thirteen-mark questions have to be answered.
- One either or questions as Case analysis.

Text Books:

S.S.Khanka, Entrepreneurial Development, S.Chand and Company Limited, New Delhi, 2016.

Reference Books:

1. Rousing Creativity: Think New Now Floyd Hurt, ISBN 1560525479, Crisp Publications Inc.1999.
2. Geoffrey Petty," How to be better at Creativity", The Industrial Society 2012.
3. Clayton M. Christensen Michael E. Raynor," The Innovator's Solution", Harvard Business School Press Boston, USA, 2007.
4. Semyon D. Savransky," Engineering of Creativity – TRIZ", CRC Press New York USA," 1st edition 2000.

5. CSG Krishnamacharyalu, Lalitha R Innovation management , Himalaya Publishing House 2013.
6. R.D.Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi, 2018.
7. Rajeev Roy ,Entrepreneurship, Oxford University Press, 2nd Edition, 2011.
8. Donald F Kuratko,T.V Rao. Entrepreneurship: A South Asian perspective. Cengage Learning, 2012.
9. Dr. Vasant Desai, "Small Scale Industries and Entrepreneurship", HPH,2006.
10. Arya Kumar. Entrepreneurship, Pearson,2012.
11. Prasanna Chandra, Projects – Planning, Analysis, Selection, Implementation and Reviews, Tata McGraw-Hill, 8 th edition, 2017.

Web Links and Video Lectures (E-Resources):

1. Entrepreneurship -An introduction https://youtu.be/Hgj_kRrvbhQ?t=17
2. Innovation business model an Entrepreneurship https://youtu.be/9BXq3gcLSMs?t=8
3. Business plan and feasibility https://youtu.be/o_5FtfzX9Is

Suggested Skill Activities:

S.no	TOPIC	Skill based Component	Activity
1	Government support activities for entrepreneurship	Visit DIC –District Industry Center of your district and gather information relevant to support activities for entrepreneurship from Government (Scheme/activities with special reference for students)	Submit a report specifying all information collected.
2	Innovation and Creativity	Refer to business journals and magazines (at least 10) and identify innovative products in market at present and its success factor.	Submit a report about the products with relevant citation & references.
3.	Business Plan	Prepare a business plan(business of your choice)to start at your domicile with all feasible reports.	Prepare relevant feasibility reports.
4.	Launching a business Business Table concept	Create a small business concept for your class and run the business in team	Business venture

5.	Evaluation and monitoring	Create and run a business for a day with proper resource mobilization and investment	Prepare an evaluation report for the business and calculate the profit.

Course Code:	**24MG202**	**Course Title:**	**Business Models For Digital Economy**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

- Students should be able to use innovative business models in established and emerging areas of the digital economy, leveraging the core principles and characteristics of digital economy in cross functional areas of management

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Blended Mode of Learning
2. Project based Learning
3. Experiential Learning
4. NPTEL and Other Videos
5. Smart Class Room
6. Flipped Class

UNIT I – INTRODUCTION	**9**
Definition – Digital Economy, Components, Evolution of economy, Scope, present scenario, digital transformation, overview of ICT, IOT, AI ,automation cloud computing across business sectors, elements of the digital economy – IT, digital platforms, digital trade, B2B, B2C gig economy in digital era.	

UNIT II – HR IN DIGITAL ECONOMY	**9**
Evolving role of HR in digital economy, HR digitalization, big data analytics, HR analytics and insights, data protection management, learning and development, talent acquisition, people analytics, workforce planning and its integration with AI. An overview on Human capital Diagnostics Tool (HCDT).	

UNIT III – FINANCE IN DIGITAL ECONOMY	9
Emergence of digital trade and e–commerce, Role of finance in digital transformation, online banking, mobile payments, POS terminals, crypto currencies, block chain transactions, advantages and disadvantages of digitalization in finance, An overview of sharing economy.	

UNIT IV – MARKETING IN DIGITAL ECONOMY	9
Digital Marketing – An introduction, Pillars of Digital marketing, Overview of Content marketing, Social media marketing, SEO & SEM, Automated marketing, E mail marketing. Benefits of digital marketing and present trends in digital marketing.	

UNIT V – PRODUCTION IN DIGITAL ECONOMY	9
Digital manufacturing-Definition, Digitalization in manufacturing – Industry 4.0 – Benefits, types of digital manufacturing – PLC, smart factory, Value chain management, Manufacturing Execution System-Product Lifecycle Management – SCM-Virtual product development and AR in guided assembly.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Relate the knowledge acquired from the fundamental concepts of the digital economy with business models.
CO2	Recall the concepts of new business models in digital economy with HR concepts.
CO3	Apply the knowledge acquired in digital economy in day to day business financial transactions.
CO4	Apply the digital marketing concepts learnt in implementing marketing campaigns in business and career.
CO5	Relate the knowledge acquired from the fundamental concepts of the digital manufacturing in business and profession.

COs and POs Mapping:

Cos	POs						
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	3	2	1	-	2	-	2
CO2	1	1	1	2	1	-	3
CO3	1		3	-	2	-	-
CO4	2	3	2	1	3	-	2
CO5	1	2	1	1	2	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE) – Theory	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
Total					100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and five (either or) 13 marks questions as one from each unit.
- All the thirteen mark questions have to be answered.
- One either or questions as case analysis.

Reference Books:

1. Introduction to Digital Economics: Foundations, Business Models and Case Studies (2ndedition), 2021, Harald overby and Jan Arild Audestad. ISBN 978-3-030-78236-8.

2. DeFi and the Future of Finance, 2021, Campbell R. Harvey, Ashwin Ramachandran, Joey Santoro. ISBN: 978-1-119-83601-8.

3. Marketing 4.0: Moving from Traditional to Digital by Philip Kotler;Publisher: Wiley; 1st edition (April 2017); ISBN10: 9788126566938;ISBN13: 9788126566938;ASIN: 8126566930

4. Ryan, D. (2014). Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page Limited.

5. Kenneth C. Laudon and Jane P Laudon, Management Information Systems – Managing the Digital Firm, 15 th edition, 2018.

Web Links and Video Lectures (E-Resources):

1. Innovation & Business Models http://acl.digimat.in/nptel/courses/video/110107094/L01.html
2. E-Business: https://digimat.in/nptel/courses/video/110105083/L01.html
3. Digital Transformation Strategy: https://www.youtube.com/watch?v=3zDLY6Ulh5U
4. Understanding Digital Markets: https://www.youtube.com/watch?v=TFWI6C0jCzE

Suggested Skill Activities:

1. Free-Model (ad-supported): A free business model is one that makes use of and is supported by ads from platforms like Google and Face book. Students have to analyze it and draft a report.
2. Freemium Model: This model is commonly used and allows users to get free access to a basic version of a product. Students will go through this model thoroughly and present it in the classroom.
3. On-Demand Model: This model refers to a virtual product or service such as online video stores like Amazon Prime Video or Apple TV where you can watch a video for a certain period of time. Students need to analyze the merits and de merits in it.
4. e-Commerce Model: Amazon was one of the first and most successful companies to adopt this digital business model of selling physical products online. Students will conduct an in depth study and draft a report about it.
5. Marketplace Model: This model refers to a two-sided marketplace where sellers and buyers use a third-party platform to trade goods and services. It helps the students to learn the digital market economy.
6. Digital Ecosystem Model: Digital ecosystems are currently one of the most complex yet robust digital business structures. Alibaba, Amazon, Apple, Google, Tesla, and other ecosystem orchestrators exploit the customer with various services across several platforms. Students can acquire knowledge about digital ecosystem and they need to make a presention in the class.

Course Code:	**24MG203**	**Course Title:**	**People Management**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

- To understand the concept of People Management and its functions
- To learn the methods to manage Human resource assets and to develop policies to achieve competitive edge through people
- To examine the principles of employee recruitment and selection, job design and job analysis, employment law, employee compensation, training and development, and safety and health. .

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Blended Mode of Learning
2. Experiential Learning
3. NPTEL and Other Videos
4. Smart Class Room
5. Flipped Class

UNIT I –PERSPECTIVES IN PEOPLE MANAGEMENT	**9**
Evolution of People management – The importance of the human capital – Role of human resource manager – Challenges for human resource managers – Trends in Human resource policies – Computer applications in human resource management –Human resource accounting and audit.	
UNIT II – THE CONCEPT OF BEST FIT EMPLOYEE	**9**
Importance of Human Resource Planning –Forecasting human resource requirement – Matching supply and demand – Internal and External sources – Organizational Attraction – Recruitment, Selection, Induction and Socialization –Theories, Methods and Process.	
UNIT III –TRAINING AND DEVELOPMENT	**9**
Types of training methods– Purpose –Benefits –Resistance. Executive development programme – Common practices – Benefits – Self-development –Knowledge management.	

UNIT IV – SUSTAINING EMPLOYEE INTEREST	**9**
Compensation plan –Reward –Motivation –Application of theories of motivation –Career management –Mentoring – Development of mentor –Protégé relationships – Job Satisfaction, Employee Engagement, Organizational Citizenship Behavior: Theories, Models.	
UNIT V – PERFORMANCE EVALUATION AND CONTROL	**9**
Method of performance evaluation – Feedback – Industry practices. Promotion, Demotion, Transfer and Separation – Implication of job change. The control process – Importance – Methods – Requirement of effective control systems grievances– Causes – Implications – Redressal methods.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Analyze the personnel functions in policy formulations to develop different kinds of People Management strategies	K4
CO2	Compare the labour demands with the labour supply in human resource planning to analyze and bridge the gaps by forecasting techniques.	K2
CO3	Develop the skills needed for a successful Human Resource manager through self-development window analysis.	K3
CO4	Identify the different motivational factors in sustaining the employees by analyzing their job satisfaction.	K3
CO5	Make use of knowledge to assess the performance of people in an organization using the different performance appraisal methods	K3

COs and POs Mapping:

COs	**Pos**						
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	3	2	-	2	-	1	2
CO2	1	1	2	-	3	3	1
CO3	-	-	3	2	1	1	-
CO4	2	1	2	1	-	2	2

CO5	1	2	-	-	2	1	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
Total					100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and five (either or) 13 marks questions each from one unit.
- All the fifteen questions have to be answered.
- One either or question as case analysis.

Reference Books:

1. Gary Dessler and Biju Varkkey, Human Resource Management, 14th Edition, Pearson Education Limited, 2015.
2. David A.Decenzo, Stephen.P.Robbins, and Susan L.Verhulst, Human Resource Management, Wiley, International Student Edition, 11th Edition, 2014.
3. Luis R.Gomez-Mejia, David B.Balkin, Robert L Cardy. Managing Human Resource. PHI Learning. 2012
4. Bernadin, Human Resource Management, Tata McgrawHill, 8thedition2012.
5. Wayne Cascio, Managing HumanResource, McGrawHill, 2015.

6. Ivancevich, Human Resource Management, McGrawHill 2012.
7. Uday Kumar Haldar, Juthika Sarkar. Human Resource management. Oxford. 2012

Web Links and Video Lectures (E-Resources):

1. https://onlinecourses.swayam2.ac.in/imb24_mg127/preview
2. https://onlinecourses.swayam2.ac.in/cec24_mg23/preview
3. https://nptel.ac.in/courses/110105069

Suggested Skill Activities:

1. **Case Studies and Analysis**: Provide students with real-world HRM scenarios or case studies where they can analyze issues such as employee relations, recruitment challenges, performance management, etc. This helps in developing analytical and problem-solving skills.
2. **Role-Playing Exercises:** Create scenarios where students take on roles such as HR managers, employees, or job candidates. This helps them practice communication, negotiation, and conflict resolution skills.
3. **Interactive Workshops on Emotional Intelligence**: Conduct workshops focused on developing emotional intelligence (EQ) skills among students, emphasizing self-awareness, empathy, and relationship management, which are critical in HR roles.
4. **Mock Interviews**: Conduct mock interviews where students take turns being interviewers and interviewees. This helps them understand the interview process from both perspectives and improves their questioning and answering skills.
5. **Team Projects**: Assign group projects where students have to collaborate on tasks such as designing an employee training program, conducting a compensation analysis, or developing a diversity and inclusion initiative. This fosters teamwork and project management skills.
6. **Guest Speakers**: Invite HR professionals or industry experts to speak to the class about their experiences and current trends in HRM. This provides insights into real-world applications of HR principles and enhances networking opportunities.
7. **Debates and Discussions**: Organize debates on controversial HR topics like the effectiveness of performance appraisals or the impact of flexible work arrangements. This encourages critical thinking and the ability to articulate and defend viewpoints.

8. **Ethics Scenarios**: Present ethical dilemmas related to HR practices and discuss the implications of different decisions. This helps students develop ethical reasoning and judgment.
9. **Industry Research and Reports**: Assign research projects where students investigate HR practices in specific industries or companies. They can then present their findings and recommendations, honing their research and presentation skills.
10. **Simulation Exercises**: Use HRM simulation software or online platforms where students can simulate managing HR functions like workforce planning, employee development, and labor relations. This provides a realistic experience in a controlled environment.

Course Code:	**24MG204**	**Course Title:**	**Financial Management**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- Understand the operational nuances of a Finance Manager.
- Comprehend the technique of making decisions related to finance functions

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Interactive Simulations
2. Blended Mode of Learning
3. Experiential Learning
4. NPTEL and Other Videos
5. Smart Class Room
6. Flipped Class

UNIT I – FOUNDATIONS OF FINANCE	**9**
Introduction to finance- Financial Management – Nature, scope and functions of Finance, organization of financial functions, objectives of Financial management, Major financial decisions – Time value of money – features and valuation of shares and bonds – Concept of risk and return – single asset and of a portfolio.	

UNIT II – INVESTMENT DECISIONS	**9**
Capital Budgeting: Principles and techniques - Nature of capital budgeting- Identifying relevant cash flows - Evaluation Techniques: Payback, Accounting rate of return, Net Present Value, Internal Rate of Return, Profitability Index - Comparison of DCF techniques - Concept and measurement of cost of capital - Specific cost and overall cost of capital	
UNIT III – FINANCING AND DIVIDEND DECISION	**9**
Leverages - Operating and Financial leverage – measurement of leverages – degree of Operating & Financial leverage – Combined leverage, EBIT – EPS Analysis- Indifference point. Capital structure – Theories – Net Income Approach, Net Operating Income Approach, MM Approach – Determinants of Capital structure. Dividend decision- Issues in dividend decisions, Importance, Relevance & Irrelevance theories- Walter‟s – Model, Gordon‟s model and MM model. – Factors determining dividend policy – Types of dividend policies – forms of dividend.	
UNIT IV – WORKING CAPITAL MANAGEMENT	**9**
Principles of working capital: Concepts, Needs, Determinants, issues and estimation of working capital - Receivables Management - Inventory management – Cash management - Working capital finance : Commercial paper, Company deposit, Trade credit, Bank finance	
UNIT V – LONG TERM SOURCES OF FINANCE	**9**
Indian capital market- New issues market- Secondary market - Long term finance: Shares, debentures and term loans, lease, hire purchase, venture capital financing, Private Equity	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Identify the concepts of financial decision of an organization.	K3
CO2	Infer the time value of money	K2
CO3	Classify the capital budgeting and cost of capital techniques	K2
CO4	Experiment how to decide the decision of capital structure and distribution of dividend	K3
CO5	Assess the short-term and long-term sources of finance	K4

COs and POs Mapping:

COs	POs						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	2	3	1	1	1	2
CO2	3	1	2	-	-	-	2
CO3	3	-	2	2	2	3	-
CO4	2	3	2	1	1	1	1
CO5	-	2	-	1	-	1	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) – Theory	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
Total					100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and five (either or) 13 marks question as one from each Unit
- All the thirteen-mark questions have to be answered.

- One either or questions as Case analysis.

Text Books:

1. M. Pandey Financial Management, Vikas Publishing House Pvt. Ltd., 11th edition, 2018
2. S.N.Maheshwari , sulthan Chand & publication.

Reference Books:

1. M. Pandey Financial Management, Vikas Publishing House Pvt. Ltd., 11th edition, 2018
2. M.Y. Khan and P.K.Jain Financial management, Text, Problems and cases Tata McGraw Hill, 8th edition, 2017.
3. Aswath Damodaran, Corporate Finance Theory and practice, John Wiley & Sons, 2011.
4. James C. Vanhorne –Fundamentals of Financial Management– PHI Learning,13th Edition, 2014.
5. Brigham, Ehrhardt, Financial Management Theory and Practice, 14th edition, Cengage Learning 2015.
6. Prasanna Chandra, Financial Management, 9th edition, Tata McGraw Hill, 2017.
7. Srivatsava, Mishra, Financial Management, Oxford University Press, 2012.

Web Links and Video Lectures (E-Resources):

1. https://www.youtube.com/watch?v=jbDRLkGEeIU&list=PLRb7ot-9tbChzZkkVpoICCzGNJ1aMo91M
2. https://www.youtube.com/watch?v=nBAFH24ianw&list=PLRb7ot-9tbChzZkkVpoICCzGNJ1aMo91M&index=2
3. https://www.youtube.com/watch?v=h0i8nNp0yNg&list=PLRb7ot-9tbChzZkkVpoICCzGNJ1aMo91M&index=3

Activity-Based Learning /Practical-Based Learning:

1. http://nptel.ac.in
2. https://swayam.gov.in

Suggested Skill Activities:

1.Analyse the most recent annual financial statements of three companies. (Gather information through online)

2.Visit a financial institution or bank. Gather information about loan and EMI. Calculate your EMI and find out the interest you are paying in total. Compare this calculation with your payment at the end and identify time value of money.

3. Download the balance sheet of any three companies and compare the capital structure of the companies in the light of debt, equity and preference shares.

4. Identify any Venture capitalist in your locality and interview him about the concepts of Venture capital.

5. Identify the blue chips companies of two Indian stock market and two international share market.

Course Code:	24MG205	**Course Title:**	**Navigating Business Research Methods**
Credits:	**3**	**L – T – P**	**3-0-0-0**

Course objectives:

To impart knowledge on the

- Understand the significance of business research in decision-making processes.
- Acquire a deep understanding of research design types and their implications.
- Gain practical experience in primary and secondary data collection methods.
- Enhance communication and report writing skills for conveying research findings.
- Recognize and adhere to ethical guidelines and principles throughout the research process

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Interactive Simulations
2. Blended Mode of Learning
3. Experiential Learning
4. NPTEL and Other Videos
5. Smart Class Room
6. Flipped Class

UNIT I – INTRODUCTION	9
Business Research – Definition and Significance – The research process – Types of Research – Exploratory and causal Research – Theoretical and empirical Research – Cross – Sectional and time – series Research – Research questions / Problems – Research objectives – Research hypotheses – Characteristics – Research in an evolutionary perspective – The role of theory in research. (Live event on collecting primary & secondary data)	
UNIT II – RESEARCH DESIGN AND MEASUREMENT	**9**
Research design – Definition – Types of research design – Exploratory and causal research design – Descriptive and experimental design – Different types of experimental design – Validity of findings – Internal and external validity – Variables in Research – Measurement and scaling – Different scales – Construction of instrument – Validity and Reliability of instrument. (Report on Navigating Product Launch: A Research Design and Measurement Case Study)	
UNIT III – DATA COLLECTION	**9**
Types of data – Primary Vs Secondary data – Methods of primary data collection – Survey Vs Observation – Experiments – Construction of questionnaire and instrument –Types of Validity – Sampling plan – Sample size – Determinants optimal sample size – Sampling techniques – Sampling methods. Case study on Optimizing Customer Experience a data collection	
UNIT IV – DATA PREPARATION AND ANALYSIS	**9**
Data Preparation – Editing – Coding – Data entry – Validity of data – Qualitative Vs Quantitative data analyses – Applications of Bivariate and Multivariate statistical techniques, Factor analysis, Discriminant analysis, Cluster analysis, Multiple regression and Correlation, Multidimensional scaling – Conjoint Analysis – Application of statistical software for data analysis.(Report On Predictive Analytics for Employee Turnover:	

Leveraging Data for Retention Strategies)	
UNIT V – REPORT DESIGN, WRITING AND ETHICS IN BUSINESS RESEARCH	**9**
Research report –Types – Contents of report – need for executive summary – chaptalization – contents of chapter – report writing – the role of audience – readability – comprehension – tone – final proof – report format – title of the report – ethics in research – Ethics in research – Subjectivity and Objectivity in research.(Case study on market analysis new product)	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Apply the knowledge acquired to formulate detailed and precise research questions and hypotheses, suggesting a depth of thought and analytical skill in designing research studies.	K3
CO2	Apply the learning how to develop research instruments such as surveys, questionnaires, or scales, ensuring they are valid and reliable tools for data collection.	K3
CO3	Apply and combine the skills necessary to construct effective questionnaires and instruments for data collection, ensuring clarity, relevance, and ensure reliability in capturing the required information.	K3
CO4	Develop proficiency in a range of bivariate and multivariate statistical techniques& using statistical software tools their features and functions to conduct various analyses efficiently and accurately	K3
CO5	Analyzing the concepts of subjectivity and objectivity in research. Understand how personal biases, perspectives, and interpretations can influence research outcomes and learn strategies to maintain objectivity and impartiality in data collection, analysis, and reporting.	K3

COs and POs Mapping:

COs	**Pos**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	1	1	-	1	-	2
CO2	3	3	2	-	-	-	-
CO3	3	2	1	1	1	1	2
CO4	2	3	2	1	1	1	-
CO5	3	-	-	1	-	1	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final marks</th></tr>
<tr><td rowspan="5">Continuous Internal Examination (CIE) – Theory</td><td>CIE – I</td><td>100</td><td rowspan="2">50</td><td rowspan="5">100</td><td rowspan="5">40</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>MCQ</td><td>20</td><td>10</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td>End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>60</td><td>60</td><td>60</td></tr>
<tr><td colspan="5">Total</td><td>100</td></tr>
</table>

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and five (either or) 13 marks question as one from each Unit.
- All the thirteen mark questions have to be answered.
- One either or questions as Case analysis.

Text Books:

1. Business Research Methods" by William G. Zikmund, Barry J. Babin, Jon C. Carr, and Mitch Griffin
2. Research0 Methodology methods and techniques "by C R Kothari, Gaurav Garg"

Reference Books:

1. Business Research Methods by Donald R Cooper and Palmela Schinder. McGraw Hill, Kothari
2. Advanced Research Methodology by R. Barker Bausell. Scarecrow Press
3. Research Methodology: An Introduction by Wayne Goddard, Stuart Melville. Juta and Co. Ltd.
4. Research Methodology: A Guide for Researchers in Management and Social Sciences by Bill Taylor, Gautam Sinha, Taposh Ghoshal. Prentice-Hall of India Private Limited, New Delhi
5. The Essence of Research Methodology by Jonker, Jan, Pennink, Bartjan. Springer.
6. Research design: Qualitative, quantitative, and mixed methods approaches by Creswell, J. (4th ed.) Thousand Oaks, CA: Sage
7. Qualitative data analysis: A methods sourcebook – Third edition by Miles, M.B., Huberman, A.M. & Saldana, J.; Thousand Oaks, CA: Sage

Web Links and Video Lectures (E-Resources):

1. https://www.youtube.com/watch?v=jbDRLkGEeIU&list=PLRb7ot-9tbChzZkkVpoICCzGNJ1aMo91M
2. https://www.youtube.com/watch?v=nBAFH24ianw&list=PLRb7ot-9tbChzZkkVpoICCzGNJ1aMo91M&index=2
3. https://www.youtube.com/watch?v=h0i8nNp0yNg&list=PLRb7ot-9tbChzZkkVpoICCzGNJ1aMo91M&index=3

Activity-Based Learning /Practical-Based Learning:

1. http://nptel.ac.in
2. https://swayam.gov.in

Suggested Skill Activities:

1. Research Proposal Development(students choose a business-related research topic, Present proposals to the class for feedback and refinement.)
2. Literature Matrix(Organize and synthesize existing research, Students create a literature matrix to summarize key articles related to their research topic)
3. Annotated Bibliography(Students compile an annotated bibliography of at least 10 sources relevant to their research topic.)
4. Survey Design and Implementation(Students design a survey related to their research topic, including questions that are clear, unbiased, and relevant.)

5. Interview and Focus Group Practice(Gain experience in qualitative data collection, Students develop interview guides or focus group discussion guides.)

Course Code:	24MG206	**Course Title:**	**Optimization Techniques**
Credits:	**4**	**L – T – P**	**3 - 0 - 2**

Course objectives:

The syllabus is designed to provide the basic tools of Linear Programming mainly for the purpose of optimize the engineering problems mathematically and obtaining solutions.

- To familiarize the students with analytical package of MS Excel, MS Word and SPSS.
- To develop analytical skills in students in order to comprehend and practice data analysis at different levels.
- To provide the basic tools of Operations research in solving the management problems using mathematical approach for decision making.

Teaching-Learning Process:

These are sample strategies which teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method does not mean only traditional method, but different type of teaching methods may be adopted to develop the outcomes.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Topics will be introduced in a multiple representation and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT I – MODELING WITH SPREADSHEETS	**9+3**

Getting started with excel - Formatting – Functions: Date and Time, Logical, Mathematical, String, Finance, Statistical Functions – Create charts. Getting started with SPSS – Descriptive Statistics with charts – Frequency, Central Tendency and Dispersion. Getting started with word – Basic editing skills

– Formatting paragraphs – Tables.

Practical exercise:

1. Basic editing skills and creating a table in Microsoft word.
2. Summarizing Data for a Categorical and Quantitative Variables and Financial Calculations in Microsoft Excel

UNIT II – LINEAR PROGRAMMING	**9+3**

Linear Programming formulation - Solution by graphical and simplex methods (Primal - Penalty, Two Phase) - Special cases.

Applications: Industrial Problems of Linear Programming

Practical exercise:

1. Simplex method in Microsoft Excel
2. Big M method in Microsoft Excel
3. Two phase method in Microsoft Excel

UNIT III – TRANSPORTATION AND ASSIGNMENT PROBLEM	**9+3**

Transportation Models (Minimizing and Maximizing Problems) – Balanced and unbalanced Problems – Initial Basic feasible solution by N-W Corner Rule, Least cost and Vogel's approximation methods - Solution by MODI / Stepping Stone method - Assignment Models (Minimizing and Maximizing Problems) – Balanced and Unbalanced Problems - Solution by Hungarian method.

Applications: Transhipment Problem and Travelling Salesman problem

Practical exercise:

1. North West Corner rule in Microsoft Excel
2. Least Cost Method in Microsoft Excel
3. Vogel's Approximation Method in Microsoft Excel
4. Hungarian method in Microsoft Excel

UNIT IV – GAME THEORY	**9+3**

Game Theory- Basic Concept and Terminologies, Two-person Zero-sum Game, and Game with Pure and Mixed Strategies: Saddle point, Dominance Rule

Applications: Graphical and Linear Programming Solutions in Game theory

UNIT V – QUEUING THEORY AND SIMULATION	**9+3**

Structure of a queuing system – Operating characteristics of queuing system — Arrival and service processes – Deterministic queuing models: M/M/1 Model of infinite queue – M/M/1 model of finite queue

Applications: Monte Carlo simulation: use of random numbers, application of simulation techniques.

Practical exercise:

1. Random number generation in Microsoft Excel
2. Monte Carlo Simulation in Microsoft Excel

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Solve the model using the learned skills in translating business decision problems into mathematical models and selecting appropriate mathematical techniques	K3
CO2	Apply various methods to optimize the linear programming problem.	K3
CO3	Demonstrate usage of MS Excel Solver in closed/open transport and assignment problem solving, with or without additional conditions.	K2
CO4	Apply the knowledge of game theory concepts to real world decision situations wherein it is required to identify, analyze, and practice to make strategic decisions to counter the consequences	K3
CO5	Apply inventory control system to ensure the control over the production management	K3

COs and POs Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	3	3	3	2	-	-
CO2	3	2	1	2	1	3	3
CO3	2	3	2	-	-	-	-
CO4	1	2	2	2	1	2	-
CO5	-	1	-	-	2	-	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) – Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment – I	40	40		
	Skill Assessment – II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
Total					100

Skill Assessment Components: Individual Assignment / Worksheet / Case Study / Mini Project

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Gupta P.K, Hira D.S, "Operations Research", 7th Edition S.Chand and Co, 2021
2. N.D. Vohra, Quantitative Techniques in Management, Tata, McGraw Hill Publications, 4th Edition.
3. S. D. Sharma, Operations Research, Kedarnath Ramnath and Company, 2008.

Reference Books:

1. Anderson, Sweeney, Williams, Camm, Martin, Quantitative Methods for Business, 12e, CengageLearning, 2013.
2. Taha, Hamdy A. Operations Research: An Introduction (9/e). Prentice Hall, 2010.

3. Bal Krishnan, Render, Stair, Jr., Managerial Decisions Modeling with Spreadsheets, Pearson Education.
4. Nagraj B, Barry R and Ralph M. S Jr., Managerial Decision Modelling with Spreadsheets, Second Edition, 2007, Pearson Education.
5. William J.Stevenson, CeyhunOzgur, "Management Science with Spread sheets", (3rd ed. reprint), Tata Mcgraw Hill, 2007.

Web Links and Video Lectures (E-Resources):

1. So lution of LPP: Simplex Method
   https://www.nptelvideos.com/lecture.php?id=14316
2. Dual Simplex Method:
   https://www.nptelvideos.com/lecture.php?id=14321
3. Assignment Problems:
   https://www.nptelvideos.com/lecture.php?id=14327
4. 333190999Travelling Salesman Problem
   https://www.nptelvideos.com/lecture.php?id=14332

Equivalent NPTEL/SWAYAM Courses:

S.No.	Course Title	Course Instructor	Host Institute
1	Exceling with Mathematical Modeling	Prof. Sandip Banerjee	IIT Roorkee
2	Operations Research	Prof. Kusumdeep	IIT Roorkee
3	A Primer to Mathematical Optimization	Prof. Debdas Ghosh	IIT(BHU) Varanasi

Cour3se Code:	24MG207	**Course Title:**	**Introduction Of AI & ML**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- Study about uninformed and Heuristic search techniques.
- Learn techniques for reasoning under uncertainty
- Introduce Machine Learning and supervised learning algorithms
- Study about ensembling and unsupervised learning algorithms

- Learn the basics of deep learning using neural networks

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. NPTEL and Other Videos
3. Smart Class Room
4. Field visit
5. Project based learning
6. Industrial Visit

UNIT I - PROBLEM SOLVING	**9**
Introduction to AI - AI Applications - Problem solving agents – search algorithms – uninformed search strategies – Heuristic search strategies – Local search and optimization problems – adversarial search – constraint satisfaction problems (CSP)	
UNIT II - PROBABILISTIC REASONING	**9**
Acting under uncertainty – Bayesian inference – naïve bayes models. Probabilistic reasoning – Bayesian networks – exact inference in BN – approximate inference in BN – causal networks	
UNIT III - SUPERVISED LEARNING	**9**
Introduction to machine learning – Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function – Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier – Support vector machine, Decision Tree, Random forests	

UNIT IV- ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING	**9**
Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization	
UNIT V-NEURAL NETWORKS	**9**
Perceptron - Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error back propagation, from shallow networks to deep networks –Unit saturation (aka the vanishing gradient problem) – ReLU, hyper parameter tuning, batch normalization, regularization, dropout.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Use appropriate search algorithms for problem solving.	K3
CO2	Apply probabilistic models examine data using statistical codes.	K3
CO3	Build supervised learning models for accurate predictions	K3
CO4	Build unsupervised models organizing large datasets into clusters	K3
CO5	Build deep learning neural network models help computers make intelligent decisions	K3

COs and POs Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	3	2	2	3	3	-	2
CO2	2	2	3	2	-	2	-
CO3	1	1	2	3	2	1	1
CO4	3	3	3	3	-	3	3
CO5	2	1	1	1	3	3	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Mark**	**Reduced Marks**	**Total**	**Final marks**

		s			
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment – I	40	40		
	Skill Assessment – II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
Total					100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and five 13 marks question (either or) from each Unit
- All the fifteen questions have to be answered.
- One case analysis for 15 marks with either or choice.

Text Books:

1. Stuart Russell and Peter Norvig, “Artificial Intelligence – A Modern Approach”, Fourth Edition, Pearson Education, 2021.
2. Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, Fourth Edition, 2020.

Reference Books:

1. Dan W. Patterson, “Introduction to Artificial Intelligence and Expert Systems”, Pearson Education,2007
2. Kevin Night, Elaine Rich, and Nair B., “Artificial Intelligence”, McGraw Hill, 2008
3. Patrick H. Winston, "Artificial Intelligence", Third Edition, Pearson Education, 2006
4. Deepak Khemani, “Artificial Intelligence”, Tata McGraw Hill Education, 2013
5. Christopher M. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2006.
6. Tom Mitchell, “Machine Learning”, McGraw Hill, 3rd Edition,1997.
7. Charu C. Aggarwal, “Data Classification Algorithms and Applications”, CRC Press, 2014
8. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, “Foundations of Machine Learning”, MIT Press, 2012.
9. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 2016

Web Links and Video Lectures (E-Resources):

1. Artificial Intelligence: https://www.google.com/url?q=https://onlinecourses.nptel.ac.in/noc24_cs88/preview
2. Machine Learning: https://www.google.com/url?q=https://onlinecourses.nptel.ac.in/noc24_cs101/preview
3. Reinforcement Learning: https://www.google.com/url?q=https://onlinecourses.nptel.ac.in/noc24_cs102/preview

Course Code:	24MG208	**Course Title:**	**Total Quality Management**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

- To learn the various principles and practices of Total Quality Management

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – INTRODUCTION TO TOTAL QUALITY MANAGEMENT	**9**
TQM definition, Framework, Benefits, awareness and obstacles, Quality – vision, mission and policy statements. Customer Focus – customer perception of quality, Translating needs into requirements, customer retention. Dimensions of product and service quality. Cost of quality.	
UNIT II – TOTAL QUALITY MANAGEMENT PHILOSOPHIES AND PRINCIPLES	**9**
Overview of the contributions of Deming, Juran Crosby, Masaaki Imai, Feigenbaum, Ishikawa, Continuous Improvement- Kaizen, Concepts of Quality circle, Japanese 5S principles and 8D methodology.	

UNIT III – STATISTICAL PROCESS CONTROL	9
Meaning and significance of statistical process control (SPC) – construction of control charts for variables and attributes. Process capability – Meaning, significance and measurement – Six sigma - concepts of process capability. Reliability concepts – Definitions, reliability in series and parallel, product life characteristics curve. Total productive maintenance (TMP), Tero Technology. Business process Improvement (BPI) – Principles, applications, reengineering process, benefits and limitations.	
UNIT IV – QUALITY TOOLS AND TECHNIQUES	**9**
Quality functions development (QFD) – Benefits, Voice of customer, information organization, House of quality (HOQ), building a HOQ, QFD process. Failure mode effect analysis (FMEA) – FMEA stages, design, process and documentation. Seven Tools (old & new). Bench marking and POKAYOKE.	
UNIT V – QUALITY MANAGEMENT SYSTEMS	**9**
Introduction to IS/ISO 9004:2018 – Quality management systems – Guidelines for performance improvements. Environmental Management system, ISO 14000, Quality Audits. TQM culture, Leadership – Quality council, employee involvement, motivation, empowerment, recognition and Reward.	

[30 hours]

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Explain the principles of total quality management, Quality statement and cost of Quality and its effect on organizations.	K2
CO2	Apply TQM principles and concepts of continuous improvement.	K3
CO3	Apply statistical process control to enhance quality.	K3
CO4	Evaluate the tools and techniques of TQM towards customer driven excellence.	K4
CO5	Develop TQM culture and Quality management system in industries.	K3

COs and POs Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	3	2	3	2	-	-
CO2	3	2	1	-	3	3	1
CO3	2	1	1	-	2	-	-
CO4	1	-	1	2	2	2	2

CO5	3	2	1	1	1	-	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) – Theory	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment – I	40	40		
	Skill Assessment – II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
Total					100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and five (either or) 13 marks questions as one from each unit.
- All the thirteen-mark questions have to be answered.
- One either or questions as case analysis.

Text Books:

1. Total Quality Management by N.V.R Naidu, G. Rajendra New Age international, ,First Edition,Jan 2006
2. Total Quality Management by R.S Naagarazan ,New Age international,3e, 2015

Reference Books:

1. Dale H. Besterfield, Carol Besterfield-Michna, Glen H. Besterfield, Mary Besterfield -Sacre, Hemant Urdhwareshe, Rashmi Urdhwareshe, Total Quality Management (TQM), Fifth edition, Pearson Education, 2018.
2. Shridhara Bhat K, Total Quality Management – Text and Cases, Himalaya Publishing House, First Edition 2010
3. Poornima M.Charantimath, Total Quality Management, Pearson Education, Second Edition, 2011.
4. Douglas C. Montgomory, Introduction to Statistical Quality Control, Wiley Student Edition4th Edition, Wiley India Pvt Limited, 2008.
5. Indian standard – quality management systems – Guidelines for performance improvement (Fifth Revision), Bureau of Indian standards, New Delhi.
6. Panneerselvam.R, Sivasankaran. P, Quality Management, PHI Learning, 2014.

Web Links and Video Lectures (E-Resources):

1. Total Quality Management :https://archive.nptel.ac.in/courses/110/104/110104080/
2. Concepts in Quality Management – I: https://www.youtube.com/watch?v=SMOQV2CyVQo
3. Quality Management Systems – I: https://www.youtube.com/watch?v=AK8fm7t3tZU
4. Quality Design and Control: https://archive.nptel.ac.in/courses/110/105/110105088/

Suggested Skill Activities:

1. BIZ (Business) Quiz: This is a group activity. Biz quiz enlightens the students in the area of emerging trends in businesses. Students have to contest as a group with remaining groups. During the activity the groups shall be asked various questions about the company names, Taglines, brand ambassadors and chief executive officers etc. Key focus of this activity is to examine the student's awareness in the area of emerging trends in business.
2. Debate: This is a group activity. The main objective of this activity is to examine the Subject knowledge, critical thinking and coordination among team members.
3. Case Study or Case Analysis: This is the most interesting management activity. Generally, In case study a real time business¬ problem will be given to the students and students are supposed to study, analyse and find out the solution for them. Case study focuses on problem solving skills, leadership skills, and analytical skills and presentation skills among the students.

4. Ad Making: Ad Making is a group activity. In this activity a team will be given a product or service. Based upon the product or service students have to prepare ad. For which each team will be given some time duration. The main objective of this management activity is to identify and develop the creative and innovative thinking among the students and also develops coordination among team members.
5. News Paper Analysis: This is an individual management activity. In this activity students will be given Newspaper and they are supposed to read a particular bulletin and analyze the same in front of the audience. This activity emphasizes on students understanding about a topic and focuses on improving communication skills and analysing current political and business updates.

Course Code:	**24MG232**	**Course Title:**	**Business Lab**
Credits:	**1**	**L – T – P**	**0-0-2**

Course objectives:
• To learn the applications of tally software in business accounting. • To create accounting documents using Tally software • To create a mock investment portfolio account • To calculate GST (mock) using online platform • To create and maintain a Linked in ID.
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Smart Class Room 2. Field visit 3. Project based learning 4. Industrial Visit

UNIT I – TALLY-I	**9**
Company Creation , Creating groups, Creation of groups and ledgers, Creating journal entries, credit and debit entries , Preparation cash book and contra entry.	

UNIT II – TALLY –II	9
Preparing trial balance and final accounts, Preparing revenue management and portfolio selection, Preparing final accounts with adjustments, Preparing inventory creation, purchase and sales order, Preparing sales journal, Rejections and delivery notes	
UNIT III - MOCK STOCT MARKET OPERATIONS	**9**
A mock or virtual portfolio or trading portfolio can help ambitious teen investors get over their fear of making their first investment. Young investors can experience the ups and downs of the stock and crypto currency market by using virtual stock market simulators that extract values from the actual market and fake money.	
UNIT IV- ONLINE PLATFORMS FOR BUSINESS MODELS	**9**
Mock GST calculation online. Usage of Creative common mail chimp, Trello, SEMrush	
UNIT V- NETTIQUETTES	**9**
Netiquettes- How to manage linkedin profile, creation, uploading post, professional connectivity, getting connected and building rapport, creating customer relationship through Linkedin.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Utilize tally for company & group creation, ledger entries and cash book preparation.	K3
CO2	Utilize tally for preparing trial balance, P/L account, final accounts & inventory management.	K3
CO3	Apply the knowledge acquired in portfolio management	K3
CO4	Utilize the skill acquired in making online GST payments	K3
CO5	Make use of social media LinkedIn id for professional development and connectivity.	K3

COs and POs Mapping:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	2	2	1	-	2	2
CO2	1	-	-	2	1	1	-
CO3	2	-	2	1	2	-	2
CO4	3	2	1	1	1	3	-
CO5	1	2	1	2		3	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of Assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE)	Continuous Assessment	75	75	100	60
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Lab Exam	100	40	40	40
					100

Reference Books:

1.Psychology of money- Morgan Housel

2.Rich dad poor dad –Robert Kiyosaki

3.Learn Tally Prime with Gaurav Aggarwal

Web Links and Video Lectures (E-Resources):

1. https://moneybhai.moneycontrol.com/ for mock stock market operations
2. 60 Day Challenge - Test your trading discipline – Zerodha

   For mock stock market operations.
3. For market automation - https://mailchimp.com/
4. https://trello.com/ - for project management
5. https://www.semrush.com/ -for marketing management
6. https://in.linkedin.com/ -linkedin profile and account.

Course Code:	24MG231	**Course Title:**	**Managerial Skill Development –II**
Credits:	**2**	**L – T – P**	**0-0-4**

Course objectives:

- To develop knowledge, skills and attitude among the students which create in them industry readiness.
- To improvise students listening skills and to make them understand the dynamics of effective listening.
- To develop students' awareness about real time happening in business and current events.
- To help students improve their communication skills in all contexts of business process.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Field survey
2. Interview
3. Group Discussions
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class
9. Interaction with industrialist
10. Observing professionals

UNIT I –LISTENING	**10**
Focuses on Listening: Listening to Principles of Effective Presentations, Principles governing the use of audio visual media - Principles of Non-Verbal Communication. Professional dressing and body language - Types of managerial speeches - Presentations and Extempore - speech of introduction, speech of thanks, occasional speech, theme speech.	
UNIT II – CURRENT BUSINESS EVENTS	**10**
Focuses on Communication	

Group communication: Meetings, group discussions. - Other Aspects of Communication: Cross Cultural Dimensions of Business Communication Technology and Communication, Ethical & Legal Issues in Business Communication - Inter communication through notice, circulars, agenda, minutes, reports. **Static Content:** Prepare Circular, agenda, minutes, reports, Case Studies. Exercises on Corporate Writing, Executive Summary of Documents,. Describing a process in industry Writing- Writing a Complaint Letter about a manufacturing defect of a product.	
UNIT III – PRESENTATION	**10**
Comprehensive listening, Public Speaking, Telephone Conversation, Communicating between teams, Informational Listening, Critical Listening, Discriminative Listening - Business Communications. **Static Content:** Creative Writing, Poster Making, Framing Advertisements, Slogans, Captions, Preparing Press Release and Press Notes.	
UNIT IV – INTERVIEW PROCESS	**10**
Mastering the art of giving interviews in - selection or placement interviews, discipline interviews, appraisal interviews, exit interviews, web /video conferencing, tele-meeting. Static Content: • Web /video conferencing, tele-meeting. • Mock Interview • Preparations before attend an Interview • Preparing possible interview questions.	
UNIT V – RESUME PREPARATION	**10**
Present the selected topic - How to prepare Job application letter and Resume/CV? Making a short speech- Extempore. Static Content: • How to prepare Job application letter and Resume/CV? • Writing Instructions	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	To develop good managerial communication skills	K3
CO2	To identify and make use of different forms of written communication required in a business context.	K3
CO3	To develop good presentation skills	K3
CO4	To make use of interview skills.	K3
CO5	Make use of Jthe skills in preparing job application letters.	K3

COs and POs Mapping:

COs	**Pos**						
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	3	2	-	-	-	1	2
CO2	2	-	2	-	-	-	1
CO3	1	1	2	-	-	-	-
CO4	-	-	3	-	-	-	-
CO5	1	1	1	-	-	-	2

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE)	Continuous Assessment	75	75	100	60
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Lab Exam	100	40	40	40
TOTAL					100

Reference Books:

4. Darren Hardy (2021). The Compound Effect, Manjul Publishing House, Macmillan.
5. Greg McKeown, (2021). Essentialism: The Disciplined Pursuit of Less, Virgin Books.
6. Scott H. Young (2019).Ultralearning: Accelerate Your Career, Master Hard Skills and Outsmart the Competition, HarperCollins

CREDIT INFO		
Sl.No	**Category**	**Credits**
1	Professional Core Courses (PCC)	54
2	Professional Electives Courses (PEC)	18
3	Employability Enhancement Courses (EEC)	18
4	Skill Enhancement Course (SEC)	5
Total Credits		95

ROHINI COLLEGE OF ENGINEERING AND TECHNOLOGY

(AUTONOMOUS)

(Anjugramam-Kanyakumari Main Road, Palkulam,Variyoor P.O.-629 401, K.K.Dist.)

Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai

Accredited with A+ Grade by NAAC

MASTER OF COMPUTER APPLICATIONS

(MCA)

Curriculum & Syllabus

(*2024-2025 Admitted Students Onwards*)

Vision Statement of RCET

To be an academic institute of continuous excellence towards education and research in rural regime and provide service to nation in terms of nurturing potentially higher social, ethical and engineering companion graduands.

Mission Statement of RCET

To foster and promote technically competent graduands by imparting the state of art Engineering education in rural regime. To enunciate research assisted scientific learning by dissemination of knowledge towards science, agriculture, industry and national security.

Vision of the Department

Our Vision is to emerge as a Centre of Excellence and Research in the field of Computer Education and Application with distinct identity and character in all areas of its dimensions.

Mission of the Department

Our Mission is to provide very high quality education in Computer Applications and thereby develop a new and smart generation of Computer Application Professionals with proper transformation of leadership, commitment and moral values.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

Graduates will be able to:

I. Apply their computing skills to analyse, design and develop innovative software products to meet the industry needs and excel as software professionals.

II. Pursue lifelong learning and do research in the computing field based on solid technical foundations.

III. Communicate and function effectively in teams in multidisciplinary fields within the global, societal and environmental context.

IV. Exhibit professional integrity, ethics and an understanding of responsibility to contribute technical solutions for the sustainable development of society.

PROGRAMME OUTCOMES (POs)

PO1 (Foundation Knowledge): Apply knowledge of mathematics, programming logic and coding fundamentals for solution architecture and problem solving.

PO2 (Problem Analysis): Identify, review, formulate and analyze problems for primarily focusing on customer requirements using critical thinking frameworks.

PO3 (Development of Solutions): Design, Develop and investigate problems with as an innovative approach for solutions incorporating ESG/SDG goals.

PO4 (Modern tool usage): Select, adopt and apply modern computational tools such as development of algorithms with an understanding of the limitations including human biases.

PO5 (Individual and Team work): Function and communicate effectively as an individual or a team leader in diverse and multidisciplinary groups. Use methodologies such as agile.

PO6 (Project Management and Finance): Use the principles of project management such as scheduling, work break down structure and be conversant with the principles of finance for profitable project management.

PO7 (Ethics): Commit to professional ethics in managing software projects with financial aspects. Learn to use new technologies for cyber security and insulate customers from malware.

PO8 (Lifelong learning): Change management skill and the ability to learn, keep up with contemporary technologies and ways of working.

CREDIT INFO		
Sl.No	Category	Credits
1.	Foundation Courses (FC)	4
2.	Professional Core Courses (PCC)	53
3.	Professional Electives Courses (PEC)	12
4.	Open Electives Courses (OEC)	3
5.	Employability Enhancement Courses (EEC)	16
6.	Mandatory Courses (MNC)	0
Total Credits		88

Foundation Courses (FC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1.	24CA101	Mathematical Foundations for Computer Applications	FC	3	1	0	4

Professional Core Courses (PCC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1.	24CA102	Advanced Data Structures And Algorithms	PCC	3	0	0	3
2.	24CA103	Unix Architecture And Programming	PCC	3	1	0	4
3.	24CA104	Web Application Development	PCC	3	0	2	4
4.	24CA105	Accounting and Financial Management	PCC	3	0	0	3
5.	24CA106	Python Programming	PCC	3	0	0	3
6.	24CA131	Advanced Data Structures And Algorithms Laboratory	PCC	0	0	4	2
7.	24CA132	Python Programming Laboratory	PCC	0	0	2	1
8.	24CA201	Object Oriented Programming Using Java	PCC	3	0	0	3
9.	24CA202	Cloud Computing Technologies	PCC	3	0	0	3
10.	24CA203	Artificial Intelligence	PCC	3	0	0	3
11.	24CA204	Software Engineering Methodologies	PCC	3	0	0	3
12.	24CA205	Mobile Application Development	PCC	3	0	0	3
13.	24CA206	Full Stack Web Development	PCC	3	0	0	3
14.	24CA231	Full Stack Web Development Laboratory	PCC	0	0	4	2
15.	24CA232	Java Programming Laboratory	PCC	0	0	4	2
16.	24CA233	Mobile Application Development Laboratory	PCC	0	0	4	2
17.	24CA301	Machine Learning	PCC	3	0	2	4
18.	24CA302	Internet Of Things	PCC	3	0	0	3
19.	24CA331	Advanced Java programming Laboratory	PCC	0	0	2	1
20.	24CA332	Internet Of Things Laboratory	PCC	0	0	2	1

Professional Electives Courses I - DATABASES AND ANALYTICS (PEC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1.	24CA303	Distributed Databases	PEC	3	0	0	3
2.	24CA304	NoSQL Databases	PEC	3	0	0	3
3.	24CA305	XML and Web Services	PEC	3	0	0	3
4.	24CA306	Information Retrieval	PEC	3	0	0	3
5.	24CA307	Big data Analytics	PEC	3	0	0	3
6.	24CA308	Statistics Using R Programming	PEC	3	0	0	3
Professional Electives Courses II - FRAMEWORK AND SOFTWAREPROCESS (PEC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1.	24CA311	Software Project Management	PEC	3	0	0	3
2.	24CA312	Software Quality Management	PEC	3	0	0	3
3.	24CA313	Software Testing	PEC	3	0	0	3
4.	24CA314	MS Bot Framework	PEC	3	0	0	3
5.	24CA315	C# and .Net Framework	PEC	3	0	0	3
6.	24CA316	Object Oriented Software Engineering	PEC	3	0	0	3

Professional Electives Courses III - DATA SCIENCE (PEC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1.	24CA321	Data Analytics and Visualization	PEC	3	0	0	3
2.	24CA322	Data Mining & Data Warehousing	PEC	3	0	0	3
3.	24CA323	Data Analytics with Python	PEC	3	0	0	3
4.	24CA324	Neural Networks	PEC	3	0	0	3
5.	24CA325	Deep Learning	PEC	3	0	0	3
6.	24CA326	Digital Image Processing	PEC	3	0	0	3
Professional Electives Courses IV - SECURITY AND NETWORK (PEC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1.	24CA341	Cryptography and Network Security	PEC	3	0	0	3
2.	24CA342	Cyber Security	PEC	3	0	0	3
3.	24CA343	Introduction to Block chain and Applications	PEC	3	0	0	3
4.	24CA344	Computer Networks	PEC	3	0	0	3
5.	24CA345	Wireless Communication Networks	PEC	3	0	0	3
6.	24CA346	Distributed Systems	PEC	3	0	0	3

Open Elective (OEC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1.	24CA371	Data Analysis	OEC	3	0	0	3
2.	24CA372	Optimization using Spreadsheet	OEC	3	0	0	3
3.	24CA373	Graph Theory	OEC	3	0	0	3
4.	24CA374	Stochastic and Random Process	OEC	3	0	0	3
5.	24CA375	Number Theory and Queuing Theory	OEC	3	0	0	3
6.	24CA376	Numerical Methods	OEC	3	0	0	3
Employability Enhancement Courses (EEC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1.	24CA151	Professional communication-I	EEC	0	0	2	1
2.	24CA351	Professional communication-II	EEC	0	0	2	1
3.	24CA352	Mini Project / Internship $	EEC	0	0	0	2
4.	24CA451	PROJECT WORK	EEC	0	0	24	12

Mandatory Courses (MNC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1.	24MX501	English for Research Paper Writing	MNC	2	0	0	0
2.	24MX502	Disaster Management	MNC	2	0	0	0
3.	24MX503	Constitution of India	MNC	2	0	0	0
4.	24MX504	நற்றமிழ் இலக்கியம்	MNC	2	0	0	0
Bridge Courses							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
Classes are to be conducted and completed before the start of the class of first semester, Examinations will be conducted along with first semester							
1.	24BX001	Data Structures and Algorithms		3	0	2	4
2.	24BX002	Problem Solving and Programming in C		3	0	2	4
Classes are to be conducted and completed before the start of the class of second semester, Examinations will be conducted along with second semester							
1.	24BX101	Introduction to Computer Organization and Operating Systems		3	0	0	3
2.	24BX102	Database Management Systems		3	0	2	4

Classes are to be conducted and completed before the start of the class of third semester, Examinations will be conducted along with third semester							
1.	24BX201	Mathematical Foundations of Computer Science		3	0	0	3
2.	24BX202	Basics of Computer Networks		3	0	0	3

SCHEME OF INSTRUCTION FOR FIRST YEAR MCA

I SEMESTER

Sl.no	Course code	Course title	Category	L	T	P	C
FOUNDATION COURSES							
1.	24CA101	Mathematical Foundations for Computer Applications	FC	3	1	0	4
THEORY COURSES							
2.	24CA102	Advanced Data Structures And Algorithms	PCC	3	0	0	3
3.	24CA103	Unix Architecture And Programming	PCC	3	1	0	4
4.	24CA105	Accounting and Financial Management	PCC	3	0	0	3
5.	24CA106	Python Programming	PCC	3	0	0	3
THEORY COURSE WITH LABORATORYCOMPONENT							
6.	24CA104	Web Application Development	PCC	3	0	2	4
LABORATORY COURSES							
7.	24CA131	Advanced Data Structures And Algorithms Laboratory	PCC	0	0	4	2
8.	24CA132	Python Programming Laboratory	PCC	0	0	2	1
EMPLOYABILITY ENHANCEMENT COURSES							
9.	24CA151	Professional communication-I	EEC	0	0	2	1
		TOTAL		18	2	10	25

II SEMESTER

Sl.no	Course code	Course title	Category	L	T	P	C
THEORY COURSES							
1.	24CA201	Object Oriented Programming Using Java	PCC	3	0	0	3
2.	24CA202	Cloud Computing Technologies	PCC	3	0	0	3
3.	24CA203	Artificial Intelligence	PCC	3	0	0	3
4.	24CA204	Software Engineering Methodologies	PCC	3	0	0	3
5.	24CA205	Mobile Application Development	PCC	3	0	0	3
6.	24CA206	Full Stack Web Development	PCC	3	0	0	3
LABORATORY COURSES							
7.	24CA231	Full Stack Web Development Laboratory	PCC	0	0	4	2
8.	24CA232	Java Programming Laboratory	PCC	0	0	4	2
9.	24CA233	Mobile Application Development Laboratory	PCC	0	0	4	2
		TOTAL		18	0	12	24

Course Code:	**24CA101**	**Course Title:**	**Mathematical Foundations for Computer Applications (MCA)**
Credits:	**4**	**L – T – P**	**3 – 1 – 0**

Course objectives:

- To perform the operations associated with sets, functions, and relations.
- To learn logic and recursive functions and the basics of combinatory.
- To learn the basic graph theory and apply the graph centralities to some data sets.

Teaching-Learning Process:

These are sample strategies which teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method does not mean only traditional method, but different type of teaching methods may be adopted to develop the outcomes.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Topics will be introduced in a multiple representation and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT I – Set Theory and Matrices	**[12 hours]**
Operations on sets - Cardinality of sets – Inclusion - Exclusion principle - Pigeonhole principle - Matrices: Finding Eigen values and Eigen vectors.	

UNIT II – Mathematical Logic	**[12 hours]**
Logic - Prepositional Equivalence - Predicate and Quantifiers - Recursive Definitions and Recursive Algorithms - Basics of Counting - Pigeonhole Principle - Permutation and Combinations.	

UNIT III – Relations and Functions	**[12 hours]**
Relations and Their Properties - n-array Relations and Their Application - Representing Relations, Closures of Relations, Equivalence Relations - Partial Orderings – Functions: Domain and Range of function, Types of functions	

UNIT IV – Graph Theory	**[12 hours]**
Introduction to Graphs - Graph Operations - Graph Isomorphism, Connectivity - Graph centralities: Degree and distance-based centralities - Clustering and Eigenvalue centralities - Euler and Hamilton Paths	

UNIT V – Boolean Algebra	**[12 hours]**
Lattices - Definition and properties - special lattices - Boolean algebra - Boolean forms and free Boolean algebra - Boolean Expressions, Boolean forms and free Boolean algebra	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Apply the fundamentals of set theory and matrices for Engineering problems	K3
CO2	Solve the given real time problems by applying the Mathematical logic concepts.	K3
CO3	Use the relation matrix to check equivalence relation.	K3
CO4	Obtain isomorphism of graphs and spanning tree of a given graph using DFS / BFS. Also determine minimal spanning tree of a given graph.	K3
CO5	Apply the properties of Boolean algebra in minimization of switching circuits.	K3

COs and POs Mapping:

Course Outcomes	Programme Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	-	-	-	-	3
CO2	3	2	2	-	-	-	-	3
CO3	3	3	2	-	-	-	-	3
CO4	3	3	2	-	-	-	-	3
CO5	3	3	2	-	-	-	-	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	I	II	
Remember	20	20	20
Understand	40	20	20
Apply	40	60	60
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Reference Books:

1. Ralph P Grimaldi, "Discrete and Computational Mathematics: An applied introduction", Pearson Education, 5th Edition, (2007).
2. Keneth. H. Rosen, Discrete Mathematics and its Applications, 6th Edition, Tata McGraw-Hill, 2009.
3. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science, Prentice Hall of India, 2006.
4. C. Liu, "Elements of Discrete Mathematics: A Computer Oriented Approach", McGraw-Hill, 4th Edition (2012)

Equivalent NPTEL/SWAYAM Courses

S.No.	Course Title	Course Instructor	Host Institute
1	Discrete Mathematics	Dr. Aditi Gangopadhyay Dr. Sugata Gangopadhyay	IIT Roorkee
2	Advanced Engineering Mathematics	Dr. P. Panigrahi Prof. J. Kumar Prof. P.D. Srivastava Prof. Somesh Kumar	IIT Kanpur

Web Links and Video Lectures (E-Resources):

1. Principle of Inclusion and Exclusion
   https://www.nptelvideos.com/lecture.php?id=13710
2. System of Linear Equations, Eigenvalues and Eigenvectors:
   https://www.nptelvideos.com/lecture.php?id=13416
3. Graph Theory
   https://www.nptelvideos.com/lecture.php?id=13728

Course Code:	**24CA102**	**Course Title:**	Advanced Data Structures And Algorithms
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To understand the concept of data structures.
- To learn and use hierarchical data structures and its operations.
- To identify the usage of Tree, graph and its applications.
- To select and design data structures and algorithms that is appropriate for problems.
- To study about Back Tracking and Branch and Bound Technique

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – Introduction	[9 hours]
Data structures - Abstract data types - Primitive data structures- – Performance analysis – Space complexity – Time complexity – Asymptotic notations – Performance measurement – Array as an abstract data type– Polynomial as an abstract data type- Sparse matrix abstract data type – String abstract data type.	

UNIT II – Stack, Queue And Linked List	[9 hours]
The Stack abstract data type- The queue abstract data type- A mazing problem- Evaluation of expressions - Evaluating postfix expression – Infix to postfix- Multiple stacks and queues -Singly linked lists - Dynamically linked stacks and queues- Doubly linked lists.	

UNIT III – Trees And Graph	[9 hours]
Introduction – Binary trees –The ADT – Properties of binary trees–Binary tree representations – Binary tree traversals – Inorder traversal – Preorder traversal – Postorder traversal – Binary search trees. GRAPHS - Graph representations - Graph operations – Minimum cost spanning tree -Shortest paths and transitive closure.	

UNIT IV – Divide &Conquer, Greedy And Dynamic Programming	[10 hours]
Divide and conquer: Merge sort - Quick sort - Binary search. Greedy method: Knapsack problem- Job sequencing with deadlines -Minimum cost spanning tree – Single source shortest path. dynamic programming: All pair shortest path- Knapsack problem – Traveling salesman problem -Flow shop scheduling.	

UNIT V – Backtracking and Branch and Bound	[8 hours]
Backtracking: N-Queens problem - Hamiltonian cycles – Graph coloring –Sum of subset. Branch and bound: The method – FIFO branch and bound- LC branch and bound – 0/1 Knapsack problem - Traveling salesman problem.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Infer the concepts of data types and linear structures to solve array related problems.	K2
CO2	Apply stack and queue data structures for storing and retrieving the values in the complex problems.	K3
CO3	Interpret the concept of non-linear data structures for tree and graph traversal.	K2
CO4	Illustrate the idea of greedy and dynamic programming technique for solving complex problems.	K2
CO5	Apply graph technique to solve back tracking and branch and bound problems.	K3

COs and POs Mapping:

Course Outcomes	Programme Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	1	-	-	-	3
CO2	3	2	3	1	-	-	-	3
CO3	3	3	2	1	-	-	-	3
CO4	3	3	2	1	-	-	-	3
CO5	3	3	2	1	-	-	-	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Internal Examination I	Continuous Internal Examination II	End Semester Examination
Remember	20	20	20
Understand	60	60	60
Apply	20	20	20
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Ellis Horowitz, Sartaj Sahani, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Universities Press (India) Private Limited, Hyderabad.
2. Ellis Horowitz and Sartaj Sahani, "Fundamentals of Computer Algorithms", Computer Science Press Inc., Galgotia Book Sources Publications, New Delhi, 2014.

Reference Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", The MIT Press, 2022.
2. Tanaenbaum A. S., Langram Y. Augestein M. J., "Data Structures using C" Pearson Education, 2004.

3. T.H. Cormen, C.E.Leiserson, R.L. Rivest and C.Stein, "Introduction to Algorithms", Prentice Hall of India, 3rd Edition, 2012.
4. Mark Allen Weiss, "Data Structures and Algorithms in C++", Pearson Education, 3rd Edition, 2009.
5. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.

Web Links and Video Lectures (E-Resources):

1. A Basic Course on Data Structures and Algorithms: **https://nptel.ac.in/courses/106102064**
2. Data Structures and Program Methodology: https://nptel.ac.in/courses/106103069
3. Programming, Data structures and Algorithms: https://nptel.ac.in/courses/106106133

Course Code:	**24CA103**	**Course Title:**	Unix Architecture and Programming
Credits:	**4**	**L – T – P**	**3-1-0**

Course objectives:

To impart knowledge on the

- To learn the basic concepts of Unix Structure, file system and basic commands.
- To learn advance file concepts, commands related to Shell script and filter commands.
- To study the kernel architecture and buffer storage.
- Familiar with the concepts of Unix process control in the operating system.
- To gain an understanding of important aspects related to the SHELL and the process.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – Introduction	[12 hours]
Unix structure: File system – Essential commands – Directory and file commands – General purpose utilities - Bourne Shell – Shell wild cards – Simple filters – Regular expressions – Grep family - Advanced filters – Sed, awk- Process - Communication and scheduling.	

UNIT II - File System Structure	[12 hours]
Kernel architecture - Kernel data structure - Buffer cache - Structure of buffer pool – Scenarios for buffer retrieval - Reading and writing disk blocks - Allocation of disk blocks - Advantages and disadvantages of buffer cache - Inode - Structure of regular file - Conversion of a pathname to an inode - Inode assignment to a new file.	

UNIT III – Process System	[12 hours]
Process states and transitions - Context of a process - Saving the context of a process –Manipulating process address space - Process creation and termination – Signals – Awaiting process termination – System boot and init process - Process scheduling – Functions of a clock Interrupt handler.	

UNIT IV – Programming With Shell	[12 hours]
Shell scripts – Command line arguments, positional parameters – Decision making and looping constructs – Redirection – File system architecture.	

UNIT V – Memory Management	[12 hours]
Swapping - Allocation of swap space – Swapping processes out – Swapping processes in – Demand paging - Data structures of demand paging - Page stealer process - Page faults.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Outline the concept of Unix architecture, file systems and the usage of basic commands.	K2
CO2	Infer the Unix commands that are used for file handling and process control.	K2
CO3	Apply Unix system calls to create and control signals in operating system.	K3
CO4	Apply Shell commands to devise a Shell script for problem solving.	K3
CO5	Determine a Shell Program for allocation and deallocation of memory resources	K2

COs and POs Mapping:

Course Outcomes	Programme Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	1	-	-	-	3
CO2	3	2	2	1	-	-	-	3
CO3	3	2	2	1	-	-	-	3
CO4	3	2	2	1	-	-	-	3
CO5	3	2	2	1	-	-	-	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final marks</th></tr>
<tr><td rowspan="5">Continuous Internal Examination (CIE)</td><td>CIE – I</td><td>100</td><td rowspan="2">50</td><td rowspan="5">100</td><td rowspan="5">40</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>MCQ</td><td>20</td><td>10</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td>End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>60</td><td>60</td><td>60</td></tr>
<tr><td colspan="5" align="right">Total</td><td>100</td></tr>
</table>

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	I	II	
Remember	20	20	20
Understand	40	40	40
Apply	40	40	40
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Sumitabha Das, "Unix System V.4 - Concepts and Applications", Tata McGraw Hill, 2014.
2. Maurice J Bach, "Design of the UNIX Operating System", Pearson, 2015.

Reference Books:

1. Richard F Gilberg, Behrouz A Forouzan, "Unix and Shell Programming - A Text Book", Cengage Learning India Private Limited, 2016.
2. UreshVahalia, "UNIX Internals: The New Frontiers", Pearson Education, 2011.
3. Keith Haviland, Dina Gray, "Unix System Programming", Addison Wesley, 2007

Web Links and Video Lectures (E-Resources):

- A basic course on Linux BASH (shell scripting): https://onlinecourses.swayam2.ac.in/aic20_sp05/preview

Course Code:	**24CA104**	**Course Title:**	Web Applications Development
Credits:	**4**	**L – T – P**	**3-0-2**

Course objectives:

To impart knowledge on the

- Students will be able to learn the Internet usage and web applications.
- To study the fundamentals of HTML and DHTML commands.
- To understand the concept of Client-Side Programming.
- To be familiar with the Server Side Programming using DOM and Java Servlet
- To identify the principles of SOAP, XML and WSDL.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – Introduction [15 hours]

Web Essentials: Clients, Servers, and communication: The Internet-Basic internet protocols -The WWW-HTTP Request message- Response Message-Web clients -Web Servers. Markup Languages: XHTML. An Introduction to HTML – History and Versions-Basic XHTML Syntax and semantics-Some fundamental HTML Elements-Relative URLs.

Practical Topics:

1. Demonstrate the program using HTML elements & attributes
2. Write a program using HTML tables, forms & canvas
3. Develop a program using HTML multimedia, APIs

UNIT II – Client Side Programming [15hours]

Style sheets: Introduction to cascading style Sheets-Features-Core Syntax-Style Sheets and HTML - Style rule cascading and Inheritance-Text Properties-Box Model Normal- Flow Box Layout. Client Side Programming: JavaScript in Perspective-Syntax-Variables and Data types -Statements-Operators- Literals-Functions-Objects.

Practical Topics:

1. Demonstrate the program using CSS selectors.
2. Demonstrate the program using CSS for embedded stylesheets, external stylesheets and inline styles.
3. Demonstrate the program using JavaScript for validating registration form.

UNIT III – Server Side Programming [15 hours]

Host objects: Introduction to the document object model – DOM -Intrinsic event handling - Modifying element style-The Document tree-DOM Event Handling - Properties of window. Server Side Programming: Java Servlets architecture overview - Servlet generating dynamic Content - Life cycle -Parameter data – Sessions - Cookies.

Practical Topics:

1. Demonstrate the program for implementing XML document for customer details.
2. Demonstrate the program using servlet that displays a message.
3. Write a servlet program to display cookie id.

UNIT IV – Representing Web Data [15 hours]

XML Documents and vocabularies -Declaration – Namespaces - JavaScript and XML: Ajax-DOM based XML processing - Event-oriented Parsing: SAX-Transforming XML Documents-Selecting XML Data: XPATH-Template based Transformations: XSLT-Displaying XML Documents in

Browsers. Programming and Presentation: Introduction to JSP -JSP and Servlets-Running JSP Applications
Practical Topics: 1. Demonstrate the program using JSP that reads parameters from user login page. 2. Write an XML file to display the Book information which includes the following: 1)Title of the book 2) Author Name 3) ISBN number 4) Publisher name 5) Edition 6) Price 3. Write a JSP program to create check boxes..

UNIT V – Web Services	**[15 hours]**
Concepts - Writing a Java Web Service-Writing a Java Web Service Client-Describing Web Services: WSDL- Representing Data Types: XML Schema- Communicating Object Data: SOAP Related Technologies	
Practical Topics: 1. Demonstrate the program using servlet that connects to the database and retrieves the data and displays it. 2. To Develop Content Management System. 3. To implement Online quiz.	

Laboratory Component: **[30 hours]**

Any 12 experiments have to be completed from the following list of experiments.

S.No.	Name of the Experiment
1	Demonstrate the program using HTML elements & attributes
2	Write a program using HTML tables, forms & canvas
3	Develop a program using HTML multimedia, APIs
4	Demonstrate the program using CSS selectors.
5	Demonstrate the program using CSS for embedded stylesheets, external stylesheets and inline styles.
6	Demonstrate the program using JavaScript for validating registration form.
7	Demonstrate the program for implementing XML document for customer details.
8	Demonstrate the program using servlet that displays a message.
9	Write a servlet program to display cookie id.
10	Demonstrate the program using JSP that reads parameters from user login page.
11	Write an XML file to display the Book information which includes the following:

	1)Title of the book 2) Author Name 3) ISBN number 4) Publisher name 5) Edition 6) Price
12	Write a JSP program to create check boxes..
13	Demonstrate the program using servlet that connects to the database and retrieves the data and displays it.
14	To Develop Content Management System.
15	To implement Online quiz.

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Utilize the basic HTML commands to develop programs.	K3
CO2	Use the concepts of CSS and JavaScript for designing the web pages.	K3
CO3	Make use of java Servlet to implement a server side program for storage purpose.	K3
CO4	Apply server side technologies to develop a software that is accessed using a web browser.	K3
CO5	Apply client and server side programming to design software for web application.	K3

COs and POs Mapping:

Course Outcomes	Programme Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	3	-	-	-	3
CO2	3	2	2	3	-	-	-	3
CO3	3	2	2	3	-	-	-	3
CO4	3	2	2	3	-	3	-	3
CO5	3	2	3	3	-	3	-	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		

	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	I	II	
Remember	20	20	20
Understand	20	20	20
Apply	60	60	60
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Jeffrey C.Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.
2. Ralph F. Grove PhD, Web Based Application Development, ISBN-13: 9780763759407, 2010

Reference Books:

1. Carles Mateu, "Introduction to Web Applications Development" Publisher: Free Technology Academy - Fundacio per a la Universitat Oberta de Catalunya (February, 2010)
2. Wang-Thomson, "An Introduction to WEB Design and Programming"
3. Steven Holzner , "PHP: The Complete Reference", TataMcGraw-Hill.
4. Thomas Powell, "Web Design the Complete Reference", Tata McGraw Hill

Web Links and Video Lectures (E-Resources):

1. A Basic Course on Web Based Technologies and Multimedia Applications: https://onlinecourses.swayam2.ac.in/nou20_cs05/preview
2. Web Technology : https://onlinecourses.swayam2.ac.in/nou24_cs18/preview
3. HTML: https://onlinecourses.swayam2.ac.in/aic20_sp11/preview

Course Code:	**24CA105**	**Course Title:**	**Fundamentals of Accounting**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To understand the basic principles of Accounting.
- To understand the Double entry system and the preparation of ledger.
- To understand the process and importance of the electronic accounting system.
- To Prepare the estimate for various business activities such as purchase, sale, production and cash budgets.
- To understand the computerized accounting environment.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. NPTEL and Other Videos
3. Smart Class Room
4. Field visit
5. Project based learning
6. Industrial Visit

UNIT I -INTRODUCTION TO ACCOUNTING	**[9 hours]**
Introduction to Financial, Cost and Management Accounting – Objectives of Financial Accounting – Accounting Principles, Concepts and Conventions- Bookkeeping and Accounting.	

UNIT II - MANAGEMENT ACCOUNTING AND BOOKKEEPING	**[9 hours]**
Meaning – Objectives of Management Accounting – Accounting System – Preparation of Journal, Ledger, Cash Book and Trial Balance- Errors disclosed and not disclosed by Trial Balance –Final Accounts – Ratio Analysis.	

UNIT III - BUDGETS AND BUDGETRY CONTROL	[9 hours]
Budgets and Budgetary Control – Meaning – Types – Sales Budget – Production Budget – Cost of Production Budget – Flexible Budgeting – Cash Budget –Master Budget – Zero Base Budgeting.	

UNIT IV- FINANCIAL MANAGEMENT	[9 hours]
Objectives of Financial Management –Preparation of Suspense Account – Depreciation – Meaning and Types – Methods of Charging and providing depreciation – Inventory management.	

UNIT V- ACCOUNTING IN COMPUTERISED ENVIRONMENT	[9 hours]
Significance of Computerized Accounting System – Codification and Grouping of Accounts – Maintaining the hierarchy of ledgers – Prepacked Accounting software.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Able to understand the basic concepts of accounting standards.	K2
CO2	Able to understand the process of maintain Accounts in an organization.	K2
CO3	Able to understand and calculating the financial position of an organization.	K2
CO4	Able to understand financial management concepts and various methods depreciation.	K2
CO5	It helps to understand the computerized accounting environment.	K2

COs and POs Mapping:

Course Outcomes	Programme Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	-	1	1	1	3
CO2	3	2	2	-	1	2	1	3
CO3	3	3	2	-	1	2	1	3
CO4	3	3	2	-	1	2	1	3
CO5	3	3	2	2	2	1	1	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	60	100	40
	CIE – II	100			
	Skill Assessment – I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Internal Examination I	Continuous Internal Examination II	End Semester Examination
Remember	20	20	20
Understand	80	80	80
Apply	0	0	0
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Reddy and Murthy, Financial Accounting by Margham Publications, 2015, Chennai.
2. S.N.Maheswari, "Financial and Management Accounting", Sultan Chand & Sons, 5 edition . 2010.

Reference Books:

1. I.M. Pandey, "Financial Management", Vikas Publishing House Pvt. Ltd., 9th Edition 2009.
2. M.Y.Khan and P.K.Jain, "Financial Management", Text, Problems and Cases", Tata McGraw Hill, 5th Edition, 2008.
3. I.M.Pandey, "Management Accounting", Vikas Publishing House Pvt. Ltd., 3rd Edition 2009.
4. Advanced Accounting, R.L.Gupta and P.K.Gupta, Advanced Accounting, Sultan Chand, New Delhi.

Web Links and Video Lectures (E-Resources):

1.Foundations of Accounting : https://youtu.be/VLSTb9bykzM

Course Code:	24CA106	Course Title:	Python Programming
Credits:	3	L – T – P	3-0-0

Course objectives:

To impart knowledge on the

- To develop Python programs with conditionals and loops.
- To define Python functions and use function calls.
- To use Python data structures – lists, tuples, dictionaries.
- To do input/output with files in Python.
- To use different modules and packages

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. NPTEL and Other Videos
3. Smart Class Room
4. Field visit
5. Project based learning
6. Industrial Visit

UNIT I - PYTHON BASICS	[10 hours]
Introduction to Python Programming – Python Interpreter and Interactive Mode – Variables and Identifiers – Values and Types – Statements. Operators – Boolean Values – Operator Precedence – Expression – Conditionals: If - Else Constructs – Loop Structures/Iterative Statements – While Loop – For Loop – BreakStatement-Continue statement – Function Call and Returning Values – Parameter Passing – Local and Global Scope – Recursive Functions.	

UNIT II - DATA TYPES IN PYTHON	[9 hours]
Lists – List Operations. Methods – Tuples – variable length arguments, Strings – Dictionary	

UNIT III -FILE HANDLING AND EXCEPTION HANDLING	[8 hours]
Files: Introduction – File Path – Opening and Closing Files – Reading and Writing Files –File Position – Exception: Errors and Exceptions, Exception Handling, Multiple Exceptions	

UNIT IV- MODULES, PACKAGES	[9 hours]
Modules: Importing Module – User Define Module – The Python Standard Libraries Modules – The Python Libraries for data processing, data mining and visualization- NUMPY, Pandas, Matplotlib	

UNIT V-OBJECT ORIENTED PROGRAMMING IN PYTHON	[9 hours]
Concepts – Creating a Class, Class methods, Class Inheritance, Encapsulation, Polymorphism, class method vs. static methods, Python object persistence	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Interpret the basic Python programming structure for solving decision making and looping problems.	K2
CO2	Utilize the compound data types lists, tuples, dictionaries to access collective data.	K3
CO3	Implement the file operations and exceptions to handle runtime errors in program	K3
CO4	Utilize the different functions used in python libraries for data processing	K3
CO5	Summarize the object oriented concepts for reusability and to organize complex programs.	K2

COs and POs Mapping:

Course Outcomes	Programme Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	2	1	-	-	3
CO2	3	2	2	2	1	-	-	3
CO3	3	3	2	2	1	-	-	3
CO4	3	3	2	3	1	-	-	3
CO5	3	3	2	2	1	-	-	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	60	100	40
	CIE – II	100			
	Skill Assessment – I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	I	II	
Remember	20	20	20
Understand	20	20	20
Apply	60	60	60
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", Second Edition, Shroff, O'Reilly Publishers, 2016 (http://greenteapress.com/wp/thinkpython/)
2. Guido van Rossum, Fred L. Drake Jr., "An Introduction to Python – Revised and Updated for Python 3.2, Network Theory Ltd., First edition, 2011
3. Wes McKinney, "Python for Data Analysis", O 'Reilly Publishers

Reference Books:

1. ReemaThareja, "Python Programming using Problem Solving Approach", Oxford University Press, First edition, 2017
2. John V Guttag, "Introduction to Computation and Programming Using Python", Revised and Expanded Edition,MIT Press, 2013

3. Charles Dierbach, “Introduction to Computer Science using Python”, Wiley IndiaEdition, First Edition, 2016
4. Timothy A. Budd, “Exploring Python”, Mc-Graw Hill Education (India) Private Ltd.,First edition,2011
5. Kenneth A. Lambert, “Fundamentals of Python: First Programs”, Cengage Learning,second edition,2012

Web Links and Video Lectures (E-Resources):

1. Python Programming: https://onlinecourses.nptel.ac.in/noc24_cs78/preview

Course Code:	**24CA131**	**Course Title:**	Advanced Data Structures And Algorithms Laboratory
Credits:	**2**	**L – T – P**	**0-4-0**

Course objectives:

To impart knowledge on the

- To learn the usage of algorithms for computing.
- To study the concept of hierarchical data structures and its operations.
- Familiar with the concept of tree and graph traversal.
- To select and design data structures and algorithms that is appropriate for problems.
- To learn the concept of back tracking and branch and bound technique

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

S.No	**Name of the Experiment**
1.	Write a program using C ++ to perform stack operations.
2.	Implement the program using C ++ to perform queue operations.
3.	Write a C++ program to sort N numbers using merge sort and quick sort.

4.	Demonstrate the program using C ++ to perform recursive function for tree traversal
5.	Program using C ++ to perform graph traversal.
6.	Write a C++ program to perform minimum spanning tree using Prim's algorithm.
7.	Demonstrate the C++ program to perform minimum spanning tree using kruskal's algorithm.
8.	C ++ program to find the solution for knapsack problem using dynamic programming approach.
9.	Implement the program using C ++ to perform the solution of 8 Queens Problem using backtracking.
10.	Demonstrate the C++ program to find the solution of traveling salesperson problem using branch and bound technique
11.	Write a C++ program to perform coloring problem using backtracking

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Apply linear data structures stack and queue to store and retrieve the values.	K3
CO2	Make use of non-linear structures to perform tree and graph operation.	K3
CO3	Apply divide and conquer technique to sort the numbers.	K3
CO4	Apply the greedy and dynamic programming to graphical problems.	K3
CO5	Use back tracking and branch and bound technique to solve real time complex problem.	K3

COs and POs Mapping:

Course Outcomes	Programme Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	2	1	-	1	3
CO2	3	2	2	2	1	-	1	3
CO3	3	3	2	2	1	-	1	3
CO4	3	3	2	2	1	2	1	3
CO5	3	3	2	2	2	2	1	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	60
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Lab Exam	100	40	40	40
				Total	100

Course Code:	**24CA132**	**Course Title:**	**Python Programming Laboratory**
Credits:	**1**	**L – T – P**	**0-0-2**

Course objectives:

To impart knowledge on the

- Develop Python programs with conditionals, loops and functions
- Represent compound data using Python lists, tuples, dictionaries
- Read and write data from/to files in Python
- Implement NumPy, Pandas, Matplotlib libraries
- Implement object oriented concepts

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

S.No	Name of the Experiment
1.	Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).

2.	Scientific problems using Conditionals and Iterative loops
3.	Linear search and Binary search.
4.	Selection sort, Insertion sort
5.	Merge sort, Quick Sort
6.	Implementing applications using Lists, Tuples
7.	Implementing applications using Sets, Dictionaries.
8.	Implementing programs using Strings.
9.	Implementing programs using written modules and Python Standard Libraries (pandas, numpy, Matplotlib, scipy)
10.	Implementing real-time/technical applications using File handling.
11.	Implementing real-time/technical applications using Exception handling
12.	Creating and Instantiating classes

Hardware/Software Requirements

1	Operating systems: Windows 7,macOS and Linux
2	Python versions:2.7, 3.6, 3.8

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Apply the Python language syntax including control statements, loops and functions to solve a wide variety of problems in mathematics and science	K3
CO2	Use the core data structures like lists, dictionaries, tuples and sets in Python to store, process and sort the data	K3
CO3	Create files and perform read and write operations	K4
CO4	Illustrate the application of python libraries	K2
CO5	Handle exceptions and create classes and objects for any real time applications.	K2

COs and POs Mapping:

Course Outcomes	Programme Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	3	1	-	1	3
CO2	3	2	2	3	1	-	1	3
CO3	3	3	2	2	1	-	1	3

CO4	3	3	2	2	1	-	1	3
CO5	3	3	2	2	1	-	1	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	60
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Lab Exam	100	40	40	40
				Total	100

Course Code:	**24CA151**	**Course Title:**	**PROFESSIONALCOMMUNICATION I**
Credits:	**1**	**L – T – P**	**0-0-2**

Course Objectives

- To provide opportunities to learners to practice active listening
- To enable learners read and comprehend materials
- To enable learners to fine-tune their linguistic skills (LSRW) with the help of technology
- To improve the performance of learners' writing skills
- To improve the performance of learners' presentation and communication skills

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk / Demonstrations
2. Language learning softwares / Language Lab
3. Online Resources
4. Smart Class Room
5. Flipped classrooms
6. Expert Lecture sessions

UNIT I – LISTENING - ATTITUDE, ATTENTION AND ADJUSTMENT		**[6 hours]**
Listening and practicing neutral accents - Listening to short talks and lectures and completing listening comprehension exercises , Listening to TED Talks		
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	**Topic**	**Hours**
1	"Your Body Language May Shape Who You Are" by Amy Cuddy Amy Cuddy's TED Talk on how adopting powerful postures can affect your mind and improve your confidence. (https://www.youtube.com/watch?v=Ks_Mh1QhMc).	
2	Podcasts The English We Speak" (BBC Learning English, Short episodes focusing on English phrases and idioms, spoken in clear, neutral British English. Listen https://www.bbc.co.uk/programmes/p02pc9zn/episodes/downloads	2
3	5 Minute English" (BBC Learning English, Discussions on a variety of topics with transcripts available, ideal for practicing listening skills. Listen https://www.bbc.co.uk/programmes/p02pc9kn/episodes/downloads	
4	The English Language Podcast" (English Language Club Conversations about the English language and tips for learners, spoken in neutral accents. Listen https://www.englishlanguageclub.co.uk/englishlanguagepodcast/	
5	YouTube Channels English Addict with Mr. Duncan" Mr. Duncan speaks in a clear, neutral British accent, discussing various aspects of English language learning. Watch https://www.youtube.com/user/duncaninchina	
6	Rachel's English" Focuses on American English pronunciation and listening practice with a neutral accent. Watch https://www.youtube.com/user/rachelsenglish	
7	English with Lucy" Lucy offers lessons on British English pronunciation and listening skills, spoken in a neutral accent. Watch https://www.youtube.com/channel/UCz4tgANd4yy8Oe0iXCdSWfA	
8	Audiobooks LibriVox" Free public domain audiobooks read by volunteers from around the world. Many readers use neutral accents.	

	Listen https://librivox.org/	
9	Audible Free Audiobooks Audible offers a selection of free audiobooks, often read in clear, neutral accents. Titles like "Pride and Prejudice" by Jane Austen are a good starting point. Explore https://stories.audible.com/startlisten	
10	Interactive Websites ESL Lab" Listening exercises with conversations and quizzes to test comprehension. Features speakers with neutral accents. Visit https://www.esllab.com/	
11	Ellllo" A vast collection of listening exercises with speakers from different English speaking countries using neutral accents. Visit https://www.elllo.org/	
	CLASSROOM ACTIVITY	
	Exercise – LISTENING COMPREHENSION EXERCISES Activities 1. Transcription Practice Choose a podcast or YouTube video with a neutral accent and transcribe it. Compare your transcription with the provided transcript to check for accuracy. 2. Shadowing Technique Listen to a short segment (12 minutes from a neutral accented podcast or video and try to repeat it exactly as you hear it, imitating the accent, intonation, and rhythm. 3. Listening and Summarizing Listen to a podcast episode or video, and then summarize it in your own words. This helps improve both listening comprehension and the ability to articulate thoughts clearly.	4

UNIT II: READING		**[6 hours]**
Reading Comprehension -Reading subject specific material -Technical Vocabulary- skimming – scanning – technical articles		
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	**TOPIC**	**HOURS**
	https://learnenglish.britishcouncil.org/skills/reading/b2-reading	4
	https://learnenglish.britishcouncil.org/business-english/english-emails	
	Compose and send emails	
	https://www.vocabulary.com	
	CLASSROOM ACTIVITY	

	Exercise: Read Aloud	**2**

UNIT III: USEFUL WEBTOOLS FOR LANGUAGE LEARNING		**[6 hours]**
1	https://lingro.com/?authuser=0	4
2	https://quillbot.com/?authuser=0	
3	https://www.csgenerator.com/?authuser=0	
4	https://www.thesaurus.com/?authuser=0	
5	https://translate.google.com/?sl=en&tl=ta&op=translate&hl=en&authuser=0	
6	https://rewordify.com/?authuser=0	
7	https://www.grammarly.com/?authuser=0	
8	https://smallseotools.com/plagiarism-checker/?authuser=0	
9	https://www.google.co.in/inputtools/try/?authuser=0	
10	https://youglish.com	
11	https://www.scribbr.com/citation/generator/	
	CLASSROOM ACTIVITY	
	Panel Discussion : Present day Technology : boon or bane ?	2

UNIT IV: WRITING		**[6 hours]**
Nuances of effective - writing Formal vs Informal Writing - Paragraph Writing - Essay Writing - Email Writing		
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	**TOPIC**	**HOURS**
1	Website review	3
2	Literature review	
3	Professional blogs	
4	Data Analysis Reports	
	CLASSROOM ACTIVITY	
	Exercise: Write letters , Technical papers	3

UNIT V : SPEAKING		**[6 hours]**
Giving one minute talks, participating in small Group Discussions, Making Presentations		
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	**TOPIC**	**HOURS**
1	Group Discussion Skills "Group Discussion Tips" by Welingkar Online video offers practical tips	2

	and strategies for participating effectively in group discussions. Watch https://www.youtube.com/watch?v=yyTkdE6UXm4	
2	"Group Discussion Do's and Don'ts" by Learn English Lab Covers the essential do's and don'ts for group discussions, helping participants understand how to contribute meaningfully. Watch https://www.youtube.com/watch?v=whwe0KD_rGw	
3	. "How to Ace Group Discussions" by Study IQ Education Provides a detailed guide on how to prepare for and excel in group discussions, including how to structure your arguments and engage with others. Watch https://www.youtube.com/watch?v=WXKj5a8hoG0	
4	Making Effective Presentations 1. "How to Make an Effective Presentation" by Mind Tools Focuses on the key elements of creating and delivering effective presentations, including planning, structure, and delivery techniques. Watch https://www.youtube.com/watch?v=puHvNWIuavU	
5	"Top Tips for Effective Presentations" by Jeff Davidson Offers tips on presentation design, body language, and engaging your audience. Watch https://www.youtube.com/watch?v=ENWBlqN1vqo	
6	"How to Create a Presentation in Canva" by Canva A stepbystep tutorial on using Canva to create professional and engaging presentation slides. Watch https://www.youtube.com/watch?v=_Akp7APaFr8	
7	"Mastering Public Speaking" by Dale Carnegie Training Covers the essentials of public speaking, including confidencebuilding techniques, clear communication, and audience engagement. Watch https://www.youtube.com/watch?v=i9bXhV7ml_M	
8	"Presentation Skills Training" by Skillopedia A comprehensive guide to improving presentation skills, including voice modulation, slide design, and handling Q&A sessions. Watch https://www.youtube.com/watch?v=jl8FEpMcfrs	
9	"How to Conduct a Group Discussion" by CareerRide Detailed advice on leading and participating in group discussions, with tips on how to present your ideas effectively within a group setting. Watch https://www.youtube.com/watch?v=Z0r3HUn_jvs	
10	Public Speaking **A well-educated mind vs a well-formed mind: Dr. Shashi Tharoor at TEDx Gateway 2013** https://www.youtube.com/watch?v=kcW4ABcY3zI&authuser=0	
11	**Malala Yousafzai UN Speech: Girl Shot in Attack by Taliban Gives Address | The New YorkTimes** https://www.youtube.com/watch?v=5SClmL43dTo&authuser=0	
	CLASSROOM ACTIVITY	
	Exercise – Self introduction - Giving one minute talks, participating in small Group Discussions, Making Presentations – public speaking	4

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Make use of active listening skills and comprehend lectures in English	K3
CO2	Utilize reading skills and comprehend literature in English	K3
CO3	Choose appropriate technology to support language skills	K3
CO4	Apply linguistic skills to Communicate effectively in formal and informal writing	K3
CO5	Plan and present proficient lectures and presentations	K3

COs and POs Mapping:

Course Outcomes	Programme Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	-	-	2	-	1	3
CO2	-	-	-	-	2	-	1	3
CO3	-	-	-	-	2	-	1	3
CO4	-	-	-	-	3	-	1	3
CO5	-	-	-	-	3	-	2	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Tota l**	**Final mark s**
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	60
	Model Lab Exam	25	25		
End Semester (Based on skill activity suggested)	Lab Exam	100	40	40	40
				Total	100

Web Links and Video Lectures (E-Resources):

MANUALS / SOFTWARE: Open Sources / British Council / Cambridge Websites

Course Code:	24CA201	Course Title:	Object Oriented Programming Using Java
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- Study the basic concepts and fundamentals of platform independent object oriented language.
- To introduce the principles of inheritance and polymorphism; and demonstrate how they relate to the design of abstract classes.
- To demonstrate skills in writing programs using exception handling. techniques and multithreading.
- To introduce the design of Graphical User Interface
- Able to design a framework using AWT Components.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – Basic Concepts	[9 hours]
Object orientation programming - Benefits of OOP – Applications of OOP. Java fundamentals: Features of java – Java development environment – Bytecode - Data types- Variables -Operators – Expressions – Functions – Static Members - Arrays – Strings -– Classes and objects – Constructing objects using constructors.	

UNIT II – Inheritance And Polymorphism	[9 hours]
Inheritance: Types - Access rules, super classes and sub classes – Overriding methods - Overriding vs overloading. Polymorphism: Static binding – Dynamic binding – Method overloading - Runtime polymorphism. Package: Create - Import – Exception handling: Exception - Types – Try and catch - Multiple catch - Nested try – throw - throws – finally - User defined exception.	

UNIT III – Input / Output	[9 hours]
Streams classes: Byte – Character - File class - File operations - Console class – Serialization. Multithreading: Java thread model – Creating thread – Creating multi thread - Thread priorities – Synchronization - Inter thread communication.	

UNIT IV – AWT Controls	[9 hours]
AWT classes – Windows fundamentals – Working with frame windows - Control fundamentals - AWT containers and components - Layout managers – Menu bars and menus- Handling events by extending AWT Components.	

UNIT V – Collections Framework	[9 hours]
Collection overview – Recent changes to collection - Collection interface – Collection classes – Working with maps –Collection algorithms - The legacy classes and interfaces. Applet class: Types – Basics – Architecture – Skeleton – Display methods – repainting – Status window – HTML applet tag – Passing parameter - Creating a swing applet - Painting in swing - A paint example, Exploring swing	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Make use of the basic OOPs concepts and the syntax of arrays, class and object to develop programs.	K3
CO2	Utilize the concept of multithreading and polymorphism to develop programs.	K3
CO3	Apply Inheritance, Polymorphism and Exception handling methods to solve the real time complex problems.	K3
CO4	Apply thread concept for synchronization to complete the task.	K3
CO5	To determine the java framework for real world problem using AWT and interface.	K3

COs and POs Mapping:

Course Outcomes	Programme Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	1	2	-	1	3
CO2	3	2	2	1	2	-	1	3
CO3	3	3	2	1	2	-	1	3
CO4	3	3	2	1	2	-	1	3
CO5	3	3	2	2	2	-	1	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Internal Examination I	Continuous Internal Examination II	End Semester Examination
Remember	20	20	20
Understand	20	20	20
Apply	60	60	60
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Herbert Schildt, "JAVA - The Complete Reference", 7 th Edition, Tata McGraw Hill, 2017.
2. Y. Daniel Liang, Pearson, "Introduction to JAVA Programming, 7th Edition, Tata McGraw Hill, 2017.

Reference Books:

1. Cay S Horstmann and Gary Cornell, "Core Java Volume I & 2", 10th Edition, Pearson Education, 2017.
2. Deitel and Deitel, "JAVA - How to Program", 11th Edition, Prentice Hall International Inc, 2017.

Web Links and Video Lectures (E-Resources):

1. A Basic course on Programming in Java: https://onlinecourses.nptel.ac.in/noc22_cs47/preview
2. Java: https://onlinecourses.swayam2.ac.in/aic20_sp13/preview

Course Code:	24CA202	Course Title:	Cloud Computing Technologies
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To understand the basic concepts of Distributed systems.
- To learn about the current trend and basics of Cloud computing.
- To be familiar with various Cloud concepts.
- To expose with the Server, Network and storage virtualization.
- To be aware of Microservices and DevOps.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. NPTEL and Other Videos
3. Smart Class Room
4. Field visit
5. Project based learning
6. Industrial Visit

UNIT I - DISTRIBUTED SYSTEMS	[9 hours]
Introduction to Distributed Systems – Characterization of Distributed Systems – Distributed Architectural Models –Remote Invocation – Request-Reply Protocols – Remote Procedure Call – Remote Method Invocation – Group Communication – Coordination in Group Communication – Ordered Multicast – Time Ordering – Physical Clock Synchronization – Logical Time and Logical Clocks.	

UNIT II - BASICS OF CLOUD COMPUTING	[9 hours]
Cloud Computing Basics – Desired features of Cloud Computing – Elasticity in Cloud – On demand provisioning - Applications – Benefits – Cloud Components: Clients, Data Centers & Distributed Servers – Characterization of Distributed Systems – Distributed Architectural Models - Principles of Parallel and Distributed computing - Applications of Cloud computing – Benefits – Cloud services – Open source Cloud Software: Eucalyptus, Open Nebula, Open stack, Aneka, Cloudsim.	

UNIT III -CLOUD INFRASTRUCTURE	[9 hours]
Cloud Architecture and Design – Architectural design challenges – Technologies for Network based system - NIST Cloud computing Reference Architecture – Public, Private and Hybrid clouds – Cloud Models : IaaS, PaaS and SaaS – Cloud storage providers - Enabling Technologies for the Internet of Things – Innovative Applications of the Internet of Things.	

UNIT IV- CLOUD ENABLING TECHNOLOGIES	[9 hours]
Service Oriented Architecture – Web Services – Basics of Virtualization – Emulation – Types of Virtualization – Implementation levels of Virtualization – Virtualization structures – Tools & Mechanisms – Virtualization of CPU, Memory & I/O Devices – Desktop Virtualization – Server Virtualization – Google App Engine – Amazon AWS - Federation in the Cloud.	

UNIT V-MICROSERVICES AND DEVOPS	[9 hours]
Defining Microservices - Emergence of Microservice Architecture – Design patterns of Microservices – The Mini web service architecture – Microservice dependency tree – Challenges with Microservices - SOA vs Microservice – Microservice and API – Deploying and maintaining Microservices – Reason for having DevOps – Overview of DevOps – Core elements of DevOps – Life cycle of DevOps – Adoption of DevOps - DevOps Tools – Build, Promotion and Deployment in DevOps.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Utilize Distributed systems in Cloud Environment to split the task across multiple computers.	K3
CO2	Articulate the main concepts, key technologies, strengths and limitations of Cloud Computing for globalization of resources.	K3
CO3	Illustrate the Architecture, Infrastructure and delivery models of Cloud computing to reduce the time and resources	K2
CO4	Use the appropriate current technology for the implementation of Cloud	K3
CO5	Adopt Microservices and DevOps in Cloud environments for faster development and deployment.	K3

COs and POs Mapping:

Course Outcomes	Programme Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	2	1	-	1	3

CO2	3	2	2	2	1	-	2	3
CO3	3	2	2	2	1	-	1	3
CO4	3	2	2	3	1	-	2	3
CO5	3	2	2	2	1	-	2	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final marks</th></tr>
<tr><td rowspan="4">Continuous Internal Examination (CIE)</td><td>CIE – I</td><td>100</td><td rowspan="2">60</td><td rowspan="4">100</td><td rowspan="4">40</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>Skill Assessment – I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td>End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>60</td><td>60</td><td>60</td></tr>
<tr><td colspan="5">Total</td><td>100</td></tr>
</table>

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

<table>
<tr><th rowspan="2">Bloom's Category</th><th colspan="2">Continuous Internal Examination</th><th rowspan="2">End Semester Examination</th></tr>
<tr><th>I</th><th>II</th></tr>
<tr><td>Remember</td><td>20</td><td>20</td><td>20</td></tr>
<tr><td>Understand</td><td>20</td><td>20</td><td>20</td></tr>
<tr><td>Apply</td><td>60</td><td>60</td><td>60</td></tr>
<tr><td>Analyse</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Evaluate</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Create</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Text Books:

1. Kai Hwang, Geoffrey C. Fox & Jack J.Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, First Edition, 2012
2. Andrew S. Tanenbaum & Maarten Van Steen,"Distributed Systems - Principles and Paradigms", Third Edition, Pearson, 2017.

Reference Books:

1. Thomas Erl, Zaigham Mahood & Ricardo Puttini, "Cloud Computing, Concept, Technology & Architecture", Prentice Hall, SecondEdition, 2013.
2. Richard Rodger, "The Tao of Microservices", ISBN 9781617293146, Manning Publications, First Edition, December 2017.
3. Magnus Larsson, "Hands-On Microservices with Spring Boot and Spring Cloud: Build and deploy microservices using spring cloud, Istio and kubernetes", Packt Publishing Ltd, First Edition, September 2019.
4. Jim Lewis, "DEVOPS: A complete beginner's guide to DevOps best practices", ISBN-13:978-1673259148, ISBN-10: 1673259146, First Edition,2019

Web Links and Video Lectures (E-Resources):

1. Advance Distributed Databases:

   https://www.google.com/url?q=https://onlinecourses.nptel.ac.in/noc24_cs99/preview
2. Cloud Computing: https://www.google.com/url?q=https://onlinecourses.nptel.ac.in/noc24_cs118/preview

Course Code:	24CA203	Course Title:	Artificial Intelligence
Credits:	3	L – T – P	3-0-0

Course objectives:

To impart knowledge on the

- To understand the fundamentals of Artificial Intelligence
- To understand the reasoning methods in Intelligent systems.
- To develop semantic-based and context-aware systems to acquire, organize process.
- Apply AI Expert System methods with the real world Problems.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – Overview Of Artificial Intelligence	**[9 hours]**
AI problems, foundation of AI and history of AI - Intelligent agents- Agents and Environments-the concept of rationality, the nature of environments, structure of agents, problem solving agents– Searching for Solution- Uninformed Search Strategies - Informed Search Strategies -Heuristic Functions.	

UNIT II – Adversarial Search And Constraint Satisfaction	**[9 hours]**
Optimal Decisions in Games-Alpha Beta Pruning-Imperfect Real-Time Decisions-Stochastic Games-Partially Observable Games-State-of-the Art Game Programs-Alternative Approaches. Constraint Satisfaction Problems- Propagation-Backtracking-Local Search-Structure of Problems.	

UNIT III – Knowledge, Reasoning, And Planning	**[9 hours]**
Logical Agents- Propositional Logic- First-order predicate Logic –Backward Chaining - Forward Chaining – Resolution – Planning and Acting in the real World-Hierarchical Planning- Multi agent Planning –real world Applications.	

UNIT IV – Communicating, Perceiving, And Acting	**[9 hours]**
Natural Language Processing-Language Models-Classification-Retrieval-Extraction- Natural Language for Communication-Structure Grammars-Parsing-Semantic Interpretation-Machine Translation-Speech recognition- Computer Vision-Image Formation-Operation-Recognitions-Robotics-Perception-Uncertain Movement-Software Architecture-Application Domain in Robotics.	

UNIT V – Expert Systems	**[9 hours]**
Strong method problem Solving-Overview of Expert System- Architecture - Rule Based Expert Systems-Model Based, Case Based, and Hybrid Systems-Analyze the models with the real world examples.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Define the Artificial Intelligence Concepts and Components	K2
CO2	Formulate a problem and find the solution using searching techniques	K2
CO3	Use the knowledge and the process of inference to derive new facts.	K3
CO4	Apply Syntax and Semantic Interpretation to the Problem	K3
CO5	Analyze the Expert System Models.	K4

COs and POs Mapping:

Course Outcomes	Programme Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	2	1	-	1	3
CO2	3	2	2	2	1	-	1	3
CO3	3	3	2	2	1	-	1	3
CO4	3	3	2	2	1	-	2	3
CO5	3	3	2	2	1	-	2	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	I	II	
Remember	20	20	20
Understand	60	20	20
Apply	20	40	40
Analyse	0	20	20
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Stuart Russel and Peter Norvig, “Artificial Intelligence – A modern approach”, Prentice Hall, Third Edition, 2010.
2. G. Luger, “Artificial Intelligence: Structures and Strategies for complex problem solving”, Fourth Edition, Pearson Education.

Reference Books:

1. Elaine Rich, Kevin Knight and Shiva shankar B Nair, “Artificial Intelligence”, McGraw Hill, 2008.
2. Ronald J. Brachman, Hector J. Levesque: Knowledge Representation and Reasoning, Morgan Kaufmann, 2004.
3. Deepak Khemani. A First Course in Artificial Intelligence, McGraw Hill Education (India), 2013.

Web Links and Video Lectures (E-Resources):

1. A Basic course on Artificial Intelligence Search Methods for Problem Solving https://nptel.ac.in/courses/106106226
2. An Introduction to Artificial Intelligence: https://nptel.ac.in/courses/106102220

Course Code:	**24CA204**	**Course Title:**	**Software Engineering Methodologies**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To learn the basic knowledge about the software Engineering and process model.
- Students will be able to choose appropriate process model depending on the user requirements.
- To plan a software engineering process to account for quality issues and non-functional Requirements.
- Students will be able to know various processes used in all the phases of the product.
- Students will be able perform various life cycle activities like Analysis, Design, Implementation, Testing and Maintenance.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning

6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – Introduction	[9 hours]
Nature of software – Software engineering – Software process – Software myths. Process model: Generic process model – Assessment and improvement – Prescriptive process models – Specialized process models- Unified process – Agile process – Extreme programming – other Agile process models - Requirement analysis – Scenario based modeling – UML model – Data modeling concepts- Class based modeling.	

UNIT II – Modeling	[9 hours]
Modeling strategies – Flow oriented modeling – Behavioral model – Patterns for requirement model – Design process – Design concept –Design model – Software architecture – Style – Design – Mapping using data flow – Class based components.	

UNIT III – Software Quality Management	[9 hours]
Software quality – Software quality dilemma – Achieving software quality – Cost impact of software defects – Defect amplification and removal – Review metrics and their use – Formality spectrum – Informal review – Formal technical reviews – Elements of software quality assurance – SQA tasks, goals and metrics – Formal approaches to SQA – Statistical SQA – ISO 9000 quality standard.	

UNIT IV – Software Testing Strategies	[9 hours]
Strategic approach to software testing – Strategic issues – Test strategies for conventional software – Test strategies for object oriented software – Test strategies for webapps – Validation testing – System testing – Debugging – white Box testing- Basic path testing –Control structure testing – Black box testing – Model based testing – Patterns for software testing.	

UNIT V – Software Maintenance	[9 hours]
Maintenance – Supportability – Business process reengineering – Software reengineering – Reverse engineering- Restructuring – Forward engineering – Software process improvement Process -. CMMI – Other SPI frameworks.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Outline the basic concepts of Software engineering for software design.	K2
CO2	Interpret the model and its use to design the software project.	K3
CO3	Apply quality metrics for the project to ensure the quality of the software.	K3
CO4	Utilize the software testing principles on the software project to determine the performance of the software.	K3
CO5	Infer the concepts of reengineering and restructuring for the software project.	K3

COs and POs Mapping:

Course Outcomes	Programme Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	1	2	-	1	3
CO2	3	2	2	1	2	-	1	3
CO3	3	2	3	2	2	-	1	3
CO4	3	2	3	2	2	2	1	3
CO5	3	2	3	2	2	2	1	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final marks</th></tr>
<tr><td rowspan="5">Continuous Internal Examination (CIE)</td><td>CIE – I</td><td>100</td><td rowspan="2">50</td><td rowspan="5">100</td><td rowspan="5">40</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>MCQ</td><td>20</td><td>10</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td>End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>60</td><td>60</td><td>60</td></tr>
<tr><td colspan="5" align="right">Total</td><td>100</td></tr>
</table>

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	I	II	
Remember	20	20	20
Understand	40	40	40
Apply	40	40	40
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Roger Pressman S and Bruce Maxim "Software Engineering: A Practitioner's Approach", Tata McGraw-Hill, 2020.

Reference Books:

1. Ian Sommerville, "Software Engineering", Pearson Education, 2018.
2. Pankaj Jalote's "Software Engineering: A Precise Approach", Wiley,2010
3. James Rumbaugh, Ivar Jacobson and Grady Booch, "The Unified Modeling Language Reference Manual", Pearson Education, 2009.

Web Links and Video Lectures (E-Resources):

1. A Basic course on Software Engineering: https://nptel.ac.in/courses/106105182
2. Software testing: https://nptel.ac.in/courses/106101163

Course Code:	**24CA205**	**Course Title:**	**Mobile Application Development**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To facilitate students to understand about Mobile OS
- To help students to gain basic understanding of Android application development
- To understand how to work with various mobile application development frameworks
- To inculcate working knowledge of Android Studio development tool
- To learn the basic and important design concepts and issues of development of mobile applications

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. NPTEL and Other Videos
3. Smart Class Room
4. Field visit
5. Project based learning
6. Industrial Visit

UNIT I - MOBILE PLATFORM AND APPLICATIONS	**[9 hours]**
Mobile Device Operating Systems — Special Constraints & Requirements — Commercial Mobile Operating Systems — Software Development Kit: iOS, Android, BlackBerry, Windows Phone — MCommerce — Structure — Pros & Cons — Mobile Payment System — Security Issues	

UNIT II - INTRODUCTION TO ANDROID	**[9 hours]**
Introduction to Android: The Android Platform, Android SDK, Eclipse Installation, Android Installation, Building you First Android application, Understanding Anatomy of Android Application, Android Manifest file.	

UNIT III - ANDROID APPLICATION DESIGN ESSENTIALS	**[9 hours]**
Anatomy of Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions.	

UNIT IV- ANDROID USER INTERFACE DESIGN & MULTIMEDIA	**[9 hours]**
User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation. Playing Audio and Video, Recording Audio and Video, Using the Camera to Take and Process Pictures	

UNIT V-ANDROID APIs	**[9 hours]**
Using Android Data and Storage APIs, Managing data using Sqlite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Summarize various mobile operating systems that make it unique for various platforms	K2
CO2	Build Android application by setting up Android development	K3
CO3	Demonstrate methods in Android programming for storing, sharing and retrieving data in applications	K3
CO4	Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces	K3
CO5	Construct interactive applications in android using databases with multiple activities including audio, video and notifications and deploy them in marketplace	K4

COs and POs Mapping:

Course Outcomes	Programme Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	2	1		1	3
CO2	3	2	2	2	1		1	3
CO3	3	3	2	2	1		1	3
CO4	3	3	2	2	1		1	3
CO5	3	3	2	2	1		1	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduce d Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE)	CIE – I	100	60	100	40
	CIE – II	100			
	Skill Assessment – I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	I	II	
Remember	20	20	20
Understand	20	20	20
Apply	60	40	40
Analyse	0	20	20
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2nd ed. (2011)
2. Google Developer Training, "Android Developer Fundamentals Course – Concept Reference", Google Developer Training Team, 2017.

Reference Books:

1. Prasanth Kumar Pattnaik,Rajib Mall,"Fundamentals of Mobile Computing",PHI Learning Pvt.Ltd,New Delhi-2012
2. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd, 2010
3. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd, 2009
4. Dawn Griffiths and David Griffiths, "Head First Android Development", 1st Edition, O‟Reilly SPD Publishers, 2015. ISBN-13: 978-9352131341
5. Erik Hellman, "Android Programming – Pushing the Limits", 1st Edition, Wiley India Pvt Ltd, 2014. ISBN-13: 978-8126547197.

Web Links and Video Lectures (E-Resources):

1. Mobile Application Development:
   https://www.google.com/url?q=https://onlinecourses.nptel.ac.in/noc24_cs118/preview

Course Code:	**24CA206**	**Course Title:**	**Full Stack Web Development**
Credits:	**3**	**L – T – P**	**3-0-0**

Course objectives:

To impart knowledge on the

- To understand the fundamentals of web programming and client side scripting.
- To learn server side development using NodeJS.
- To understand API development with Express Framework.
- To understand and architect databases using NoSQL and SQL databases.
- To learn the advanced client side scripting and ReactJS framework

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. NPTEL and Other Videos
3. Smart Class Room
4. Field visit
5. Project based learning
6. Industrial Visit

UNIT I - INTRODUCTION TO EXPRESS FRAMEWORK	[9 hours]
Introduction – RESTful Services – Introducing Express – Building Your First Web Server – Nodemon – Environment Variables – Route Parameters – Handling HTTP GET Requests – Handling HTTP POST Requests – Calling Endpoints Using Postman – Input Validation – Handling HTTP PUT Requests – Handling HTTP Delete Requests	

UNIT II - SERVER SIDE PROGRAMMING WITH NODE JS	[9 hours]
Introduction to Web Servers – Javascript in the Desktop with NodeJS – NPM – Serving files with the http module – Introduction to the Express framework – Server-side rendering with Templating Engines – Static Files – async/await – Fetching JSON from Express	

UNIT III - ADVANCED NODE JS AND DATABASE	[9 hours]
Introduction to NoSQL databases – MongoDB system overview - Basic querying with MongoDB shell – Request body parsing in Express – NodeJS MongoDB connection – Adding and retrieving data to MongoDB from NodeJS – Handling SQL databases from NodeJS – Handling Cookies in NodeJS – Handling User Authentication with NodeJS	

UNIT IV- ADVANCED CLIENT SIDE PROGRAMMING	[9 hours]
React JS: ReactDOM – JSX – Components – Properties – Fetch API – State and Lifecycle – JS Localstorage – Events – Lifting State Up – Composition and Inheritance	

UNIT V- APP IMPLEMENTATION IN CLOUD	[9 hours]
Cloud providers Overview – Virtual Private Cloud – Scaling (Horizontal and Vertical) – Virtual Machines, Ethernet and Switches – Docker Container – Kubernetes	

Course outcomes:
On completion of the course, the student will have the ability to:

CO1	Utilize the web application framework to build a single, multi and hybrid pages	K3
CO2	Build server side programs of the web application to store information in the database and access dynamically.	K3
CO3	Utilize NoSQL databases with MongoDB for developing scalable applications with evolving data schemas.	K3
CO4	Construct a complete web application using React, NodeJS and MongoDB and deploy on Cloud.	K4
CO5	Utilize the facilities of cloud providers for creating and launching applications	K3

COs and POs Mapping:

Course Outcomes	Programme Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	2	1	-	1	3
CO2	3	2	2	2	1	-	1	3
CO3	3	3	2	2	1	-	1	3
CO4	3	3	2	2	2	-	1	3
CO5	3	3	2	2	2	-	1	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final marks</th></tr>
<tr><td rowspan="4">Continuous Internal Examination (CIE)</td><td>CIE – I</td><td>100</td><td rowspan="2">60</td><td rowspan="4">100</td><td rowspan="4">40</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>Skill Assessment – I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td>End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>60</td><td>60</td><td>60</td></tr>
<tr><td colspan="5">Total</td><td>100</td></tr>
</table>

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	I	II	
Remember	20	20	20
Understand	20	20	20
Apply	60	40	40
Analyse	0	20	20
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. David Flanagan, "Java Script: The Definitive Guide", O'Reilly Media, Inc, 7th Edition, 2020
2. Matt Frisbie, "Professional JavaScript for Web Developers", Wiley Publishing, Inc, 4th Edition, ISBN: 978-1-119-36656-0, 2019

Reference Books:

1. Alex Banks, Eve Porcello, "Learning React", O'Reilly Media, Inc, 2nd Edition, 2020
2. Marc Wandschneider, "Learning Node", Addison-Wesley Professional, 2nd Edition, 2016
3. Joe Beda, Kelsey Hightower, Brendan Burns, "Kubernetes: Up and Running", O'Reilly Media,1st edition, 2017
4. Paul Zikopoulos, Christopher Bienko, Chris Backer, Chris Konarski, Sai Vennam, "Cloud Without Compromise", O'Reilly Media, 1st edition, 2021

Web Links and Video Lectures (E-Resources):

1. Full Stack Web Development: https://nptel.ac.in/courses/106106156
2. Full Stack Web Development: https://www.udemy.com/topic/full-stack-web-development/
3. Full Stack Web Development : https://www.coursera.org/professional-certificates/ibm-full-stack-cloud-developer

Course Code:	24CA231	Course Title:	Full Stack Web Development Laboratory
Credits:	**2**	**L – T – P**	**0-0-4**

Course objectives:

To impart knowledge on the

- Usage of various front and back end Tools
- They can understand and create applications on their own
- Demonstrate and Designing of Websites can be carried out.
- Develop web based applications using suitable client side and server side code.
- Implement web based applications using effective database access.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

S.No	Name of the Experiment
1.	Create a form and validate the contents of the form using JavaScript.
2.	Get data using Fetch API from an open-source endpoint and display the contents in the form of a card.
3.	Create a NodeJS server that serves static HTML and CSS files to the user without using Express.
4.	Create a NodeJS server using Express that stores data from a form as a JSON file and displays it in another page. The redirect page should be prepared using Handlebars.
5.	Create a NodeJS server using Express that creates, reads, updates and deletes students' details and stores them in MongoDB database. The information about the user should be obtained from a HTML form.
6.	Create a NodeJS server that creates, reads, updates and deletes event details and stores them in a MySQL database. The information about the user should be obtained from a HTML form.
7.	Create a counter using ReactJS
8.	Create a Todo application using ReactJS. Store the data to a JSON file using a simple NodeJS server and retrieve the information from the same during page reloads.
9.	Create a simple Sign up and Login mechanism and authenticate the user using cookies. The user information can be stored in either MongoDB or MySQL and the server should be built using NodeJS and Express Framework.
10.	Create and deploy a virtual machine using a virtual box that can be accessed from the host computer using SSH.
11.	Create a docker container that will deploy a NodeJS ping server using the NodeJS image.

Hardware/Software Requirements

1	NodeJS/Express JS, ReactJS, Docker, any IDE like NOTEPAD++/visual studio code/sublime text etc.
2	MySQL, MongoDB

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Implement and deploy the client side of the web application	K3
CO2	Develop and deploy server side applications using NodeJS	K4
CO3	Use Express framework in web development	K3
CO4	Implement and architect database systems in both NoSQL and SQL environments.	K3
CO5	Develop a full stack single page application using React, NodeJS, and a Database and deploy using containers.	K4

COs and POs Mapping:

Course Outcomes	Programme Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	3	2	-	1	3
CO2	3	2	2	3	2	-	1	3
CO3	3	3	2	3	2	-	1	3
CO4	3	3	2	3	2	-	1	3
CO5	3	3	2	3	2	-	1	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	60
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Lab Exam	100	40	40	40
				Total	100

Reference Books:

1. David Flanagan, "Java Script: The Definitive Guide", O'Reilly Media, Inc, 7th Edition, 2020
2. Alex Banks, Eve Porcello, "Learning React", O'Reilly Media, Inc, 2nd Edition, 2020
3. Marc Wandschneider, "Learning Node", Addison-Wesley Professional, 2nd Edition, 2016
4. https://www.geeksforgeeks.org/best-full-stack-developer-courses/

Course Code:	24CA232	Course Title:	Java Programming Laboratory
Credits:	**2**	**L – T – P**	**0-4-0**

Course objectives:

To impart knowledge on the

- To learn the basic concepts of platform independent object oriented language.
- To study the principles of inheritance and polymorphism to demonstrate how to design the abstract classes.
- Familiar with the skills for developing programs using exception handling techniques and multithreading.
- To study the concept of Graphical User Interface
- Able to design a framework using AWT Components.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

S.No	Name of the Experiment
1.	Write a java program using array and control structures.
2.	Implement the program using java classes.
3.	Demonstrate the java program using class and constructors.
4.	Write a java program using method overloading.
5.	Demonstrate the java program using inheritance. (Single, Multilevel)
6.	Write a java program using inheritance and show method overriding.
7.	Demonstrate the java program using interface.
8.	Write a java program using exception handling.

9.	Demonstrate the java program using package.
10.	Implement the java program using file operations.
11.	Write a java program using multithreading.
12.	Demonstrate the java program to implement operations on objects using Collections framework.

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Utilize the OOPs concepts and the syntax of arrays, class and object to develop programs.	K3
CO2	Make use of multithreading and polymorphism to develop programs.	K3
CO3	Apply Inheritance, Polymorphism and Exception handling methods to solve the real time complex problems.	K3
CO4	Use thread concept for synchronization to complete the task.	K3
CO5	To determine a java framework for real world problem using AWT and interface.	K4

COs and POs Mapping:

Course Outcomes	Programme Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	2	1	-	1	3
CO2	3	2	2	2	1	-	1	3
CO3	3	3	2	2	1	-	1	3
CO4	3	3	2	3	1	-	1	3
CO5	3	3	2	3	1	-	1	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	60
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Lab Exam	100	40	40	40
				Total	100

Course Code:	24CA233	Course Title:	Mobile Application Development Laboratory
Credits:	**2**	**L – T – P**	**0-0-4**

Course objectives:

To impart knowledge on the

- To understand the need and characteristics of mobile applications.
- To design the right user interface for mobile applications.
- To understand the design issues in the development of mobile applications.
- To understand the development procedure for mobile applications.
- To develop mobile applications using various tools and platforms.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

S.No	Name of the Experiment
1.	Develop an Android application using controls like Button, TextView, EditText for designing a calculator having basic functionality like Addition, Subtraction, Multiplication, and Division.
2.	Develop an application to set an image as wallpaper. On click of a button, the wallpaper image should start to change randomly every 30 seconds.
3.	Drawing graphics in android, creating animations with androids graphics API, Playing audio & video, Capturing media
4.	Write a program to create an activity with two buttons START and STOP. On pressing the START button, the activity must start the counter by displaying the numbers from One and the counter must keep on counting until the STOP button is pressed. Display the counter
5.	Using Location Manager and Location Provider, working with maps, Working with GPS, Bluetooth and Wi-Fi, Integrating Google maps, services for push notification Google ads
6.	Develop a simple application with one Edit Text so that the user can write some text in it. Create a button called “Convert Text to Speech” that converts the user input text into voice.

7.	Create an activity like a phone dialer with CALL and SAVE buttons. On pressing the CALL button, it must call the phone number and on pressing the SAVE button it must save the number to the phone contacts.

Hardware/Software Requirements

1	JDK, ECLIPSE IDE / equivalent, ANDROID STUDIO

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Understand the basics of mobile application development frameworks and tools	K2
CO2	Develop a UI for mobile applications	K4
CO3	Design mobile applications that manage memory dynamically	K4
CO4	Build applications based on mobile OS like Android.	K3
CO5	Build location based services	K3

COs and POs Mapping:

Course Outcomes	Programme Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	2	1	-	2	3
CO2	3	2	2	2	1	-	2	3
CO3	3	2	2	2	1	-	2	3
CO4	3	2	2	2	1	-	2	3
CO5	3	2	2	3	1	-	2	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	60
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Lab Exam	100	40	40	40
				Total	100

ROHINI COLLEGE OF ENGINEERING AND TECHNOLOGY

(AUTONOMOUS)

(Anjugramam-Kanyakumari Main Road, Palkulam,Variyoor P.O.-629 401, K.K.Dist.)

Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai

Accredited with A+ Grade by NAAC

BE. Mechanical Engineering

Curriculum & Syllabus

(*2024-2025 Admitted Students Onwards*)

Proceedings of the 1st Academic Council [29.06.2024]

Vision Statement of RCET

To be an academic institute of continuous excellence towards education and research in rural regime and provide service to nation in terms of nurturing potentially higher social, ethical and engineering companion graduands.

Mission Statement of RCET

To foster and promote technically competent graduands by imparting the state of art engineering education in rural regime.

To enunciate research assisted scientific learning by dissemination of knowledge towards science, agriculture, industry and national security.

Vision of the Department

To inculcate competence in the field of mechanical engineering for the students by providing quality education and learning opportunities to become ethically strong engineers for the development of society.

Mission of the Department

To provide fundamentals and technical skills in Mechanical Engineering through effective teaching-learning methodologies.

To provide an ambience for research through collaborations with industry and academia.

To inculcate the students' leadership quality through employability skills with ethical values.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1	Graduates will apply the knowledge of Mechanical Engineering concepts and innovative methods to solve real-world engineering problems.
PEO2	Graduates will have the required qualities for a successful carrier in Mechanical Engineering and related fields.
PEO3	Graduates will exhibit professional skills with ethical values and teamwork.

PROGRAMME OUTCOMES (POs)

PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life- long learning in the broadest context of technological change.

CREDIT INFO		
Sl.No	Category	Credits
1	Humanities and Social Science (HSS)	13
2	Basic Science Courses (BSC)	25
3	Engineering Science Courses (ESC)	25
4	Professional Core Courses (PCC)	59
5	Professional Electives Courses (PEC)	18
6	Open Electives Courses (OEC)	12
7	Employability Enhancement Courses (EEC)	17
8	Mandatory Courses (MNC)	-
Total Credits		169

Humanities and Social Science (HSS)							
Sl.no	Course Code	Course Title	Course Type	L	T	P	Credit
1.	24GE101	Heritage of Tamils	HSS	1	0	0	1
2.	24EN101	English for Engineers	HSS	2	0	1	2.5
3.	24GE201	Tamil and Technology	HSS	1	0	0	1
4.	24EN231	Presentation and Language Skills Laboratory	HSS	0	0	3	1.5
5.	24MG601	Product Innovation & Entrepreneurship	HSS	2	0	0	2
6.	24GE701	Professional Ethics and Human Values	HSS	2	0	0	2
7.	24ME701	Industrial Engineering & Psychology	HSS	3	0	0	3
Basic Science Courses (BSC)							
Sl.no	Course Code	Course Title	Course Type	L	T	P	Credit
1.	24MA101	Matrices and Calculus	BSC	3	1	0	4
2.	24PH101	Engineering Physics	BSC	3	0	2	4
3.	24CY101	Engineering Chemistry	BSC	3	0	2	4
4.	24MA201	Complex Variables and Transforms	BSC	3	1	0	4
5.	24PH202	Applied Material Science	BSC	3	0	0	3
6.	24CY401	Environmental Science and Engineering	BSC	2	0	0	2

S.No	Course Code	Course Title	Course Type	L	T	P	Credit
7.	24MA302	Probability, Statistics and Numerical Methods	BSC	4	0	0	4

Engineering Science Courses (ESC)

S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1.	24ME201	Engineering Graphics & Design	ESC	1	0	4	3
2.	24EE201	Fundamentals of Electrical Engineering	ESC	2	0	4	4
3.	24ME301	Engineering Mechanics	ESC	3	1	0	4
4.	24CS201	Programming for Problem Solving Using C	ESC	2	0	4	4
5.	24EC201	Fundamentals of Electronics Engineering	ESC	2	0	2	3
6.	24GE231	Workshop Practice	ESC	0	0	3	1.5
7.	24CS331	Programming for Problem Solving In Python	ESC	0	0	3	1.5
8.	24EE404	IoT-Sensors and Devices	ESC	3	0	2	4

Professional Core Courses (PCC)

S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1.	24ME302	Engineering Thermodynamics	PCC	3	0	0	3
2.	24ME304	Kinematics of Machinery	PCC	3	0	0	3
3.	24ME305	Fluid Mechanics & Hydraulic Machines	PCC	3	0	2	4
4.	24ME306	Engineering Materials &Metallurgy	PCC	2	0	2	3
5.	24ME307	Manufacturing Processes	PCC	3	0	2	4
6.	24ME401	Thermal Engineering	PCC	3	0	2	4
7.	24ME402	Mechanics of Materials	PCC	3	0	2	4
8.	24ME403	Metrology & Measurements	PCC	2	0	2	3
9.	24ME404	Machine Tools and Machining	PCC	3	0	2	4
10.	24EC501	Microprocessors, Microcontrollers and Interfacing Techniques	PCC	3	0	2	4
11.	24ME501	Dynamics of Machinery	PCC	3	0	2	4
12.	24ME502	Heat and Mass Transfer	PCC	3	0	2	4
13.	24ME601	Design of Machine Elements	PCC	3	0	0	3

14.	24ME602	Mechatronics, Robotics & Control	PCC	3	0	2	4
15.	24ME631	Computer Aided Modelling and Assembly Laboratory	PCC	0	0	2	1
16.	24ME702	Design of Transmission Systems	PCC	3	0	0	3
17.	24ME703	Finite Element Analysis	PCC	3	0	2	4
Professional Electives Courses (PEC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
Professional Elective- I (Materials And Design Stream)							
1.	24ME571	Foundation Skills In Integrated Product Development	PEC	3	0	0	3
2.	24ME572	Engineering Optimization	PEC	3	0	0	3
3.	24ME573	Bio-Materials	PEC	3	0	0	3
4.	24ME574	Micro And Nano Electro-Mechanical Systems	PEC	3	0	0	3
5.	24ME575	Geometric Modeling	PEC	3	0	0	3
6.	24ME576	Composite materials	PEC	3	0	0	3
PROFESSIONAL ELECTIVE- II (Automotive ENGINEERING STREAM)							
1.	24ME581	Intelligent Vehicle System	PEC	3	0	0	3
2.	24ME582	Automotive Testing	PEC	3	0	0	3
3.	24ME583	Electric And Hybrid Vehicle Systems	PEC	3	0	0	3
4.	24ME584	Automotive Electronic Systems	PEC	3	0	0	3
5.	24ME585	Automotive Emission & NVH Control	PEC	3	0	0	3
6.	24ME586	Automotive Styling	PEC	2	0	2	3
PROFESSIONAL ELECTIVE- III (THERMAL STREAM)							
1.	24ME671	Computational Fluid Dynamics	PEC	2	0	2	3
2.	24ME672	Refrigeration And Air Conditioning	PEC	2	0	2	3
3.	24ME673	Energy Conversion Technologies	PEC	2	0	2	3
4.	24ME674	Renewable Energy	PEC	2	0	2	3
5.	24ME675	Design Of Heating And Ventillation Systems	PEC	2	0	2	3

S.No	Course Code	Course Title	Course Type	L	T	P	Credit
6.	24ME676	Gas Dynamics And Jet Propulsion	PEC	2	0	2	3
PROFESSIONAL ELECTIVE- IV (MANUFACTURING STREAM)							
1.	24ME681	Pneumatic And Hydraulic Systems	PEC	2	0	2	3
2.	24ME682	Additive Manufacturing	PEC	2	0	2	3
3.	24ME683	Computer Integrated Manufacturing	PEC	2	0	2	3
4.	24ME684	Advance In Welding Technology	PEC	2	0	2	3
5.	24ME685	Non-Destructive Testing	PEC	2	0	2	3
6.	24ME686	Intelligent Manufacturing	PEC	2	0	2	3
PROFESSIONAL ELECTIVE- V (INDUSTRIAL ENGINEERING STREAM)							
1.	24ME771	Statistical Quality Control	PEC	3	0	0	3
2.	24ME772	Operation Research	PEC	3	0	0	3
3.	24ME773	Supply Chain Management	PEC	3	0	0	3
4.	24ME774	Total Quality Management	PEC	3	0	0	3
5.	24ME775	Product Development And Management	PEC	3	0	0	3
6.	24ME776	Digital Marketing	PEC	3	0	0	3
PROFESSIONAL ELECTIVE- VI (ROBOTICS &AUTOMATION STREAM)							
1.	24ME781	Industry 4.0	PEC	3	0	0	3
2.	24ME782	Industrial Robotics	PEC	3	0	0	3
3.	24ME783	Industrial Automation	PEC	3	0	0	3
4.	24ME784	Industrial Networking	PEC	3	0	0	3
5.	24ME785	Virtual Instrumentation Systems	PEC	3	0	0	3
6.	24ME786	Material Handling Systems	PEC	3	0	0	3
Open Electives Courses (OEC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
OPEN ELECTIVE-I (Artificial Intelligence and Computer science and Engineering)							
1.	24AI601	Artificial Intelligence and Machine Learning Fundamentals	OEC	3	0	0	3
2.	24AI602	Business Intelligence and Its Applications	OEC	3	0	0	3

3.	24AI603	Data Science Fundamentals	OEC	3	0	0	3
4.	24CS601	Augmented Reality / Virtual Reality	OEC	3	0	0	3
5.	24CS602	Full Stack Development	OEC	3	0	0	3
6.	24CS603	Software Testing and Quality Assurance	OEC	3	0	0	3
7.	24CS604	Cloud Computing	OEC	3	0	0	3
OPEN ELECTIVE-II (Civil and Agricultural Engineering)							
1.	24AG601	Principles of Crop Production	OEC	3	0	0	3
2.	24AG602	Dairy and Food Engineering	OEC	3	0	0	3
3.	24AG603	Post-Harvest Technology	OEC	3	0	0	3
4.	24AG604	Agricultural Finance, Banking and Co-operation	OEC	3	0	0	3
5.	24CI601	Rural Development	OEC	3	0	0	3
6.	24CI602	Geographic Information System	OEC	3	0	0	3
7.	24CI603	Water Resources management	OEC	3	0	0	3
8.	24CI604	Climate Change and its Impact	OEC	3	0	0	3
OPEN ELECTIVE-III (Bio Medical and Electrical Engineering)							
1.	24BM701	Wearable Devices	OEC	3	0	0	3
2.	24BM702	Telemedicine and Healthcare Delivery	OEC	3	0	0	3
3.	24BM703	Medical Informatics	OEC	3	0	0	3
4.	24BM704	Basics of Human Anatomy and Physiology	OEC	3	0	0	3
5.	24EE701	Robot Process Automation	OEC	3	0	0	3
6.	24EE702	Electric vehicle Technology	OEC	3	0	0	3
7.	24EE703	Smart Grid	OEC	3	0	0	3
8.	24EE704	Energy Conservation and Management	OEC	3	0	0	3
OPEN ELECTIVE-IV (Electronics and Communication and Instrumentation)							
1.	24EC501	Nano Electronics	OEC	3	0	0	3
2.	24EC503	Digital Signal Processing	OEC	3	0	0	3
3.	24EC504	Fuzzy Logic Systems and ANN	OEC	3	0	0	3
4.	24EC506	Fiber Optic Sensors	OEC	3	0	0	3

5.	24MG701	Industrial Instrumentation	OEC	3	0	0	3
6.	24MG702	Process Automation and Control	OEC	3	0	0	3
7.	24MG703	Control Systems	OEC	3	0	0	3
8.	24MG704	Micro Electromechanical Systems	OEC	3	0	0	3
Employability Enhancement Courses (EEC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1.	24ME351	Mini Project – I (Introduction to Innovative Projects)	EEC	0	0	2	1
2.	24ME451	Mini Project – II (Design and development of the product)	EEC	0	0	2	1
3.	24EN451	Soft Skills Development	EEC	0	0	2	1
4.	24ME551	Mini Project – III (Community based Project)	EEC	0	0	2	1
5.	24EN651	Business and Managerial Communications	EEC	0	0	2	1
6.	24GE551	Quantitative and Reasoning Skills-I	EEC	0	0	2	1
7.	24ME651	Mini Project-IV (Micro Project)	EEC	0	0	2	1
8.	24GE651	Quantitative and Reasoning Skills-II	EEC	0	0	2	1
9.	24ME751	Project Work Phase- I (Design & Analysis)	EEC	0	0	4	2
10.	24ME752	Industrial Training / Internship	EEC	0	0	0	2
11.	24ME851	Project Work Phase- II (Prototype& Testing)	EEC	0	0	10	5
Mandatory Courses (MNC)							
S.No	Course Code	Course Title	Course Type	L	T	P	Credit
1.	24MC101	Induction Programming	MNC	THREE WEEKS			
2.	24MC201	Sports and Yoga for Youth Empowerment - I	MNC	0	0	2	0
3.	24MC202	NCC Credit Course Level - I	MNC	1	0	2	1#
4.	24MC301	Sports and Yoga for Youth Empowerment - II	MNC	0	0	2	0

5.	24MC401	NCC Credit Course Level - II	MNC	1	0	2	1#
6.	24MC601	Disaster Management	MNC	1	0	0	1#
7.	24MC701	Constitutions of India	MNC	1	0	0	1#

# denotes no credit

Recommended Courses for I st SEMESTER

S. No.	Course Code	Course Title	Course Category	L	T	P	C
THEORY COURSES							
1.	24GE101	தமிழர் மரபு /Heritage of Tamils	HSS	1	0	0	1
2.	24MA101	Matrix and calculus	BSC	3	1	0	4
INTEGRATED COURSES							
3.	24EN101	English For Engineers	HSS	2	0	1	2.5
4.	24PH101	Engineering Physics	BSC	3	0	2	4
5.	24CY101	Engineering Chemistry	BSC	3	0	2	4
6.	24ME201	Engineering Graphics & Design	ESC	1	0	4	3
7.	24EE101	Fundamentals of Electrical Engineering	ESC	2	0	4	4
MANDATORY COURSES							
8.	24MC101	Induction Programming	MNC	Three Weeks			
		Total		**14**	**1**	**15**	**22.5**

Recommended Courses for IInd SEMESTER

S. No.	Course Code	Course Title	Course Category	L	T	P	C
THEORY COURSES							
1.	24GE201	தமிழரும் தொழில்நுட்பமும் / Tamil and Technology	HSS	1	0	0	1
2.	24MA201	Complex Variables and Transforms	BSC	4	0	0	4
3	24PH202	Applied Material Science	BSC	3	0	0	3
4	24CY401	Environmental Science and Engineering	BSC	2	0	0	2
5	24ME301	Engineering Mechanics	ESC	3	1	0	4
INTEGRATED COURSES							
6	24CS201	Programming For Problem Solving Using C	ESC	2	0	4	4
7	24EC201	Fundamentals of Electronics Engineering	ESC	2	0	2	3
LABORATORY COURSES							
8	24GE231	Workshop Practices	ESC	0	0	3	1.5
9	24EN231	Presentation and Language Skills Laboratory	HSS	0	0	3	1.5
MANDATORY COURSES							
10	24MC201	Sports and Yoga For Youth Empowerment - I	MNC	0	0	2	0
11	24MC202	NCC Credit Course Level - I	MNC	1	0	2	1#
		Total		**17**	**1**	**12**	**24**

பாடநெறி குறியீடு:	24GE101	பாடத்தின் தலைப்பு:	தமிழர்மரபு
கிரெடிட்	1	L - T - P	1-0-0

பாடத்திட்ட நோக்கங்கள்:

1. தமிழின் மதச்சார்பற்ற தன்மை, இந்திய மொழிக் குடும்பத்தின் திராவிட மொழி, திருக்குறளின் கருத்துக்கள், சமயங்களின் தாக்கம், நவீன இலக்கிய வளர்ச்சி ஆகியவற்றை நினைவு கூர்தல்.
2. தமிழர்களின் சமூக மற்றும் பொருளாதார வாழ்வில் நடுகல், சிற்பங்கள், சிலைகள் மற்றும் அழகிய கைவினைப் பொருட்கள், இசைக்கருவிகள் ஆகியவற்றின் தொடர்புடைய அறிவைக் கோடிட்டுக் காட்டுதல்.
3. தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகளை மனதில் பதிய வைத்தல்.
4. தமிழ்நாட்டின் தாவரங்கள் மற்றும் விலங்கினங்கள், சங்க நகரங்கள் மற்றும் துறைமுகங்கள், சங்க காலத்தின் ஏற்றுமதி மற்றும் இறக்குமதிகளை நினைவுபடுத்துதல், வெளிநாடுகளில் சோழர் படையெடுப்பைக் கண்டறிதல்.
5. இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கைக் கண்டறிதல், இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்குக்கு இணையாக இந்தியாவின் பிற பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கத்தை அடையாளம் காணுதல்.

அலகு I மொழி மற்றும் இலக்கியம்:	**[3hours]**
இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம்- பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.	
அலகு II மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக்கலை:	**[3hours]**
நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை	

- இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:	**[3hours]**
தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.	

அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள்:	**[3hours]**
தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறைமுகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி.	

அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு:	**[3hours]**
இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தங்கங்களின் அச்சு வரலாறு.	

பாடநெறி முடிவுகள் (பாமு):

பாடநெறியின் முடிவில், மாணவர் பின்வரும் திறன்களைப் பெறுவர்:

பாமு	**பாடநெறி முடிவுகள்**	**மிக உயர்ந்த அறிவாற்றல் நிலை**
அலகு I பாமு:	தமிழின் மதச்சார்பற்ற தன்மை, திராவிட மொழியின் பங்கு, திருக்குறளின் கருத்துக்கள், சமயங்களின் தாக்கம், நவீன இலக்கிய வளர்ச்சி ஆகியவற்றையும் தெரிந்துகொள்கிறார்கள்.	கே 1

அலகு II பாமு:	தமிழர்களின் சமூக மற்றும் பொருளாதார வாழ்வில் நடுகல், சிற்பங்கள், சிலைகள் மற்றும் அழகிய கைவினைப் பொருட்கள், இசைக்கருவிகள் ஆகியவற்றை விவரிக்கும் ஆற்றலை பெறுகிறார்கள்.	கே 2
அலகு III பாமு:	தமிழர்களின் பாரம்பரிய விளையாட்டுகளை தெரிந்து கொள்ளுவதால் விளையாட வேண்டும் ஏன்ற ஆர்வத்தை பெறுகிறார்கள்.	கே 1
அலகு IV பாமு:	தமிழ்நாட்டின் தாவரங்கள் மற்றும் விலங்கினங்கள் பற்றிய அறிவையும், சங்க கால கட்டிடக்கலை, ஏற்றுமதி மற்றும் இறக்குமதி தொழில் நுட்ப அறிவை பெறுகிறார்கள்..	கே 1
அலகு V பாமு:	இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கையும், இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு இணையாக இருப்பதையும், தெரிந்து கொள்கிறார்கள்.	கே 1

பாமு**கள்**	**மிக உயர்ந்த அறிவாற்றல் நிலை**	**பாடநெறி முடிவுகள்**											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
பாமு**1**	கே 1	**2**	-	-	-	-	-	-	-	-	-	-	-
பாமு**2**	கே 2	**1**	-	-	-	-	-	-	-	-	-	-	-
-பாமு**3**	கே 1	**1**	-	-	-	-	-	-	-	-	-	-	-
பாமு**4**	கே 1	**1**	-	-	-	-	--	-	-	-	-	-	-
பாமு**5**	கே 1	**1**	-	-	-	-	-	-	-	-	-	-	-

பாடநெறி முடிவுகள் மற்றும் நிரல் முடிவுகள் ஒப்பிடுதல்

நிலை 3- அதிக ஒத்துப்போதல், நிலை 2- மிதமாக ஒத்துப்போதல், நிலை 1- குறைவாக ஒத்துப்போதல், நிலை 0- ஒத்துப்போகவில்லை

மதிப்பீட்டுத் திட்டம்:

கூறுகள்	மதிப்பீட்டின் வகை	அதிகபட்ச மதிப்பெண்கள்	குறைக்கப்பட்ட மதிப்பெண்கள்	இறுதி மதிப்பெண்கள்
தொடர்ச்சியான உள் தேர்வு	தொடர்ச்சியான உள் தேர்வு - I	100	40	40
	தொடர்ச்சியான உள் தேர்வு - II	100	40	

இறுதி பருவ தேர்வு	எழுத்து தேர்வு	100	60	60
மொத்தம்				100

மதிப்பீட்டு முறை

ப்ளூமின் வகை	தொடர்ச்சியான மதிப்பீட்டு சோதனைகள்		இறுதி தேர்வு
	1	2	
நினைவில் கொள்ளுதல்	60	50	60
புரிந்து கொள்ளுதல்	40	50	40
விண்ணப்பித்தல்	0	0	0
பகுப்பாய்வுதல்	0	0	0
மதிப்பிடுதல்	0	0	0
உருவாக்குதல்	0	0	0

இறுதி பருவ தேர்வு: (கேள்வி முறை)

- ஒவ்வொரு யூனிட்டும் இரண்டு 2 மதிப்பெண் வினாக்களையும் ஒரு 16 மதிப்பெண் வினாவையும் (இரண்டில் ஒன்று) கொண்டுள்ளது.
- பதினைந்து கேள்விகளுக்கும் பதிலளிக்க வேண்டும்.

TEXT BOOKS

1. .தமிழகவரலாறு - மக்களும்பண்பாடும் - கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்).

2. கணினித்தமிழ் -முனைவர் இல. சுந்தரம். (விகடன்பிரசுரம்).

3. கீழடி - வைகைநதிக்கரையில்சங்ககாலநகரநாகரிகம் (தொல்லியல்துறைவெளியீடு)

4. பொருநை - ஆற்றங்கரைநாகரிகம். (தொல்லியல்துறைவெளியீடு)

5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)

6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.

REFERENCE BOOKS

1. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).

2.The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)

3. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

4. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)

5.. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)

6.. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Course Code:	**24MA101**	**Course Title:**	**Matrices and calculus** (Common to AI&DS, Agri, Biomedical, Civil, CSE, CSE(AI&ML), EEE, ECE, MECH)
Credits:	**4**	**L – T – P**	**3 – 1 – 0**
Pre-requisite			**NIL**

Course objectives:

- To provide the basic tools of calculus mainly for the purpose of modeling the engineering problems mathematically and obtaining solutions.
- To learn the concept of eigenvalues and eigenvectors and to reduce the quadratic form to canonical form.
- To learn the foundation course of single variable and multivariable calculus plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

Teaching-Learning Process:

These are sample strategies which teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method does not mean only traditional method, but different type of teaching methods may be adopted to develop the outcomes.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Topics will be introduced in a multiple representation and encourage the students to come up with their own creative ways to solve them.

• Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT I – Matrices	[12 hours]
Eigenvalues, Eigenvectors and their properties – Diagonalization of a matrix (Symmetric matrix) – Cayley - Hamilton theorem (without proof) – Inverse and Power of a matrix by Cayley - Hamilton theorem – Quadratic forms and Nature of quadratic forms. Application: Reduction of a quadratic form to canonical form by orthogonal transformation.	

UNIT II – Differential Calculus	[12 hours]
Functions – Limit – Continuity – Derivatives – Differentiation rule – Product and quotient rules – Chain rules – Implicit differentiation – Logarithmic differentiation. Application: Maxima and Minima of functions of one variable	

UNIT III – Functions of Several Variables	[12 hours]
Partial differentiation – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables. Application: Maxima and Minima of functions of two variables using MATLAB - Lagrange's method of undetermined multipliers.	

UNIT IV – Integral Calculus	[12 hours]
Definite and Indefinite integrals - Substitution rule - Techniques of Integration: Bernoulli's theorem (without proof) – Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals. Application: Area between simple closed curves.	

UNIT V – Multiple Integrals	[12 hours]
Double integrals –Double integrals in cartesian and polar coordinates – Change of order of integration– Area enclosed by plane curves – Triple integrals – Change of variables in double and triple integrals. Application: Volume of solids, Mass of Lamina	

Course outcomes:

On completion of the course, the student will have the ability to:

COs	Course Outcome	Cognitive domain
CO1	Apply the matrix algebraic techniques for eigen value related applications	K3
CO2	Understand the concepts of limit and continuity of functions	K2
CO3	Compute the derivatives and the extreme points and solve engineering problems	K3
CO4	Use the partial derivatives to find the maxima and minima of multivariable functions	K3
CO5	Use fundamental theorem of calculus to evaluate definite integrals	K3
CO6	Apply the concepts of multiple integrals to find the areas and volumes of geometrical shapes	K3

COs and POs Mapping:

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	2	1	-	2	-	-	-	-	-	-	2
CO2	2	1	1	-	-	-	-	-	-	-	-	1
CO3	3	2	1	-	2	-	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	-
CO6	3	2	1	-	1	-	-	-	-	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final marks</th></tr>
<tr><td rowspan="5">Continuous Internal Examination (CIE)</td><td>CIE – I</td><td>100</td><td rowspan="2">50</td><td rowspan="5">100</td><td rowspan="5">40</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>MCQ</td><td>20</td><td>10</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td>End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>60</td><td>60</td><td>60</td></tr>
<tr><td colspan="5">Total</td><td>100</td></tr>
</table>

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or choice).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	20	20	20
Understand	40	20	20
Apply	40	60	60
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
3. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 2015. [For Units II & IV - Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8]

Reference Books:

1. Muthusubramanian R and Salivahanan S, "Basic Electrical and Electronics Engineering," McGraw Anton. H, Bivens. I and Davis. S, " Calculus ", Wiley, 10th Edition, 2016
2. Bali. N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
3. Jain. R.K. and Iyengar. S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition, 2016.
4. Narayanan. S. and Manicavachagom Pillai. T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.

5. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.Hill, NewDelhi, 2009.

Equivalent NPTEL/SWAYAM Courses

SI.No.	Course Title	Course Instructor	Host Institute
1	Matrix Analysis with Applications	Prof. S. K. Gupta Prof. Sanjeev Kumar	IIT Roorkee
2	Calculus of One Real Variable	Prof. Joydeep Dutta	IIT Kanpur

Web Links and Video Lectures (E-Resources):

1. System of Linear Equations, Eigenvalues and Eigenvectors:
https://www.nptelvideos.com/lecture.php?id=13416
2. Concept of Domain, Limit, Continuity and Differentiability:
https://www.nptelvideos.com/lecture.php?id=13422
3. Matrix Diagonalization: https://www.nptelvideos.com/lecture.php?id=13481

Course Code:	**24EN101**	**Course Title:**	**ENGLISH FOR ENGINEERS** (Common to AI&DS, AE, BME, CE, CSE, CSE(AI&ML), EEE, ECE, MECH)
Credits:	**2.5**	**L – T – P**	**2-0-1**

Course Objectives:

- To develop an understanding of Basic English Grammar.
- To enhance listening skills and select appropriate responses.
- To practise presentation and speaking techniques.
- To develop a quest for reading.
- To practise professional writing.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Language learning softwares / Language Lab
3. Online Resources
4. Smart Class Room
5. Flipped classrooms
6. Project based Collaborative Experiential learning
7. Expert Lecture sessions

UNIT I - BASIC GRAMMAR- VOCABULARY AND EXPRESSIONS	**[8 hours]**
Grammar: Parts of speech - Types of sentences: Assertive - Imperative - Interrogative & Exclamatory - Affirmative - Negative - Gerunds & Infinitives - Tenses - Voices- Impersonal passives- Prepositions - Articles & Determiners- Cause and effect expressions - Vocabulary: Affixes- Synonyms & Antonyms - Homonyms - Homophones- Compound Nouns.	

UNIT II - ACTIVE LISTENING - RESPONDING		**[15 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
SI. No.	**Topic**	**Hours**
1.	Listening to Audio (Podcasts- Audiobooks- Radio Program) and Practice Exercise-Answering Cloze Test Based on Listening	3
2.	Listening to native speaker's Telephone Conversations– Analyzing a Product	3
3.	Listening to Job Interviews - Sports Commentaries / Animated stories / Anecdotes / Event narration	3
4.	Video Comprehension – Brainstorming and Note-Taking	3
CLASSROOM ACTIVITIES		
1.	Listening to Statistical Information and Follow-up Exercises. - Form Filling Exercises	1
2.	Debate and reviewing the performance of each participant - Panel Discussion	2

UNIT III: SPEAKING AND PRESENTATION SKILLS		[15 hours]
LIST OF EXERCISES		
LAB ACTIVITIES		
SI. No.	**Topic**	**Hours**
1.	Speaking Development through English software S-net or Globarena and Online Content (Tenses- Voices- SV Agreement-Prepositions- Coherence Markers- Relative Clauses- Modals- Punctuation)	5
CLASSROOM ACTIVITIES		
1.	Self-Introduction - Sharing Childhood Experiences- Talking about Favorite Personalities	1
2.	Describing Recent Innovation in Technology	1
3.	Interviewing Celebrities and Entrepreneurs	1
4.	Situational Conversations (Meeting a friend in a cafe) - Narrating Personal Experience	1
5.	Group Communication- Discussing Social Issues- Current Affairs and Debate	1
6.	Role-Play- Picture/Movie Description	1
7.	Presentation – I (Book /Movie Review- Story Telling- General Presentations)	2
8.	Presentation – II (Technical Presentations)	2

UNIT IV: READING BETWEEN LINES		[12 hours]
LIST OF EXERCISES		
LAB ACTIVITIES		
SI. No.	**Topic**	**Hours**
1.	Reading Comprehension - skimming - scanning (General / Technical passages	2
2.	Reading Longer Texts with Time Frame	2
3.	Reading Data using different types of Texts- Magazines and Internet Materials	2

4.	Reading Research Papers-- Editing/Proofreading	2
CLASSROOM ACTIVITIES		
1.	Job Advertisements – Manual for Product/Service – Telephone Phrases	1
2.	Reading Cause and Effect Essays-Technical Papers and Case Studies - Sorting out jumbled Sentences in a Paragraph	2
3.	Short Stories - Critical Reading	1

UNIT V- WRITING FOR ENGINEERS	[7+3 hours]
Writing - Application Letters - Resume- Product Description - Essay related to Technical / Social / current topics - Interpretation of Charts - Short Articles on everyday life - letters – Enquiry- Quotation- Order- Claim - Adjustment - Response to complaints - Statement of Purpose (SoP) -Emails - Memos -Notices - Circulars - Minutes of Meetings - Internship - Accident Report - Feasibility Report- Recommendations.	

LIST OF EXERCISES		
LAB ACTIVITIES		
SI. No.	**Topic**	**Hours**
1.	Mind Mapping and Brainstorming on any Social Event/Issue	1
2.	Creating a Blog/Vlog/YouTube Channel –Uploading MP3/MP4 – Practice (Movie/Book/ Gadget Review- General/Tech Talks- Interview with Celebrities)	1
3.	Creating a Product Review Blog.	1

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Level
CO1	Identify various grammatical components- build vocabulary and apply expressions for error-free sentences	K3
CO2	Make use of appropriate words to respond by listening to general and technical online contents	K3
CO3	Experiment with the nuances of presentation and speaking skills	K3
CO4	Apply reading skills in various academic contexts	K3
CO5	Construct legible and flawless sentences proficiently with appropriate choice of words and structures for varied professional contexts	K3

COs and POs Mapping:

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	-	-	-	-	-	-	-	-	-	3	-	3
CO2	-	-	-	-	-	-	-	-	-	3	-	3
CO3	-	-	-	-	-	-	-	-	-	3	-	3
CO4	-	-	-	-	-	-	-	-	-	3	-	3
CO5	-	-	-	-	-	-	-	-	-	3	-	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max. Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - **Theory**	CIE – I	100	60	100	25
	CIE – II	100			
	Skill Assessment I (2 Assignments + 1 seminar)	40	40		
	Skill Assessment II (3 Assignments)	40			
Continuous Internal Examination (CIE) - **Laboratory**	Continuous Assessment (Lab activities & exercises)	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	10	10	10
Understand	30	30	30

Apply	60	60	60
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Gangalakshmi- C- Rathika- B- Saranraj- L. Professional English for Engineers. New Delhi: Cengage- 2022.
2. Murphy- Raymond. English Grammar in Use Book with Answers: A Self-study Reference and Practice Book for Intermediate Learners of English. Fourth Edition: Cambridge University Press- 2012.

Reference Books:

1. Raman- Meenakshi and Sangeetha Sharma. Communication Skills. New Delhi: OUP-2018
2. R. C. Sharma_ Krishna Mohan - Business Correspondence and Report Writing _ a Practical Approach to Business _ Technical Communication-Mc Graw Hill India (2017)

Web Links and Video Lectures (E-Resources):

MANUALS / SOFTWARE: Open Sources / British Council / Cambridge Websites

Suggested Skill Activities:

1) Listening tests materials [Select podcasts / radio programmes / YouTube videos / audiobooks / materials from British Council] - Cloze tests where students fill in missing

words from transcripts – Yes or No Question Answers – one-word answers based on recording – summary of recording

2) Self-introduction / Introduce Colleague
3) Just a Minute talks
4) Extempore
5) Mock GDs
6) Mock Interviews
7) Note Taking of Engineering Lectures
8) Create videos / blogs
9) Present Technical Papers
10) Reading Comprehension Exercises
11) Writing letters – Leave letter – Letter for academic purposes
12) Writing Essays
13) Composing Mails
14) Preparing Statement of Purpose
15) Preparing Covering letter and Resume

CourseCode	**24CY101**	**Course Title:**	**Engineering Chemistry (Common to ALL Branches)**
Credits:	**4**	**L – T – P**	**3-0-2**

Course objectives:

- To provide a comprehensive understanding of water quality parameters, water treatmenttechniques and wastewater systems.
- To use the fundamental science and engineering principles relevant to materials that includescharacterization, properties and processing of engineering materials.
- To familiarize with the principles, working and applications of electrochemistry and storagedevices for safe, effective and efficient operations.
- To study, measure, monitor, control and prevent corrosion processes, economically andsafely.
- To classify different types of fuel and fuel analysis techniques that assists to choose mostconvenient fuel for a process involving combustion.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Blended Mode of Learning
3. Experiential Learning
4. NPTEL and Other Videos for theory topics
5. Flipped Class
6. Lab Experiment Videos

UNIT-1 WATER TREATMENT	[9 hours]
Water Sources- Water Quality parameters - Hardness of water – types-units and calcium carbonate equivalent. -Determination of hardness of water by EDTA method. Scale and sludge, caustic embrittlement, priming and foaming and boiler corrosion. Water softening methods – internal and external conditioning –zeolite process and ion exchange process. Desalination – reverse osmosis and electro dialysis- Municipal water treatment and waste water treatment process.	
Practical Topics: 1. Determination of total hardness by EDTA method. 2. Estimation of alkalinity by Indicator method. 3. Estimation of chlorine content in water sample by Argentometric method. 4. Determination of BOD in water samples.	

UNIT-2 CHEMISTRY OF ENGINEERING MATERIALS	[9 hours]
Adhesives: Introduction- requisites of a good adhesive-adhesive action- industrial applications of adhesives. **Insulating Materials**: Introduction- requirements- Glass and ceramics - preparation, properties and applications - fabrication of ceramic ware. **Lubricants-**Classification of lubricants with examples-characteristics of a good lubricants - mechanism of lubrication (thick film, thin film and extreme pressure) - properties of lubricants: viscosity, cloud point, pour point, flash point and fire point. **Electronic materials:** Introduction-types, properties and applications of semiconducting materials and transistors, materials used in IC's, fibers and cables- properties and applications, organic solar cells - types and applications.	
Practical Topics: 1. Determination of viscosity of oils using Oswald viscometer. 2. Determination of cloud point and pour point of oils.	

UNIT-3	[9 hours]

ELECTROCHEMISTRY	
Introduction – Electrode potential – Nernst equation and problems - Electrochemical series - Conductometric titrations (acid - base & precipitation titration) **Electrodes:** Construction, working and applications of Standard and reference electrode (Hydrogen & Calomel) – Ion selective (glass electrode) – determination of pH using glass electrode. Batteries and Fuel Cells – Types of batteries —dry cell -Lead Storage battery–Nickel- Cadmium Battery – Lithium battery – Battery hazards - Biological Batteries. Fuel Cells – Hydrogen-Oxygen FuelCell.	
Practical Topics: 1. Estimation of strength of hydrochloric acid by pHmetry. 2. Determination of strength of acids in a mixture of acids using conductivity meter. 3. Determination of charging and discharging rate of batteries.	

UNIT-4 **CORROSION AND ITS CONTROL**	**[9 hours]**
Corrosion – causes, factors, types, Chemical and Electrochemical Corrosion (Galvanic, Differential aeration) –galvanic series-factors influencing rate of corrosion-measurement of corrosion. Determination of corrosion rate by weight loss method. Control Methods-Electrochemical protection – Sacrificial Anodic method – Impressed Current Cathodic Protection – Corrosion Inhibitors – Bio corrosion Protective Coatings – Paints, Constituents,Functions- Surface coating - Surface preparation for metallic coatings, Electroplating and Electro-lessPlating- ceramic coatings, thermal vaporization coating, HVOF coating	
Practical Topics: 1. Estimation of the Ferrous ions in mild steel by Spectrophotometry. 2. Determination of rate of corrosion of by weight loss method	

UNIT-5 **FUELS AND COMBUSTION**	**[9 hours]**
Fuels: Introduction: Classification of fuels; solid fuel -Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Liquid fuels -Manufacture of synthetic petrol –hydrogenation of coal (Bergius process), Knocking – octane number, diesel oil – cetane number; Power alcohol and biodiesel. Combustion of fuels: Introduction: Calorific value – higher and lower calorific values, Theoretical calculation of calorific value by Dulong's formula - Ignition temperature: spontaneous ignition temperature, Explosive range; Flue gas analysis – ORSAT Method.	
Practical Topics: 1. Determination of flash point and fire point of fuels.	

Laboratory component: **[30 hours]**

Any ten experiments have to be completed from the following list of experiments

No.	Name of the experiment
1	Determine the total hardness of water sample by EDTA method.
2	Analyze the alkalinity of water sample by Indicator method.

3	Analyze the chlorine content in water sample by Argentometric method.
4	Determine the BOD of water samples.
5	Describe the procedure to determine the viscosity of oil using an Oswald viscometer.
6	Identify the cloud point and pour point of oils.
7	Make use of glass electrode to determine the strength of hydrochloric acid.
8	Make use of conductivity meter to determine the strength of acids in a mixture of acids.
9	Determine quantitatively the amount of Ferrous ions in mild steel by Spectrophotometry.
10	Determine the of rate of corrosion of by weight loss method.
11	Describe the procedure to determine the flash point and fire point of fuels.
12	Conduct a study to find out the charging and discharging rate of batteries.

Course outcomes: On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest cognitive level
CO1	Analyze the water quality parameters and choose appropriate water treatment methods for use in industries and daily life.	K4
CO2	Make use of the applications of the materials in different engineering disciplines.	K3
CO3	Utilize the principles of electrochemistry and find the materials for energy conversion and storage.	K4
CO4	Determine the corrosion rate to propose suitable protection methods for environmental considerations	K3
CO5	Choose suitable fuels for engineering processes and automobile applications.	K3

COs and POs Mapping

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	60	100	25
	CIE – II	100			
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

COs	Highest Cognitive Level	POs 1	2	3	4	5	6	7	8	9	10	11	12
CO1	K4	**3**	**2**	-	-	-	**1**	-	-	-	-	-	-
CO2	K3	**3**	**2**	**1**	**1**	-	-	-	-	-	-	-	-
CO3	K4	**3**	**2**	**1**	**1**	-	-	-	-	-	-	-	-
CO4	K3	**2**	**1**	**1**	-	-	**1**	**2**	-	-	-	-	-
CO5	K3	**3**	**2**	-	-	-	-	-	-	-	-	-	-

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	10	10	10
Understand	30	30	30
Apply	40	40	40
Analyze	20	20	20
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Jain P.C. and Jain M, Engineering Chemistry, Dhanpat Rai Publishing Company, New Delhi, 17th Edition,2021.
2. Dara S S and Umare S.S, A Text Book of Engineering Chemistry, S.Chand & Company Limited, 20thEdition, 2018.

Reference Books:

1. Benjamin M. M, Water Chemistry, Waveland Press, 2nd Edition, 2019.
2. Cicek V, Corrosion Engineering, Springer Publishing, 1st Edition, 2021.
3. Shahinpoor. M, Fundamentals of Smart Materials, Publisher: Royal Society of Chemistry, 1st Edition,2020.
4. Berg H, Bernhardsson S, and Johansson P, Electric Vehicle Batteries: Moving from Research towardsInnovation, Publisher: Springer, 1st Edition, 2019.
5. B.K.Sharma "Engineering chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2014).

Web links and Video Lectures (e-Resources):

1. Water and wastewater treatment - https://onlinecourses.nptel.ac.in/noc23_ce12/preview
2. SemiconductorDevices and circuits. - https://nptel.ac.in/courses/108108112
3. Corrosion ProtectionMethods - https://onlinecourses.nptel.ac.in/noc23_mm01/preview

4. Elementary Electrochemistry - https://onlinecourses.nptel.ac.in/noc23_cy19/preview
5. Fuel and combustionTechnology - https://archive.nptel.ac.in/courses/103/105/103105110/

Suggested Skill Activities:

1. Measure the TDS, PH & electrical conductivity of a home water.
2. Removal of temporary hardness of any water sample by suitable method.
3. Find the charging and discharging rate of mobile batteries when it is use or not.
4. The need of engineering material is essential in our day today life. - Justify the answer.
5. Measure the corrosion rate of iron bar when it is exposed in the environment.
6. List out the recent engineering materials used in emerging field.
7. Calculate the higher and lower calorific value of a fuel by using Dulong's formula.
8. List out the type of coatings applied on materials which are used in our daily life.
9. Improper disposal of batteries leads to environmental hazard. Suggest the suitable disposable method.
10. Pure Iron material undergo corrosion more fast than other materials. Give reasons.

Course Code:	**24ME201**	**Course Title:**	**Engineering Graphics and Design**
Credits:	**3**	**L – T – P**	**1-0-4**

Course objectives:

To impart knowledge on the

- To enable students to understand the standards and conventions of engineering drawing.
- To enhance the visualization skills to understand objects in the respective positions with respect to principal planes.
- To comprehend general projection theory, with emphasis on orthographic projection to represent three-dimensional objects in two-dimensional views.
- To emphasize freehand sketching and pictorial view to aid in the visualization process and to efficiently communicate ideas graphically.
- To Introduce CAD software for the creation of 3D models and 2D engineering drawings.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. NPTEL and Other Videos
3. Smart Class Room
4. Project based learning

UNIT I - DRAWING FUNDAMENTALS, GEOMETRIC CONSTRUCTION, PROJECTION OF POINTS, STRAIGHT LINES AND PLANES	[15 hours]
Drawing BIS standards – Orthographic projections – First angle projection - Drawing instruments – Sheet layout – Conventions – Lines, Lettering, Numbering and Dimensioning Geometric construction – Construction of regular polygons – Conic sections – Ellipse, Parabola and Hyperbola by eccentricity method. Projection of points – Points situated in all four quadrants. Projection of straight lines – Straight lines inclined to both principal planes – Finding true length of the line and true inclinations with respect to principal planes – Rotating line method. Projection of planes – Introduction – Polygonal lamina and Circular lamina - Orientation of planes - Plane parallel to both principal planes, Planes perpendicular to both principal planes and Planes inclined to both principal planes – Rotating object method. Orthographic projection of simple engineering components.	

UNIT II - PROJECTION OF SOLIDS	[15 hours]
Projection of solids – Introduction – Types of solids – Polyhedra and solids of revolution - Projection with axes inclined to one of the principal planes and parallel to other – Change of Position method. 2D drafting - Basic commands – Coordinate systems, Object section methods. Line, Circle, Polyline, Rectangle, Hatch, Fillet, Chamfer, Trim, Extend, Offset, Dim style – Annotation and Layering – Object snaps - 3D modelling – Basic commands – Extraction of multiple views – Part modelling of simple components - Utensils, Hand tools & Furniture etc. - Drawing views using 3D environment.	

UNIT III - DEVELOPMENT OF SURFACES AND PICTORIAL PROJECTION	[15 hours]
Development of lateral surfaces of truncated Prisms, Pyramids, Cylinders and Cones– Parallel line method and Radial line method. Pictorial Projection – Isometric projection – Introduction – Isometric scale – Isometric view of two right regular composite solids – Isometric projection of truncated frustum of solids – Box method. Problems on applications of Isometric projections of simple objects / engineering components.	

UNIT IV- BASIC COMPUTER AIDED DRAWING APPLICATIONS	[15 hours]
Free hand Sketching - Sketching of geometry - multiple view projection from single pictorial view of objects – Illustrative examples - True free hand, Guided Free hand, Roads, Buildings, Utensils, Hand tools & Furniture's etc. Drawing Simple Mechanisms - Bicycles, Tricycles, Gear trains, Ratchets, two-wheeler cart &Four-wheeler carts to dimensions etc.	

UNIT V- MULTIDISCIPLINARY APPLICATIONS AND PRACTICE	[15 hours]
Electric Wiring and lighting diagrams - Like, Automatic fire alarm, Call bell system, UPS system, Basic power distribution system using suitable software. **Basic Building Drawing** - Draw various types of lines, graphical symbols for materials, doors and windows, symbols for sanitary, water supply and electrical installations and write abbreviations as per IS 962. Like, Architectural floor plan, basic foundation drawing, steel structures- Frames, bridges, trusses using Auto CAD or suitable software, **Electronics Engineering Drawings** - Like, Simple Electronics Circuit Drawings, practice on layers concept. **Graphs & Charts** - Like, Column chart, Pie chart, Line charts, Gantt charts, etc. using Microsoft Excel or any suitable software.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Apply principles of first angle projection in drafting plan and elevation of points, lines, planes, and solids.	K3
CO2	Apply change of position method in the projection of solids and determine the true shape of the section.	K3

CO3	Apply principles of orthographic projection to extract 2D views from 3D drawing using freehand sketching.	K3
CO4	Apply parallel line and radial line methods to develop lateral surfaces of solids so that students can understand applications in sheet metal design.	K3
CO5	Apply box method to develop the isometric view of simple, truncated, and composite solids.	K3
CO6	Develop simple part model in 3D and plan, elevation, and section of building using a designated CAD software.	K6

COs and POs Mapping:

CO/ PO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**P O8**	**P O9**	**PO 1 0**	**PO 11**	**PO 1 2**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	1	-	-	-	-	-	-	-	2	-	-	1	2	-
CO2	3	1	-	-	-	-	-	-	-	2	-	-	1	2	-
CO3	3	1	-	-	-	-	-	-	-	-	-	-	1	2	-
CO4	3	1	-	-	-	-	-	-	-	2	-	-	1	-	-
CO5	3	1	-	-	-	-	-	-	-	2	-	-	1	2	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Lab Exam	100	50	50	50
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	0	0	0
Understand	20	20	20
Apply	40	40	40
Analyze	0	0	0
Evaluate	0	0	0
Create	40	40	40

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. N.D.Bhatt,"Engineering Graphics", Charotor Publishing House, 53RD Edition 2019
2. Natrajan K.V., "A textbook of Engineering Graphics", Dhanalakshmi Publishers, Chennai (2015)

Reference Books:

1. Venugopal K. and Prabhu Raja V., "Engineering drawing + AutoCAD", New Age International (P) Limited (2022)
2. Lakhwinder pal singh, Harwinder Singh, "Engineering Drawing Principles and Applications", Cambridge University Press, 2021.
3. Cecil Johnson, Jay D Helsel and Dennis R Short, "Engineering Drawing and Design", Seventh Edition, McGraw Hill, 2007.
4. Patil, Rajashekar, "Computer Aided Engineering Graphics", New Age International Ltd,2018.
5. Chris Schroder, "Printed Circuit Board Design using AutoCAD", Newnes,1997.
6. K S Sai Ram, "Design of steel structures", Third Edition by Pearson.
7. A S Pabla, "Electrical power distribution", 6th edition, Tata Mcgrawhill.
8. K. R. Gopalakrishna, & Sudhir Gopalakrishna, "Textbook of Computer Aided Engineering Drawing", 39th Edition, Subash Stores, Bangalore, 2017

Web Links and Video Lectures (E-Resources):

1. **http://nptel.ac.in/courses/112103019**
2. https://archive.nptel.ac.in/courses/112/105/112105294/

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 and 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 and SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 and SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

LABORATORY REQUIREMENTS

SYSTEM REQUIREMENTS (For a batch of 30 Students)

Hardware:

1. Intel i3 core due processor with 4GB ram with 500GB hard disk – 30 Nos.
2. Laser Printer – 1 No.

Software:

Drafting package – AutoCAD – Adequate license (Open source)

Suggested Skill Activities:

1. 2D drafting of plan and elevation of computer CPU.
2. 2D drafting of plan and elevation of a thermos flask.

3. 2D drafting of a plan and elevation of piston and cylinder.
4. Sketching the projections of a bicycle in freehand.
5. Sketching the projections of a stapler.
6. Cut and develop the lateral surface of a funnel.
7. Cut one edges vertically and develop the lateral surface of CPU cabin.
8. Cut and develop the lateral surfaces of elbow of a pipe.
9. Draw the isometric view of a simple bread toaster.
10. Draw the isometric view of the computer table.
11. Sketch the assembled view of the screw jack using the orthographic projections of its components.
12. Draft the plan, elevation and section of your home using CAD.
13. Draft the plan, elevation and section of 2 storey office building using CAD.
14. Develop the 3D model of the (a) and (b).

Course Code:	**24EE101**	**Course Title:**	**Fundamentals of Electrical Engineering**
Credits:	**4**	**L – T – P**	**3-0-2**

Course objectives:

To impart knowledge on the

- Basics of DC electric circuits
- Concepts of AC circuits and magnetic circuits
- Working principle of electrical machines
- Working principle of transformers and special machines
- Sensors used for IoT and Automation

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Classroom
8. Flipped Class

UNIT I –DC Circuits	[9 hours]
Introduction to DC Circuits – Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws –Nodal Analysis, Mesh analysis with independent sources only – Appliances.	
Practical Topics: 1. Model an electrical circuit and simulate it to verify Ohms Law. 2. Model an electrical circuit and simulate it to verify Kirchhoff's Voltage Law. 3. Model an electrical circuit and simulate it to verify Kirchhoff's Current Law.	

UNIT II – AC Circuits and Magnetic Circuits	[9 hours]
Representation of sinusoidal waveform – peak and rms values, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations – Converters: rectifiers and inverters; Basics of magnetic circuits – Flux – Flux density – Magnetic resonance – Self-inductance – mutual-inductance – Coupling.	
Practical Topics: 1. Demonstrate the measurement of power in an RLC circuit using wattmeter method. 2. Interpret the DC output of an RLC circuit using half wave rectifier. 3. Interpret the DC output of an RLC circuit using full wave rectifier.	

UNIT III – Electrical Machines	[9 hours]
Selection of Motor- DC Motor and DC Generator - Construction - Principle of operation - Speed control – Emf and Torque equations- Applications - Single-phase induction motors – Construction –Principle of operation- Types - Three phase Induction motors -Construction–Principle of Operation –Types.	
Practical Topics: 1. Conduct the load test on DC shunt motor to outline its characteristics. 2. Outline the study on the starting methods of DC series motor. 3. Conduct the load test on three phase induction motor to obtain its characteristics.	

UNIT IV – Transformers and Special Machines	[9 hours]
Single phase transformer – Construction – Principle of Operation – Applications – Three phase transformer – Construction – Principle of Operation – Applications – Permanent Magnet Brushless	

DC motors – Stepper motor – Linear Induction motor – Hysteresis motor – Introduction to Electric Vehicle.
Practical Topics: 1. Interpret the study on the operation of single phase transformer for different constructions. 2. Interpret the study on the operation of three phase transformer for different constructions. 3. Outline the study on the operation of a stepper motor for different step angles.

UNIT V – Sensors and its Applications	**[9 hours]**
Introduction – Protocols – Sensors in IoT – Mobile based sensors –Medical sensor – Neural sensor – Motion sensor – PIR sensor, Air quality sensor – CO_2 Sensor, RFID sensor, Water leakage detection sensor – Introduction to actuators in automation – Case studies: Smart homes – Smart cities – Smart parking system.	
Practical Topics: 1. Utilize Arduino and Bluetooth module for automating home appliances. 2. Utilize ESP8266 processor for automating home appliances. 3. Construct an Arduino based solar tracker for solar irradiation measurement.	

Laboratory Component: **[30 hours]**

Any 12experiments have to be completed from the following list of experiments.

S.No.	Name of the Experiment
1	Model an electrical circuit and simulate it to verify Ohms Law.
2	Model an electrical circuit and simulate it to verify Kirchhoff’s Voltage Law.
3	Model an electrical circuit and simulate it to verify Kirchhoff’s Current Law.
4	Demonstrate the measurement of power in an RLC circuit using wattmeter method.
5	Interpret the DC output of an RLC circuit using half wave rectifier.
6	Interpret the DC output of an RLC circuit using full wave rectifier.
7	Conduct the load test on DC shunt motor to outline its characteristics.
8	Outline the study on the starting methods of DC series motor.
9	Conduct the load test on three phase induction motor to obtain its characteristics.
10	Interpret the study on the operation of single phase transformer for different constructions.
11	Interpret the study on the operation of three phase transformer for different constructions.

12	Outline the study on the operation of a stepper motor for different step angles.
13	Utilize Arduino and Bluetooth module for automating home appliances.
14	UtilizeESP8266 processorfor automating home appliances.
15	Construct an Arduino based solar tracker for solar irradiation measurement.

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Apply the circuit laws and theorems to compute the electrical parameters of domestic and industrial appliances.	K3
CO2	Compare the behavior of AC circuits & magnetic circuits for a given input.	K3
CO3	Explain the construction, working, and application of rotating electric machines to infer its characteristics.	K2
CO4	Explain the working and applications of transformers and special machines.	K2
CO5	Identify the sensors for applications in Engineering.	K3

COs and POs Mapping:

COs	**POs**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	2	1	-	-	-	-	-	-	-	-	1
CO2	2	1	1	-	-	-	-	-	-	-	-	1
CO3	2	1	1	-	-	-	-	-	-	-	-	1
CO4	2	1	1	-	-	-	-	-	-	-	-	1
CO5	3	2	1	-	1	-	-	-	-	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Typeof assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

Assessment Pattern

Bloom's Category	Internal Assessment Tests		Terminal Examination
	1	2	
Remember	20	20	20
Understand	40	40	40
Apply	40	40	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. D P Kothari and I.J Nagarath, "Basic Electrical and Electronics Engineering," McGraw Hill Education (India)Private Limited, Second Edition, 2020
2. A.K.Sawhney and PuneetSawhney,"A Course in Electrical & Electronic Measurements & Instrumentation,"DhanpatRai and Co, 2015.

Reference Books:

1. John Bird, "Electrical Circuit theory and technology", Routledge; 2017.
2. Muthusubramanian R and Salivahanan S, "Basic Electrical and Electronics Engineering,"McGraw Hill, NewDelhi,2009.
3. Nagsarkar T K and Sukhija M S, "Basics of Electrical Engineering," Oxford University press, 2012.
4. V K Mehta, Rohitmehta "Principles of Electronics," S.Chand& Company Ltd, 2015.
5. Mahmood Nahvi and Joseph A.Edminister, "Electric Circuits," Schaum' Outline Series, McGraw Hill, 2009.
6. H.S. Kalsi, "Electronic Instrumentation," Tata McGraw-Hill, New Delhi, 2010.
7. Ian Sinclair, "Sensors and Transducers," Elsevier Science, 3rd Edition, 2000.
8. Perry Lea, "Internet of things for architects," Packt, 2018.
9. V N Mittle and Arvind Mittle "Basic Electrical Engineering," McGraw Hill, New Delhi, 2005.

10. R.S. Sedha, "A Textbook of Applied Electronics," S. Chand & Co., 2008.
11. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry and Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017.

Web Links and Video Lectures (E-Resources):

1. A Basic Course on Electric and Magnetic Circuits : https://onlinecourses.nptel.ac.in/noc24_ee125/preview
2. Basic Electrical Circuits: https://onlinecourses.nptel.ac.in/noc24_ee112/preview
3. Digital Circuits: https://onlinecourses.nptel.ac.in/noc24_ee147/preview
4. Electrical Machines – I: https://onlinecourses.nptel.ac.in/noc24_ee103/preview
5. Sensor Technologies: Physics, Fabrication and Circuits: https://onlinecourses.nptel.ac.in/noc24_ee83/preview

Suggested Skill Activities:

1. List the different electrical loads available in home, college and prepare their rating chart.
2. Design the residential house wiring using fuse, switch, indicator, lamp, circuit breaker, energy meter and apply Thevenin's theorem to find the current in particular branch.
3. Take a room in your home and replace the fluorescent lamp to LED lamp to calculate the monthly electrical charge and compare with the previous month.
4. Write the parts of the fan and electric mixer in home and draw the wiring diagram for fan and electric mixer.
5. Visit the nearby substation and list out the details of safety measures followed by electrical engineers.
6. List out the rating of electrical machines used in home appliances.
7. Identify the semiconductor devices in electronic appliances.
8. Develop IOT based solutions for engineering applications.
9. Draw the wiring diagram of EV and mention its parts.
10. Visit nearby power plants and demonstrate the various components, working, power generation and distribution in power plants as a report.

பாடநெறி குறியீடு:	**24GE201**	**பாடத்தின் தலைப்பு:**	தமிழரும்தொழில்நுட்பமும்
கிரெடிட்	1	L - T - P	1-0-0

பாடத்திட்டநோக்கங்கள்:

1. சங்ககாலத்து நெசவுத்தொழிலை விவரிப்பதற்கும் மட்பாண்டத்தொழில் நுட்பத்தைக் கண்டறிவதற்கும்.
2. சங்ககால கட்டுமானம், மேடை அமைப்பு, சிற்பங்கள், கோவில்கள், அம்மன்கோவில், திருமலைநாயக்கர் மஹால், செட்டிநாட்டு வீடுகள், இந்தோ - சாரோசெனிக் கட்டிடக்கலை ஆகியவற்றைக் கண்டறிந்து மேற்கோள் காட்ட.
3. கப்பல் கட்டுதல் மற்றும் இரும்புத் தொழிலைக் கண்டறிதல், சிலப்பதிகாரத்தில் நாணயங்கள், மணி தயாரிக்கும் தொழிற்சாலைகள், மணிகளின் வகைகள் ஆகியவற்றைப் படிக்க.
4. நீர்நிலைகளின் முக்கியத்துவத்தைகாட்ட, கால்நடை வளர்ப்பு மற்றும் கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகளை கண்காணிக்க, விவசாயம், மீன்பிடி, முத்து மற்றும் முத்துகலாச்சாரம் மற்றும் கடல் பற்றிய பண்டைய அறிவை அங்கீகரிக்க.
5. அறிவியல் தமிழின் வளர்ச்சி மற்றும் தமிழ்க்கணிப்பொறியின் வளர்ச்சியைக் கவனிக்க, இணையத்தில் தமிழ்மென்பொருள் மேம்பாடு, தமிழ் அகராதிகளை மேற்கோள் காட்ட.

அலகு I நெசவு மற்றும் பானைத்தொழில்நுட்பம்:	**[3 hours]**
சங்ககாலத்தில் நெசவுத்தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்புபாண்டங்கள் - பண்டங்களில் கீறல் குறியீடுகள்.	
அலகு II வடிவமைப்பு மற்றும் கட்டிடத்தொழில்நுட்பம்:	**[3 hours]**
சங்ககாலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்ககாலத்தில் வீட்டுப்பொருட்களில் வடிவமைப்பு - சங்ககாலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடைஅமைப்பு பற்றியவிவரங்கள் - மாமல்லபுரச்சிற்பங்களும், கோவில்களும் - சோழர்காலத்துப் பெருங்கோவில்கள் மற்றும் வழிபாட்டுத்தலங்கள் - நாயக்கர்காலக்கோயில்கள் மாதிரி கட்டமைப்பு பற்றி அறிதல்,மதுரைமீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலைநாயக்கர்மஹால் - செட்டி நாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ - சாரோசெனிக் கட்டிடக்கலை.	
அலகு III உற்பத்தித் தொழில்நுட்பம்	**[3 hours]**

கப்பல் கட்டும் கலை - உலோகவியல் - இரும்பு தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு வரலாற்றுச்சான்றுகளாக செம்பு மற்றும் தங்கநாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சங்கு மணிகள் - எலும்புத்துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு IV வேளாண்மை மற்றும் நீர்பாசனத்தொழில்நுட்பம்	**[3 hours]**
அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக்கு குமுழித்தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மைச்சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன் வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்.	

அலகு V அறிவியல் தமிழ் மற்றும் கணிதத்தமிழ்:	**[3 hours]**
அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி -தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ்மென்பொருள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.	

பாடநெறி முடிவுகள் (பாமு):

பாடநெறியின் முடிவில், மாணவர் பின்வரும் திறன்களைப் பெறுவார்:

பாமு	**பாடநெறி முடிவுகள்**	**மிக உயர்ந்த அறிவாற்றல் நிலை**
அலகு I பாமு:	சங்க கால ஜவுளி தொழில் மற்றும் மட்பாண்ட தொழில்நுட்பம் பற்றி அறிவார்கள்.	கே 1
அலகு II பாமு:	சங்க கால கட்டுமானம், மேடை அமைப்பு, சிற்பங்கள், கோவில்கள், அம்மன் கோவில், திருமலை நாயக்கர் மஹால், செட்டிநாட்டு வீடுகள், இந்தோ-சராசனிக் கட்டிடக்கலை ஆகியவற்றை விவரிக்க இயலும்.	கே 2
அலகு III பாமு:	கப்பல் கட்டுதல், இரும்புத் தொழில், நாணயம் தயாரித்தல் மற்றும் மணி தயாரிக்கும் தொழில்கள் பற்றி அறிந்து கொள்கிறார்கள்.	கே 1
அலகு IV பாமு:	நீர்நிலைகளின் முக்கியத்துவம், கால்நடை வளர்ப்பு, கிணறு, விவசாயம், மீன்பிடி, முத்து மற்றும் முத்து கலாச்சாரம்	கே 1

	மற்றும் கடல் பற்றிய போதுமான அறிவை பெற்றுகொள்கிறார்கள் .	
அலகு V பாமு:	அறிவியல் தமிழின் வளர்ச்சி, தமிழ்க் கணிப்பொறியின் வளர்ச்சி, இணையத்தில் தமிழ் மென்பொருள் மேம்பாடு, தமிழ் அகராதிகளை சந்தேகம் இன்றி முழுமையாக தெரிந்து கொள்கிறார்கள்.	கே 1

மதிப்பீட்டு முறை

ப்ளூமின் வகை	தொடர்ச்சியான மதிப்பீட்டு சோதனைகள்		இறுதி தேர்வு
	1	2	
நினைவில் கொள்ளுதல்	60	50	60
புரிந்து கொள்ளுதல்	40	50	40
விண்ணப்பித்தல்	0	0	0
பகுப்பாய்வுதல்	0	0	0
மதிப்பிடுதல்	0	0	0
உருவாக்குதல்	0	0	0

பாடநெறி முடிவுகள் ***மற்றும் நிரல் முடிவுகள் ஒப்பிடுதல்***

நிலை 3- அதிக ஒத்துப்போதல், நிலை 2- மிதமாக ஒத்துப்போதல், நிலை 1- குறைவாக

பாமு**கள்**	**மிக உயர்ந்த அறிவாற்றல் நிலை**	**பாடநெறி முடிவுகள்**											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
பாமு**1**	கே 1	**2**	-	-	-	-	-	-	-	-	-	-	-
பாமு**2**	கே 2	**1**	-	-	-	-	-	-	-	-	-	-	-
பாமு**3**	கே 1	**1**	-	-	-	-	-	-	-	-	-	-	-
பாமு**4**	கே 1	**1**	-	-	-	-	-	-	-	-	-	-	-
பாமு**5**	கே 1	**1**	-	-	-	-	-	-	-	-	-	-	-

ஒத்துப்போதல், நிலை 0- ஒத்துப்போகவில்லை

மதிப்பீட்டுத் திட்டம்:

கூறுகள்	மதிப்பீட்டின் வகை	அதிகபட்ச மதிப்பெண்கள்	குறைக்கப்பட்ட மதிப்பெண்கள்	இறுதி மதிப்பெண்கள்

தொடர்ச்சியான உள் தேர்வு	தொடர்ச்சியான உள் தேர்வு - I	100	40	40
	தொடர்ச்சியான உள் தேர்வு - II	100	40	
இறுதி பருவ தேர்வு	எழுத்து தேர்வு	100	60	60
மொத்தம்				100

இறுதி பருவ தேர்வு: (கேள்வி முறை)

- ஒவ்வொரு யூனிட்டும் இரண்டு 2 மதிப்பெண் வினாக்களையும் ஒரு 16 மதிப்பெண் வினாவையும் (இரண்டில் ஒன்று) கொண்டுள்ளது.
- பதினைந்து கேள்விகளுக்கும் பதிலளிக்க வேண்டும்.

TEXT BOOKS

1. *தமிழகவரலாறு - மக்களும்பண்பாடும் - கே. கே. பிள்ளை* (வெளியீடு: *தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்*).
2. *கணினித்தமிழ் - முனைவர்இல. சுந்தரம்.* (விகடன்பிரசுரம்).
3. *கீழடி - வைகைநதிக்கரையில்சங்ககாலநகரநாகரிகம்* (தொல்லியல்துறைவெளியீடு)
4. *பொருநை - ஆற்றங்கரைநாகரிகம்.* (தொல்லியல்துறைவெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).

REFERENCE BOOKS

1. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
2. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
3. Keeladi - ‘Sangam City C ivilization on the banks of river Vaigai’ (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
4. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)

5. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)

6. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Course Code:	**24MA201**	**Course Title:**	**Complex Variables and Transforms** (Common to ALL branches)
Credits:	**4**	**L – T – P**	3 – 1 – 0

Course objectives:

- To impart analytical ability in solving mathematical problems as applied to the respective branches of Engineering.
- To familiarize the students with complex integration techniques and contour integration techniques which can be used in real integrals.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.

Teaching-Learning Process:

These are sample strategies which teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method does not mean only traditional method, but different type of teaching methods may be adopted to develop the outcomes.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Topics will be introduced in a multiple representation and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT I – Complex Differentiation	**[12 hours]**
Function of a complex variable – Analytic functions – Necessary conditions and sufficient conditions (excluding proof) – Cauchy – Riemann equations — Properties of analytic function – Harmonic conjugate – Construction of Analytic functions - Conformal mapping: w = z+a, az, 1/z, and bilinear transformation.	
UNIT II – Complex Integration	**[12 hours]**
Statement and application of Cauchy's integral theorem and integral formula – Taylor and Laurent expansions – Isolated singularities – Residues - Cauchy's residue theorem. Applications: Contour integration over unit circle and semicircular contours (excluding poles on axis).	

UNIT III – Laplace Transforms	[12 hours]
Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems – Transforms of derivatives and integrals – Initial and Final Value Theorem – Inverse Laplace Transform – Convolution Theorem (Statement only) – Solution of linear second order Ordinary differential equations with constant coefficients using Laplace transforms.	
UNIT IV – Fourier Series and Fourier Transforms	**[12 hours]**
Dirichlet's conditions – General Fourier series – Odd and even functions – Half range series – Harmonic analysis - Statement of Fourier integral theorem – Fourier transform pair – Parseval's identity.	
UNIT V – Partial Differential Equation	**[12 hours]**
Formation of partial differential equations - Classification of partial differential equations - Solutions of one dimensional wave equation, One dimensional heat equation (excluding insulated ends) – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges).	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Construct analytic functions and use their conformal mapping property in Engineering problems.	K3
CO2	Solve real and complex integrals using the Cauchy's integral formula and residue theorem.	K3
CO3	Apply Laplace transforms techniques in system modelling, digital signal processing, process control, solving boundary value problems	K3
CO4	Apply Fourier series to solve the steady state two-dimensional heat equation in cartesian coordinates.	K3
CO5	Apply the effective mathematical tools for solutions of partial differential equations that model physical phenomena and engineering problems.	K3

COs	**POs**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	1
CO5	3	2	1	-	-	-	-	-	-	-	-	-
CO6	3	2	1	-	-	-	-	-	-	-	-	1

COs and POs Mapping:

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	20	20	20
Understand	20	20	20
Apply	60	60	60
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
3. Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill

Education Pvt. Ltd., New Delhi, Second reprint, 2012

4. Kandasamy. P., Thilagavathy. K, and Gunavathy. K, Engineering Mathematics Volume I & II, S. Chand & Co, New Delhi, 2005.Reference Books:

Equivalent NPTEL/SWAYAM Courses

S. No.	Course Title	Course Instructor	Host Institute
1.	Partial Differential Equations	Prof. Sivaji Ganesh	IIT Bombay
2.	Introduction to Fourier Analysis	Prof. Parasar Mohanty	IIT Kanpur
3.	Complex Analysis	Prof. Pranav Haridas	IIT Madras

Web Links and Video Lectures (E-Resources):

1. Analytic Functions, C-R Equations:
https://www.nptelvideos.com/lecture.php?id=13416
2. Laplace Transform and its Existence:
https://www.nptelvideos.com/lecture.php?id=13433
3. Taylor's, Laurent Series of f(z) and Singularities:
https://www.nptelvideos.com/lecture.php?id=13431
4. Applications of Fourier Transform to PDEs:
https://www.nptelvideos.com/lecture.php?id=13442

Course Code	**24PH202**	**Course Title:**	**APPLIED MATERIAL SCIENCE (Common to Mech,Civil & Agri)**
Credits	**3**	**L – T – P**	**3-0-0**

Course objectives:

- To study the electrical properties of materials including electron theory of metals.
- To familiarize with the properties of semiconductors, determination of charge carriers and device applications.
- Equipping the students to understand the applications of magnetic materials and dielectric materials.
- To impart knowledge on the processing and applications of new engineering materials
- To motivate the students towards the different material testing methods

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I CONDUCTING MATERIALS	[9 hours]
Classical free electron theory - Expression for electrical conductivity - Thermal conductivity, Wiede- Mann Franz law, Merits & Demerits of classical free Electron Theory - Quantum free electron theory - Electron in a metal – degenerate and non-degenerate states – Fermi- Dirac statistics– Density of energy states – Energy bands in solids – Electron effective mass.	

UNIT II SEMICONDUCTING MATERIALS	[9 hours]
Direct and indirect band gap semiconductors – Intrinsic Semiconductors - Carrier concentration in intrinsic semiconductors - Variation of Fermi level with temperature – extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors – Variation of Fermi level with temperature – Hall effect and devices- Ohmic contacts– Schottky diode.	

UNIT III MAGNETIC AND DIELECTRIC MATERIALS	[9 hours]
Magnetic materials – Classification (Dia , Para & Ferro) – Hysteresis – Ferrites - $BaTiO_3$ – Application of Nd-FeB magnets. Electric polarization – Different types of polarization – Temperature and frequency dependence –Dielectric loss and dielectric breakdown – dielectric materials applications - capacitors and transformers	

UNIT IV SMART MATERIALS	[9 hours]
Metallic glasses - Shape memory alloys - Composites - Definition and Classification - Fiber reinforced plastics (FRP) and fiber reinforced metals (FRM) - Ceramics - Classification - Crystalline - Non Crystalline - Bonded - ceramics, Manufacturing methods - Slip casting - Isostatic pressing - Gas pressure	

bonding - Properties - thermal, mechanical, electrical and chemical ceramic fiber- Applications of ceramics in electronics.

UNIT V MATERIALS TESTING	[9 hours]
Microscope-Magnification Power-Resolving Power-Optical & Electron Microscope-Difference between optical & Electron Microscope-Tunneling - Scanning Electron Microscope-Transmission Electron Microscope- Scanning Tunneling Microscope- hardness - Rockwell and Brinell hardness - Knoop and Vickers Micro hardness- spot test techniques	

Course outcomes: On completion of the course, the student will have the ability to:

CO No	Corse Outcomes	Level
CO1	Explain the electrical properties of materials.	K2
CO2	Apply the properties of semiconducting materials in electronics.	K3
CO3	Infer the properties of magnetic and dielectric materials for relevant electrical and electronics engineering applications.	K2
CO4	Utilize the smart materials in the field of Engineering..	K3
CO5	Make use of different testing methods for analyzing the properties of materials.	K3

COs and POs Mapping

COs	**POs**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	2	1	1	-	-	-	-	-	-	-	-	1
CO2	3	2	1	-	-	-	-	-	-	-	-	1
CO3	2	1	1	-	-	-	-	-	-	-	-	1
CO4	3	2	1	-	-	-	-	-	-	-	-	1
CO5	3	2	1	-	-	-	-	-	-	-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- NotMapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End semester Examination
	1	2	
Remember	20	20	20
Understand	60	40	40
Apply	20	40	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered

TEXT BOOKS:

1.S.O. Kasap. Principles of Electronic Materials and Devices, McGraw Hill Education(Indian Edition), 2020.

2.R.F.Pierret. Semiconductor Device Fundamentals. Pearson (Indian Edition), 2006.

3. O.P.Khanna. "Materials Science and metallurgy: Dhanpat Rai Publications,2011

REFERENCE BOOKS:

1. Jasprit Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-HillEducation (Indian Edition), 2019.
2. Charles Kittel, Introduction to Solid State Physics, Wiley India Edition, 2019.
3. Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, Concepts of Modern Physics, McGrawHill (Indian Edition), 2017.

NPTEL COURSE:

Sl.No	Course Name	Course Instructor	Course Conducting Agency
1	Solid state Physics	Prof. Amal Kumar Das	IIT Kharagpur

WEB LINKS AND VIDEO LECTURES (E-RESOURCES):

1. Electrical Conductivity: https://www.youtube.com/watch?v=QvPSVwzU-8A
2. Band Theory of solids: https://www.youtube.com/watch?v=qcE2Wcpm05k&ab_channel=nptelhrd
3. Intrinsic semiconductor: https://www.youtube.com/watch?v=JZN3DAaeOB8
4. Brinell Hardness Test: https://www.youtube.com/watch?v=TM487F4p-YM
5. FRP: https://www.youtube.com/watch?v=tyKtUoQo9VM&list=PLbMVogVj5nJTnVBY4n36KHSPJsPDy38QS

Suggested Skill Activities:

1.As you look at materials and objects around your house ,identify the conductors and insulators?

2. Identify the change when you connect a light bulb to battery using conductive materials?

3. What will happen if you connect a light bulb to battery using insulating materials?

4. List the usage of alphanumerical displays in day to life.

5.Compute the size variation and efficiency of the nano materials.

6.Illustrate the role of semiconductors in renewable energy technologies.

7.Explain the reason for using smart materials like SMA in retractable roofs.

8.List out 10 uses of magnetic materials in house.

9.Explain the testing methodology used in aerospace technology.

10.Discuss about the role of semiconductor in temperature sensors which is air conditioner.

Course Code:	**24CY401**	**Course Title:**	**Environmental Science and Engineering**
Credits:	**2**	**L – T – P**	**2-0-0**

Course objectives:

To impart knowledge on the

- To gain in-depth knowledge on natural processes and resources that sustain life and govern economy.
- To know the importance of water resources which are important socially, economically viable and environmentally sustainable.
- To impart the Knowledge of pollution and its control methods.
- To mitigate the environmental and health risks associated with indiscriminate waste andfind the suitable methodologies for waste management.
- To balance ecological, economic and social goals, such as reducing carbon emissions, promoting renewable energy and ensuring equitable resource access.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. NPTEL and Other Videos
3. Smart Class Room
4. Field visit
5. Project based learning
6. Industrial Visit

UNIT I - Ecology and Biodiversity	**[6 hours]**
Definition, scope and importance of environment – need for public awareness – conceptof an ecosystem - Biodiversity and its values- Biodiversity at global, national and local level- India as a mega-diversity nation – hotspots of biodiversity – threats to biodiversity – endangered and endemic speciesof India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.	
UNIT II - Water resources and Environment microbiology	**[6 hours]**
Water resources: Use and over- utilization of surface and groundwater – dams benefits andproblems, conflicts over water –Water availability at global level, surface level, ground level-Sources-Hydro phonics -Classification of microorganism –Role of microorganism in waste water treatment-Bacterial nutrition and growth.	
UNIT III -Air and Noise pollution	**[6 hours]**
Sources and classification of air pollutants and their effect on human health-Ambient airquality and emission standards-Air pollutants-Particulate matters-Control equipments- Gravity separator- Centrifugal separator-fabric filter-Electrostatic separator, Catalytic convertors– Noise pollution-causes – Consequences-Control measures- modern tools used in pollution mitigation measures-sustainable activity of pollution control- recent case studies - Environmental Protection Act.	

UNIT IV- Solid waste and Hazardous waste management	[6 hours]
Soil contaminants–sources and management methods of -Solid Waste Hazardous waste – Plastic waste- -Biomedical waste- Hazardous waste& E-waste management -Case studies on Occupational Health and Safety Management system (OHASMS).	

UNIT V-Environmental management and Sustainable development	[6 hours]
Renewable and non-renewable energy Sources- Energy Polices- Development, GDP, Sustainability-concept, needs and challenges-economic, social and aspects of sustainability-Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment-Sustainable goals -Sustainable habitat- Green buildings, Green materials, Energy efficiency, Sustainable transports. Carbon emission-Carbon footprint-Carbon Sequestration.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Illustrate the important features of environment and its conservation.	K2
CO2	Explain the need of water resources and its application to meet the modern requirements and the necessity of its conservation.	K2
CO3	Identify the causes, effects of environmental pollution and explain the control techniques for particulate, gaseous emissions and contribute to the preventive measures in the society.	K3
CO4	Identify the different management methods of solid and hazardous waste.	K3
CO5	Explain the sustainability practices and identify green materials for sustainable development .	K2

COs and POs Mapping:

COs	Highest Cognitive Level	POs											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	K2	1	-	-	-	-	1	1	-	-	-	-	-
CO2	K2	2	1	-	-	-	1	1	-	-	-	-	-
CO3	K3	2	-	-	-	-	1	2	1	-	-	-	-
CO4	K3	1	-	-	-	-	2	2	1	-	-	-	-
CO5	K2	1	-	-	-	-	1	2	1	-	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE)	CIE – I	100	60	100	40
	CIE – II	100			
	Skill Assessment – I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	60	60	60
				Total	100

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	20	20	20
Understand	60	40	40
Apply	20	40	40
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Benny Joseph,Environmental Science and Engineering ‘, Tata McGraw-Hill, NewDelhi, (2014).
2. Miguel Fischer,“Environmental Management: Ecosystems, Competitiveness and WasteManagement” Nova Science Publishers, (2021)

Reference Books:

1. Dharmendra S.Sengar, ‘Environmental law ‘, Prentice hall of India Pvt Ltd, NewDelhi, (2007).

2. Erach Bharucha, "Textbook of Environmental Studies", Universities Press (I) Pvt, Ltd, Hydrabad, (2015).

3. G.TylerMiller,Scott E.Spoolman,"Environmental Science",Cengag Learning IndiaPvt.Ltd,Delhi, (2014).

4. Mahuabasu, Xavier saverimuthu, "Fundamentals of Environmental Studies", Cambridge university press,(2017)

5. Anubha Kaushik , C.P. Kaushik, "Perspectives in Environmental Studies", New Age International Pvt. Ltd, New Delhi, (2004). 6. Frank R. Spellman, "Handbook of EnvironmentalEngineering", CRC Press, (2015).

Web Links and Video Lectures (E-Resources):

1. Ecology andSociety**:** https://onlinecourses.nptel.ac.in/noc24_hs149/preview
2. SustainablePower GenerationSystems**:** https://onlinecourses.nptel.ac.in/noc24_ge54/preview
3. Environmentand Development**:** https://onlinecourses.nptel.ac.in/noc24_hs150/preview

Suggested Skill Activities:

1. Why is it beneficial to follow a student centered and participatory process for environmental education?
2. Identify the endemic species of flora and fauna found nearest to your locality.
3. List the major arguments cited against the construction of dams.
4. Discuss how the symbiotic relationship between algae and bacteria is useful in the treatment of sewage in an oxidation pond.
5. List the various ways in which an individual can contribute towards pollution prevention in the society.
6. Mention any four hazardous wastes originating from households and explain theirmanagement strategies.
7. Conduct a survey and find out how chemicals and various material are distributed /cycled in your campus.
8. List the common organic materials that are suitable and unsuitable for composting.
9. List the advantages of recycling of MSW with examples.
10. What are the major obstacles in the implementation of incineration technology in developing countries.

Course Code:	**24ME301**	**Course Title:**	**Engineering Mechanics**
Credits:	**4**	**L – T – P**	**3-1-0**

Course objectives:

To impart knowledge on the

- To Learn the use scalar and vector analytical techniques for analysing forces in statically determinate structures
- To introduce the equilibrium of rigid bodies, vector methods and free body diagram
- To study and understand the properties of surfaces and solids.
- To learn the principles of friction, forces and apply the concepts of frictional forces at the contact surfaces of various engineering systems.
- To develop basic dynamics concepts – force, momentum, work and energy

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I – Statics of Particles	**[9+3 hours]**
Fundamental Concepts and Principles, Systems of Units, Method of Problem Solutions, Statics of Particles - Forces in a Plane, Resultant of Forces, Resolution of a Force into Components, Rectangular Components of a Force, Unit Vectors. Equilibrium of a Particle- Newton's First Law of Motion, Space and Free-Body Diagrams.	

UNIT II – Equilibrium of Rigid Bodies	[9+3 hours]
Principle of Transmissibility, Equivalent Forces, Vector Product of Two Vectors, Moment of a Force about a Point, Varignon's Theorem, Rectangular Components of the Moment of a Force, Distributed Loads on Beams, Moment of a Force about an Axis, Couple - Moment of a Couple, Equivalent Couples, Addition of Couples, Resolution of a Given Force into a Force -Couple system, Further Reduction of a System of Forces, Equilibrium in Two Dimensions - Reactions at Supports.	

UNIT III – Properties of Surfaces and Solids	[9+3 hours]
Centroids of lines and areas – symmetrical and unsymmetrical shapes, Determination of Centroids by Integration, Theorems of Pappus-Guldinus, Centre of Gravity of a Three-Dimensional Body, Moments of Inertia of Areas and Mass - Determination of the Moment of Inertia of an Area by Integration, Polar Moment of Inertia, Radius of Gyration of an Area, Parallel-Axis Theorem, Moments of Inertia of Composite Areas, Moments of Inertia of a Mass - Moments of Inertia of Thin Plates.	
UNIT IV – Friction	**[9+3 hours]**
The Laws of Dry Friction, Coefficients of Friction, Angles of Friction, Wedge friction, Wheel Friction, Rolling Resistance, Ladder friction, Belt friction.	
UNIT V – Dynamics of Particles	**[9+3 hours]**
Kinematics - Rectilinear Motion and Curvilinear Motion of Particles. Kinetics- Newton's Second Law of Motion-Equations of Motions, Dynamic Equilibrium, Energy and Momentum Methods - Work of a Force, Kinetic Energy of a Particle, Principle of Work and Energy, Principle of Impulse and Momentum, Impact of bodies.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Illustrate the vector and scalar representation of forces and moments of particles	K2
CO2	Draw the free body diagram and apply equilibrium principle for two dimensional rigid bodies.	K2
CO3	Determine the centroid and moment of inertia of various surface and solids.	K3
CO4	Apply the friction and its effects by the laws of friction	K3
CO5	Apply fundamental principle to solve the problem in dynamics of particles and rigid bodies.	K3

COs and POs Mapping:

<table>
<tr><th rowspan="2">COs</th><th colspan="12">POs</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th></tr>
<tr><td>CO1</td><td>2</td><td>1</td><td>1</td><td>1</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>3</td></tr>
<tr><td>CO2</td><td>3</td><td>2</td><td>1</td><td>1</td><td>1</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>3</td></tr>
<tr><td>CO3</td><td>2</td><td>1</td><td>1</td><td>1</td><td>1</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>3</td></tr>
<tr><td>CO4</td><td>3</td><td>2</td><td>1</td><td>1</td><td>1</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>3</td></tr>
<tr><td>CO5</td><td>3</td><td>3</td><td>1</td><td>1</td><td>1</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>3</td></tr>
</table>

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max Marks</th><th>Reduced Marks</th><th>Total</th><th>Final marks</th></tr>
<tr><td rowspan="5">Continuous Internal Examination (CIE) - Theory</td><td>CIE – I</td><td>100</td><td rowspan="2">50</td><td rowspan="5">10
0</td><td rowspan="5">40</td></tr>
<tr><td>CIE – II</td><td>100</td></tr>
<tr><td>MCQ</td><td>20</td><td>10</td></tr>
<tr><td>Skill Assessment - I</td><td>40</td><td rowspan="2">40</td></tr>
<tr><td>Skill Assessment - II</td><td>40</td></tr>
<tr><td>End Semester Examination (ESE)</td><td>Theory Exam</td><td>100</td><td>60</td><td>60</td><td>60</td></tr>
<tr><td colspan="5">Total</td><td>100</td></tr>
</table>

Assessment Pattern

<table>
<tr><th rowspan="2">Bloom's Category</th><th colspan="2">Continuous Assessment Tests</th><th rowspan="2">Terminal Examination</th></tr>
<tr><th>1</th><th>2</th></tr>
<tr><td>Remember</td><td>40</td><td>20</td><td>20</td></tr>
<tr><td>Understand</td><td>40</td><td>40</td><td>40</td></tr>
<tr><td>Apply</td><td>20</td><td>40</td><td>40</td></tr>
<tr><td>Analyze</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Evaluate</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Create</td><td>0</td><td>0</td><td>0</td></tr>
</table>

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Text Books:

1. Beer Ferdinand P, Russel Johnston Jr., David F Mazurek, Philip J Cornwell, Sanjeev Sanghi, Vector Mechanics for Engineers: Statics and Dynamics, McGraw Higher Education., 12thEdition, 2019.
2. Vela Murali, “Engineering Mechanics-Statics and Dynamics”, Oxford University Press, 2018.
3. Kottiswaran N “Engineering Mechanics-Statics and Dynamics”, Pearson Education,.

Reference Books:

1. Boresi P and Schmidt J, Engineering Mechanics: Statics and Dynamics, 1/e, Cengage learning, 2008.
2. Hibbeller, R.C., Engineering Mechanics: Statics, and Engineering Mechanics: Dynamics, 13th edition, Prentice Hall, 2013.
3. Irving H. Shames, Krishna Mohana Rao G, Engineering Mechanics – Statics and Dynamics, 4thEdition, Pearson Education Asia Pvt. Ltd., 2005.
4. Meriam J L and Kraige L G, Engineering Mechanics: Statics and Engineering Mechanics: Dynamics, 7th edition, Wiley student edition, 2013.
5. Timoshenko S, Young D H, Rao J V and SukumarPati, Engineering Mechanics, 5thEdition, McGraw Hill Higher Education, 2013.
6. Bansal R K., Engineering Mechanics-Statics and Dynamics, Revised 7th Edition, Laxmi Publications.

Web Links and Video Lectures (E-Resources):

1. **NPTEL: Engineering Mechanics**
   https://archive.nptel.ac.in/courses/112/106/112106286/
2. **https://www.iitg.ac.in/rkbc/me101/Presentation/L16-18.pdf**

Suggested Skill Activities:

1. Force analysis on any stationary object
2. Force analysis of structures and structural components
3. Determination of centre of gravity of composite surfaces
4. Building different types of slopes for frictional applications
5. Force analysis on any moving object

Course Code:	**24CS201**	**Course Title:**	**PROGRAMMING FOR PROBLEM SOLVING USING C**
Credits:	**4**	**L – T – P**	**2-0-4**

Course objectives:

To impart knowledge on the

- To gain knowledge on problem solving techniques
- To learn how to write simple and modular C programs
- To develop C programs using arrays and strings
- To learn the usage of pointers in accessing and manipulating memory
- To develop applications in C using structures & files

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. Lab experiment videos
3. Blended Mode of Learning
4. Project based Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Classroom
8. Flipped Class

UNIT1 - BASICS OF C PROGRAMMING	**[6 hours]**
Problem Solving Techniques: Introduction to Algorithm, Pseudo code, Flow Chart, Structure of ‘C’ program. C Tokens: Keywords, Data Types, Constants, Variables - Declaration - Qualifiers – typedef	
Practical Topics: 1. Steps in Problem Solving Drawing flowchart using yEd tool/Raptor Tool programs using simple statements. 2. Programs to illustrate the use of user-defined data types	
UNIT II – BASIC CONSTRUCTS IN C	**[6 hours]**
Managing simple Input and Output operations - Operators and Expressions - Decision Making:	

Branching statements, looping statements - Function: Declaration, Definition - Passing arguments by value - Recursion - Storage classes	
Practical Topics: 1. Programs using decision making statements 2. Programs using looping statements 3. Programs using user defined functions and recursive functions	
UNIT III – ARRAYS AND STRINGS IN C	**[6 hours]**
Arrays: Initialization - One dimensional, Two dimensional, and Multi-dimensional arrays - String: Basics, declaring and initializing strings, string handling functions: standard and user defined functions	
Practical Topics: 1. Build programs using arrays and array-based operations. 2. Programs using one dimensional and two dimensional arrays. 3. Implementations involving array usage for string operations.	
UNIT IV – POINTERS IN C	**[6 hours]**
Pointers - Passing arguments by address - Dynamic Memory Allocation - Pointer arithmetic - Pointers and one dimensional array - Pointers and Multi-Dimensional Array: Array of Pointers, Pointer to Pointer, Pointer to an array - void Pointer - Pointer to function	
Practical Topics: 1. Implementations involving pointers for dynamic memory allocation 2. Implementations involving pointers for string manipulation.	
UNIT V – STRUCTURES, UNIONS AND FILE HANDLING IN C	**[6 hours]**
Structure: Declaration, Definition-Array of Structures - Pointer to Structure – Nested Structures- Union: Defining union, Accessing union members. Files: File Management functions, Random access in file- Working with Text Files and Binary Files	
Practical Topics: 4. Programs to implement structures 5. Programs to implement union 6. Programs to implement various file operations.	

Laboratory Component: **[45 hours]**

Any 12 experiments have to be completed from the following list of experiments.

S.No.	Name of the Experiment
1	Steps in Problem Solving Drawing flowchart using yEd tool/Raptor Tool programs using simple statements
2	Programs to illustrate the use of user-defined data types
3	Programs using decision making statements
4	Programs using looping statements
5	Programs using user defined functions and recursive functions
6	Build programs using arrays and array-based operations.
7	Programs using one dimensional and two dimensional arrays.
8	Implementations involving array usage for string operations.
9	Implementations involving pointers for dynamic memory allocation
10	Implementations involving pointers for string manipulation.
11	Programs to implement structures
12	Programs to implement union
13	Programs to implement various file operations

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Make use of problem solving techniques to solve real world problems & outline the structure of C program	K3
CO2	Identify the appropriate looping and control statements in C and develop applications using these statements	K3
CO3	Make use of arrays & strings in development of simple applications	K3
CO4	Apply the concepts of pointers and develop C programs using pointer	K3
CO5	Develop programs for storing, retrieving and processing data using structures and files.	K3

COs and POs Mapping

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	**3**	**3**	2	-	1	-	-	-		-	-	1
CO2	**3**	**3**	2	-	1	-	-	-		-	-	1
CO3	**3**	**3**	2	1	1	-	-	-		-	-	1
CO4	**3**	**3**	2	1	1	-	-	-		-	-	1
CO5	**3**	**3**	3	1	1	-	-	-		-	-	1

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	**Type of assessment**	**Max Marks**	**Reduced Marks**	**Total**	**Final marks**
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	15	50	50
	Lab Exam	100	35		
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Internal Examination		End Semester Examination
	1	2	
Remember	20	20	20
Understand	20	20	20
Apply	60	60	60
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

Text Books:

1. Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2015.
2. Pradip Dey, Manas Ghosh, "Programming in C", AICTE Edition, Oxford University Press, 2018

Reference Books:

1. Yashavant P. Kanetkar, "Let Us C : Authentic guide to C programming language", Eighteenth Edition, BPB Publications, 2021
2. Ashok N Kamthane, Programming in C, Pearson, Third Edition, 2020
3. Reema Thareja, "Programming in C", Oxford University Press, Second Edition, 2016.
4. Paul Deitel and Harvey Deitel, "C How to Program with an Introduction to C++", Eighth edition, Pearson Education, 2018.
5. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", 1st Edition, Pearson Education, 2013.
6. E.Balagurusamy, "Programming in ANSI C", seventh edition, Mc Graw Hill Education,2017

Suggested Skill Activities:

1. Steps in Problem Solving Drawing flowchart using yEd tool/Raptor Tool
2. Write a Program to calculate and display the volume of a CUBE having its height (h=10cm), width (w=12cm) and depth (8cm).
3. Ramya has bought 50 kg of onion for Rs 40 per kg and 60 kg of potato for Rs 20 per kg.

Then she sold out all the stock with the selling price of Rs 60 per kg and Rs 30 per kg for onion and potato respectively. Write a C program which computes the profit gained by her.

4. A Food delivery boy needs to walk down every street in his area in order to deliver the food. Assume that the distances between the streets along the roads are given. The food delivery boy starts at the hotel and returns back to the hotel after delivering all the foods. Implement an algorithm to help the food delivery boy to walk minimum distance for the purpose.
5. Write a program to input name, marks of 5 subjects of a student and display the name of the student, the total marks scored, percentage scored and the class of result.
6. A location in a map is represented by a pair of points as x co-ordinate and y co-ordinate. Person X wants to move towards person Y which is residing in the location L1 and L2 respectively. Write C Program to find the distance between these two person .
7. If a four-digit number is input through the keyboard, write a program to obtain the sum of the first and last digit of this number.
8. Write a program to find GCD (greatest common divisor or HCF) and LCM (least common multiple) of two numbers
9. Write a Program to multiply two 3 X 3 Matrices.
10. Write a program to create a structure named company which has name, address, phone and no Of Employee as member variables. Read name of company, its address, phone and no Of Employee. Finally display these members‟ value.
11. Write a program to create array of books. Collect various details of books such as topic, author, department. Collect details for N books and display the details of books based on department name or author
12. A class has strength of N students. The class has two mentors, one person for the odd roll numbers and the other for the rest. Write a C program which reads the roll numbers of all the students and gives two lists of roll numbers corresponding to each advisor
13. Write a C program to maintain the inventory details of items sold in a super market such as item id, name, no of items available, price per item. Perform efficient data storage based on user‟s demand at runtime
14. Write a C program to use binary files for maintaining a telephone directory which includes telephone no, Owner name and address. Here address includes details such as door no, street name, locality, city and pincode. Update the door no of all people belonging to a particular street as follows: Increment the old door no by 10 to get the new door no. (Eg: If the old door no is 13, update it as 23)

Course Code:	**24EC201**	**Course Title:**	**Fundamentals of Electronics Engineering**
Credits:	**3**	**L – T – P**	**2-0-2**
Pre-requisite			**NIL**

Course objectives:

To impart knowledge on the

- Semiconductor devices and applications
- Fundamentals of digital electronics
- Basics of operational amplifiers and its applications
- Basic concepts of Microcontrollers.
- Interfacing of microcontrollers with applications.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Interactive Simulations
4. Lab experiment videos
5. Blended Mode of Learning
6. Project based Learning
7. Experiential Learning
8. NPTEL and Other Videos
9. Smart Class Room
10. Flipped Class

UNIT I - Semiconductor Devices and Applications	**[6 hours]**
PN Junction Diodes, V-I Characteristics – Half wave and full wave rectifiers- Physical operation of special diodes: LED, OLED, AMOLED, - Bipolar Junction Transistors – Construction, types, Configuration, BJT as a single stage common Emitter amplifier	
Practical Topics: 1. Familiarize with lab instruments (Multi-meter/Power supply/CRO). 2. Plot V-I characteristics of a PN junction diode 3. Observe the wave shapes for the Half wave and full wave rectifier circuit. 4. Plot of input and output characteristics and calculation of parameters of transistors in CE configuration.	

UNIT II – Fundamentals of Digital Electronics	[6 hours]
Logic gates – Combinational Logic: Boolean Algebra, Logic simplification using K- map, De M organ's Theorem, Logic IC, Half Adder, Full Adder, Multiplexers, Demultiplexers- Sequential circuits- Shift Register, Counters	
Practical Topics: 1. Implementation of the given Boolean function using logic gates. 2. Design and verify the truth table of a S-R and J-K flip-flop. 3. Design and verify operation of half adder and full adder.	

UNIT III – Operational Amplifiers	[6 hours]
Basic model; Virtual ground concept; Inverting Amplifier, Non-inverting Amplifier, Integrator, Differentiator, Summing Amplifier, Comparator - Analog to Digital Converter, Successive approximation type-Digital to Analog Converter, R-2R Ladder Networks.	
Practical Topics: 1. Verify the operation of an op-amp as Inverting and non-inverting amplifiers. 2. Verify the operation of an op-amp as (a) adder (b) subtractor. 3. Design and verify a voltage follower and voltage comparator circuit with OPAMP IC 741C and observe the wave forms.	

UNIT IV – Microcontrollers	[6 hours]
8051 architecture – Pin Diagrams -Types of buses - I/O Ports functions – Instruction set – Addressing modes – Assembly language programming - Introduction to Arduino platform- Arduino UNO architecture	
Practical Topics: 1. Perform assembly language program for addition using 8051 microcontroller 2. Perform Subtraction of 2 - 8 bit numbers using microcontroller 8051. 3. Write and verify assembly language program for arithmetic and logical operations.	
UNIT V – Interfacing of Microcontroller	**[6 hours]**
LED interfacing - Stepper motor interfacing -DC motor interfacing	
Practical Topics: 1. Interface the stepper motor using 8051 interface modules.	

Laboratory Component: **[30 hours]**

Any 12 experiments have to be completed from the following list of experiments.

S.No.	Name of the Experiment
1	Familiarize with lab instruments (Multi-meter/Power supply/CRO).
2	Plot V-I characteristics of a PN junction diode
3	Observe the wave shapes for the Half wave and full wave rectifier circuit
4	Plot of input and output characteristics and calculation of parameters of transistors in CE configuration.
5	Implementation of the given Boolean function using logic gates
6	Design and verify the truth table of a S-R and J-K flip-flop
7	Design and verify operation of half adder and full adder
8	Verify the operation of an op-amp as Inverting and non-inverting amplifiers
9	Verify the operation of an op-amp as (a) adder (b) subtractor (c) voltage comparator
10	Design and verify a voltage follower and voltage comparator circuit with OPAMP IC 741C and observe the wave forms.
11	Perform assembly language program for addition using 8051 microcontroller
12	Perform Subtraction of 2 - 8 bit numbers using microcontroller 8051
13	Write and verify assembly language program for arithmetic and logical operations.
14	Interface the stepper motor using 8051 interface modules
15	Design, Construct and verify the XOR gate using switches.

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Explain the basic concepts of semiconductor devices and applications
CO2	Construct the simple linear Integrated circuits for an application using IC741
CO3	Build a basic combinational and sequential circuit using the fundamental concepts and techniques used in digital electronics
CO4	Illustrate the concepts of basic architecture of microcontrollers
CO5	Develop software and hardware for interfacing peripherals with 8051 microcontrollers

COs and POs Mapping:

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2	2	2	--	--	--	--	--	--	--	--
CO2	3	2	2	3	--	--	--	--	--	--	--	--
CO3	3	2	3	3	--	--	--	--	--	--	--	--
CO4	3	2	1	2	--	--	--	--	--	--	--	--
CO5	3	2	1	2	--	--	--	--	--	--	--	--

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	25
	CIE – II	100			
	MCQ	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
Continuous Internal Examination (CIE) - Laboratory	Continuous Assessment	75	75	100	25
	Model Lab Exam	25	25		
End Semester Examination (ESE)	Theory Exam	100	35	50	50
	Lab Exam	100	15		
				Total	100

Assessment Pattern

Bloom's Category	Internal Assessment Tests		Terminal Examination
	1	2	
Remember	30	20	30
Understand	40	50	30
Apply	30	30	20
Analyse	0	0	20
Evaluate	0	0	0
Create	0	0	0

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Reference Books:

1. Satya Sai Srikant Prakash Kumar Chaturvedi, Basic Electronics Engineering, Springer Nature Singapore Publishing Company Pvt Ltd., 2020
2. R.K. Singh, Ashish Dixit, Basic Electronics Engineering & Devices, University Science Press, Laxmi Publications Pvt. Ltd., 2021
3. Ramesh Gaonkar, "Microprocessor Architecture, Programming and Applications with the 8085", 6th Edition, Pangram International Publication (India) Pvt. Ltd.,2013
4. "Sensors and Transducers – D. Patranabis" –PHI Learning Private Limited., 2003
5. Floyd, Electronic Devices, Pearson Education 10th edition, 2018
6. Electronic Devices & Circuit Theory, R.L Boylestad and L. Nashelsky, Pearson Education, 2021
7. Op-amps and Linear Integrated Circuits, Ramakanth A Gayakwad, Pearson Education, 4th Edition, 2015
8. Digital Logic and Computer Design, M. Morris Mano, Pearson India, 2017, ISBN: 9789332586048,9332586047

Web Links and Video Lectures (E-Resources):

1. Semiconductor Devices and Circuits: https://onlinecourses.nptel.ac.in/noc24_ee143/preview
2. Digital Circuits: https://onlinecourses.nptel.ac.in/noc24_ee147/preview
3. Operational amplifiers: https://nptel.ac.in/courses/108/108/108108114/
4. Microcontrolles and Microprocessors: https://onlinecourses.nptel.ac.in/noc22_ee12/preview
5. Introduction to Microprocessors and Microcontrollers: https://nptel.ac.in/courses/117104072

Suggested Skill Activities:

1. **Construct** a simple '**Rain alert alarm'** using Transistors.
2. **Build** a '**Touch Sensor'** circuit with three components, a resistor, a transistor, and a light-emitting diode.
1. **Make** a simple photodiode-based '**fire sensor'**
2. **Demonstrate** that a zener diode can be used as a '**voltage regulator'** in the reverse biased mode.
3. **Build** the microcontroller circuit for a simple **real-world application**

Course Code:	**24GE231**	**Course Title:**	**WORKSHOP PRACTICE**
Credits:	**1.5**	**L – T – P**	**0-0-3**

Course objectives:
To provide hands on training to the students in: • Applying basic techniques to measure a field, infer masonry work and install plumbing design. • Fabricating carpentry, foundry, sheet metal and welding works to practice on workshop trades and making end products. • Utilizing machining processes like turning, drilling, tapping in parts and 3D printing for performing the jobs. • Designing electrical wiring layout with MCBs and RCCBs, developing staircase wiring and illumination design circuits for buildings. • Assembling simple electronic components on PCB by soldering and desoldering and testing with IoT based interfaces. • Developing blogs and website design for the complete access over the network.
Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes: 1. Project based learning 2. Industrial Visit

GROUP – A (Civil and Mechanical)

PART I - CIVIL ENGINEERING PRACTICES	**[5 hours]**
1. FIELD MEASUREMENT, MASONRY WORK AND PLUMBING a. Calculate the area of a built-up space and a small parcel of land-use standard measuring tape and digital distance measuring devices.	

b. Visit a nearby site where construction is at initial stage and observe for following (if necessary, visit two/three times with a gap of a week). If drawings are available relate/match activities with the drawings.

i. Digging and filling.
ii. Foundation preparations.
iii. Brick/stone masonry.
iv. Concrete laying and curing.
v. Laying of sewerage/sanitary lines.
vi. Bar bending and bar laying for columns, beams and ceiling.
vii. Onsite testing for quality.
viii. Onsite preparation for construction work.
ix. Erection and removal of form work, scaffolding, centering/shuttering.

Prepare a brief report on the construction activities, methods, tools, equipments and materials being used.

c. Installation of water lines for wash basin and showers faucet.

PART II MECHANICAL ENGINEERING PRACTICES	[5 hours]

2. CARPENTRY, FOUNDRY, WELDING AND SHEET METAL
   a. Carpentry: Prepare T/L/Lap Joint from given wooden work piece and make a Box/Tray out of plywood using modern power tools.
   b. Welding: Make a Butt/Lap of MS plate using Arc welding process.
   c. Casting: Demonstration of Pattern making by sand moulding.
   d. Sheet Metal: Fabrication of Sheet Metal Tray and Funnels.
3. LATHE, DRILLING MACHINE AND 3D PRINTER
   a. Designing a driller component using radial machine.
   b. Perform a job using facing and turning in lathe.
   c. Printing simple 3D geometric shapes using SLA printer.

GROUP – B (Electrical, Electronics and IT)

PART III ELECTRICAL ENGINEERING PRACTICES	[3 hours]

4. ELECTRICAL WIRING
   a. Design a wiring circuit integrating energy meter, MCBs and RCCBs.
   b. Develop fluorescent lamp wiring, staircase wiring and electric fan wiring circuits.

PART IV ELECTRONICS ENGINEERING PRACTICES	[4 hours]

5. IOT BASED SOLUTIONS AND PCB
   a. Design a single layer PCB layout structure.
   b. Fabricate single layer PCB printing.
   c. Assembling, soldering and desoldering practice on single layer PCB.

d. GPIO programming in ESP8266, sensor and actuator interfacing with internet enabled microcontroller device.
e. Integration of microcontroller-based system with Cloud platform.

PART V	COMPUTER SCIENCE AND ENGINEERING PRACTICES	[3 hours]

6. INTERACTIVE DYNAMIC WEBSITE

a. Design a website for an application using HTML and CSS.
b. Convert the designed website into responsive website using Bootstrap.
c. Add dynamism to the website by using JavaScript and embed the social media components to the website.
d. Incorporate the database interaction with the website.
e. Deploy the developed website in the server.

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Apply basic techniques for field measurements, masonry work and plumbing.	K3
CO2	Make use of workshop trades like carpentry, foundry, sheet metal and welding for practicing on manufacturing of components.	K3
CO3	Develop simple components using Lathe, Drilling Machine and 3D Printer.	K3
CO4	Construct the electrical wiring circuits for buildings based on their requirement.	K3
CO5	Develop IoT based solutions and PCB for real world use cases.	K3
CO6	Build and host an interactive dynamic website.	K3

COs and POs Mapping:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	1	1	2	-	-	-	1	1	-	1	3	2	1
CO2	3	2	1	1	2	-	-	-	1	1	-	1			
CO3	3	2	1	1	2	-	-	-	1	1	-	1			
CO4	3	2	1	1	2	-	-	-	1	1	-	1	1	-	-
CO5	3	2	1	1	2	-	-	-	1	1	-	1			
CO6	3	2	1	1	2	-	-	-	1	1	-	1	-	1	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

The weightage of Continuous Internal Evaluation (CIE) is 60% and for End Semester Examination (ESE) is 40%.

S.No	Component	Type of Assessment	Max Marks	Reduced Marks	Total	Final Marks
1.	**Continuous Internal Examination(CIE)-Laboratory**	Continuous Assessment	75	75	100	60
2.		Model Lab Exam	25	25		
3.	**End Semester Examination (ESE)**	Lab Exam	100	40	40	40
					Total	100

Assessment Pattern

Bloom's Category	Terminal Examination
Remember	0
Understand	0
Apply	100
Analyze	0
Evaluate	0
Create	0

Text Books:

1. AICTE's Prescribed Textbook: Workshop / Manufacturing Practices (with Lab Manual) ISBN: 978-93-91505-332
2. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.

Reference Books:

1. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4 th edition, Pearson Education India Edition, 2002.
2. Gowri P. Hariharan and A. Suresh Babu," Manufacturing Technology – I" Pearson Education, 2008.
3. Roy A. Lindberg, "Processes and Materials of Manufacture", 4 th edition, Prentice Hall India, 1998.
4. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House, 2017.

Course Code:	**24EN201**	**Course Title:**	**Presentation and Language Skills Laboratory** (Common to AI&DS, AE,BME, CE, CSE, CSE(AI&ML),EEE, ECE,MECH)
Credits:	**1.5**	**L – T – P**	**0-0-3**

Course Objectives:

- To apply critical listening skills.
- To make use of critical thinking skills.
- To apply stress as well as tonal variation.
- Make use of language skills to produce error free sentences
- To experiment with presentation skills.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Lab experiment videos
2. Blended Mode of Learning
3. Project based Learning
4. Smart Classroom
5. Flipped Class

UNIT I		**[12 hours]**
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	**Topic**	**Hours**
1.	Listening to audios (online platforms) and making a critical appreciation of audio content	3
2.	Listening to breaking news	2
3.	Listening to British council / Cambridge English (Selected topics)	2
CLASSROOM ACTIVITIES		
1.	Speaking current issues (selected topics)	2
2.	Making conversations at work place, Public Speaking (based on festivals and celebrations)	3

UNIT II		[12 hours]
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	**Topic**	**Hours**
1	English Movie clips and software in the Lab C (Globarena)	3
2	Vocabulary Development through movies/ short films/ Documentaries	3
CLASSROOM ACTIVITIES		
1	Speaking - Just a minute talk and expressions for plans and decisions	3
2	Describing a product	3

UNIT III		[12 hours]
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	**Topic**	**Hours**
1.	Listening to TED talks, scientific lectures.	3
2.	Reading Comprehension strategies	2
3.	Reading- Editorials	2
CLASSROOM ACTIVITIES		
1.	Speaking- Introduction to Phonetics- Speech sounds- Vowels and Consonants- Stress- Rising/ Falling Tone	2
2.	Writing- A day in my life	2
3.	Writing- Situational Dialogues	1

UNIT IV		[12 hours]
LIST OF EXERCISES		
LAB ACTIVITIES		
Sl.No.	**Topic**	**Hours**
1.	Reading Popular Blogs Listening Editorials	3
2.	Creating a Blog	2
CLASSROOM ACTIVITIES		

S.No.	Name of the Experiments
1	Making conversation at workplace
2	Writing articles
3	Making expressions for plans and decisions
4	Describing a product
5	Day in my life
6	Writing Terminology for engineers
7	Spotting errors
8	Expansion of proverbs
9	Instructions
10	Reading comprehension

	UNIT V	[12 hours]
1.	Errors in Pronunciation. Error detection	3
2.	Writing - Terminology for Engineers. Writing Articles and preparing day to day scripts.	2 2

LIST OF EXERCISES		
LAB ACTIVITIES		
Sl. No.	**Topic**	**Hours**
1.	Prepare PowerPoint presentation (topics selected by students)	3
2.	Reading newspaper articles	2
CLASSROOM ACTIVITIES		
1.	Present the selected topic.	3
2.	Making a short speech / Extempore	2
3.	Writing - Expanding a Proverb Writing Instructions	2

Course Outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Cognitive Level
CO1	Build communicative competence through critical listening skills.	K3
CO2	Make use of critical thinking skills to express plans and opinions.	K3
CO3	Apply stress as well as tonal variations for effective communication.	K3

CO4	Make use of language skills to produce error free sentences.	K3
CO5	Experiment with presentation skills to address confidently.	K3

COs and POs Mapping:

COs	**POs**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	-	-	-	-	-	-	-	-	-	3	-	3
CO2	-	-	-	-	-	-	-	-	-	3	-	3
CO3	-	-	-	-	-	-	-	-	-	3	-	3
CO4	-	-	-	-	-	-	-	-	-	-	-	3
CO5	-	-	-	-	-	-	-	-	-	3	-	3

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Assessment Pattern:

Name of the Test	**Marks**	**Total**	**Reduced to**
Continuous Assessment (Experiments 1-10)	50	100	50
Model Examination	50		
End Semester Lab Exam	100	100	50
		TOTAL	**100 MARKS**

Textbooks:

1. Raman, Meenakshi and Sangeetha Sharma. Professional Communication. Oxford University Press, Oxford, 2014.
2. Dr. Chellammal. V. Learning to Communicate. Allied Publishers, New Delhi, 2003.
3. Mohan, Krishna. And Meera Bannerjee. Developing Communication Skills. Macmillan India Ltd. 1990.

Reference Books:

Murphy – Raymond. English Grammar in Use BOOK with Answers: A Self-Study. Reference and Practice Book for Intermediate Learners of English. Fourth edition: Cambridge University Press – 2012.

MANUALS/ SOFTWARE: Open Sources / Websites