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

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	

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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

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-Hill Education (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.