SYLLABUS

24MG206 - OPTIMIZATION TECHNIQUES

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UNIT I – Modeling with Spreadsheets	**[9+3 hours]**

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 hours]**

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 hours]**

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 hours]**

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 hours]**
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.	K3
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

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.

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

Web Links and Video Lectures (E-Resources):

1. Solution 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. Travelling Salesman Problem
   https://www.nptelvideos.com/lecture.php?id=14332