MTH3011: Optimization

Programme: M.Sc./B.Tech. Year: 1st /3rd Semester: 1st /7th
Course: Core/Open Elective Credits: 4 Hours: 40

Course Context and Overview (100 words):

Optimization has an important place in both practical and theoretical worlds since it help us to achieve a goal in the best possible way through the timing, cost and magnitude of actions to be carried out. The operation research is used in daily life and it arises across all branches of mathematics and in application areas ranging from biology and engineering to business and finance including computer science (machine learning, data analysis, Neural Networks, computational complexity, theoretical computer science), electrical & communication engineering (signal processing, internet, wireless sensor networks, robotic networks, control), mechanical assemblies and simulation (which are key engineering features of the design and manufacturing process), industrial engineering, environmental and civil engineering. Students will learn an introduction to the theory of multi-variable optimization, some basic problems of the said areas, the skills to formulate & how they can solve all those problems.

Prerequisites Courses: No

Course outcomes (COs):

On completion of this course, the students will have the ability to:
CO1: Understand the mathematical tools that are needed to solve optimization problems.
C02: Identify and develop operational research models from the description of the real systems related to transportation, assignment and travelling salesman problem, decision problems of business and all units of social organization including government and military organization.
C03: Understand the concept of Game theory and Queuing theory related to various business problems.
C04: Understand the concept of Project Management related to the network scheduling of predetermined project.

Course Topics:

Topics	**Lecture Hours**	
UNIT - I **1. Linear Programming Problem**		
1.1 Introduction and definition of Linear Programming Problem. Formulation of L P Problem, Graphical solutions of LP Problem.	3	16
1.2 Convex Sets.	3	
1.3 Solution of a LP Problem by Simplex Method, Two Phase Method and Big-M Method.	4	
1.4 Duality. Solution of a LP Problem by its Dual.	2	

1.5 Sensitivity Analysis	4	
UNIT - II **2. Transportation and Assignment**		8
2.1 Mathematical Formulation of Transportation Problem, Initial Feasible Solution Methods,	2	
2.2 Optimality Test, Degeneracy in TP.	2	
2.3 Mathematical formulation of assignment problem. Hungarian Method.	2	
2.4 Unbalanced and Restricted assignment problem. Traveling Salesman Problem.	2	
UNIT - III **3. Game Theory and Job Sequences and Queuing Theory**		12
3.1 Saddle point. Solution of Games with saddle point. Two Person Zero Sum Game. Pure and Mixed Strategies	3	
3.2 Algebraic Solution Procedure. Graphical method for 2 × n and m × 2 games. Matrix method for m × n games.	3	
3.3 Sequencing Problem, Processing of n Jobs Through Two Machines and m Machines, Graphical Method of Two Jobs m Machines Problem.	3	
Different Models of Queuing System.	3	
UNIT - IV **4. CPM and PERT**		4
4.1 Phases of project management. Rules for drawing network diagram. Time estimates and Critical path in network analysis. Disadvantage of network technique.	4	

Textbook references (IEEE format):
Text Book:

1. A. H. Taha, “Operations Research - An Introduction”, Prentice Hall, (7th Edition), 2002.
2. .J. C. Pant, “Introduction to Optimization Operation Research”. Jain Brothers, 2008.
3. W. L. Winston, ``Operations Research Applications and Algorithms", Brooks/Cole, 4th Edition, 2003.
4. F. S. Hillier and G. J. Lieberman, ``Introduction to operations research", McGraw-Hill, 7th Edition, 2001.

Reference books:

1. B. E. Gillet, “Introduction to Operations Research: a computer oriented algorithm approach”, Tata McGraw Hill.
2. C. Mohan and Kusum Deep, “Optimization Techniques”, New Age, 2009.

Additional Resources: NPTEL, MIT Video Lectures, Web resources etc.

Evaluation Methods:

Item	Weightage
Attendance	5%
Assignment	5%
Quiz	15%
Midterm	25%
Final Examination	50%

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