INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

OPTIMIZATION TECHNIQUES								
V Semester: CSE(DS)								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
ACDD07	Core	3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: There are no prerequisites to take this course.								

I. COURSE OVERVIEW:

This course covers mathematical algorithms for improving processes across engineering, economics, logistics, and computer science. Through the study of this course students apply these methods to real-world problems, achieving enhanced efficiency and resource utilization. The course equips students with practical skills and evidence of improved performance in diverse applications.

II. COURSES OBJECTIVES:

The students will try to learn

I. The fundamental concepts of optimization and linear programming, with a focus on problem formulation and solution using graphical and simplex methods.
II. The analytical skills in solving resource allocation problems, including transportation, assignment, and job sequencing models.
III. The decision-making techniques such as game theory and project management, to real-world managerial and operational problems.

III. COURSE OUTCOMES:

At the end of the course, students should be able to:

CO1 Understand the concept of Optimization, Formulation and solve Linear Programming problems
CO2 Apply optimization techniques to find initial basic feasible solutions and move towards optimality in transportation problems, including unbalanced and maximization cases.
CO3 Implement the Hungarian Algorithm and other optimization methods to solve assignment problems, including cases with multiple solutions, unbalanced conditions, and maximization models.
CO4 Apply sequencing techniques, including Johnson's Algorithm, to optimize job scheduling for different machine configurations, ensuring efficient workflow and minimal processing time.
CO5 Apply game theory concepts and strategies, including pure and mixed strategies, to analyze and optimize decision-making in competitive environments.
CO6 Apply network analysis techniques, including CPM and PERT, to determine the critical path, analyze project timelines, and optimize project planning and control.

IV. COURSE CONTENT:

MODULE - I: INTRODUCTION (10)

Introduction: Introduction: Meaning, Nature, Scope & Significance of Optimization - Typical applications. The Linear Programming Problem – Introduction, Formulation of Linear Programming problem, Limitations of L.P.P, Graphical method, Simplex method: Maximization and Minimization model (exclude Duality problems), Big-M method.

MODULE - II: TRANSPORTATION AND ASSIGNMENT PROBLEM (10)

Transportation Problem: Introduction, Transportation Model, Finding initial basic feasible solutions, Moving towards optimality, Unbalanced Transportation problems, Transportation problems with maximization, Degeneracy Assignment Problem: Introduction, Mathematical formulation of the problem, Solution of an Assignment problem, Hungarian Algorithm, Multiple Solution, Unbalanced Assignment problems, Maximization in Assignment Model.

MODULE - III: SEQUENCING (09)

Classical Sequencing Concepts: Introduction to Sequencing: Johnson's Algorithm: n Jobs – 2 Machines, n Jobs – 3 Machines: Jobs – m Machines, Approximation techniques, NEH Heuristic, Branch and Bound approach, Graphical solution method, Gantt chart representation.

Advanced Sequencing Concepts: Flexible Job Shop Scheduling (FJSS), Dynamic Sequencing, Multi-Objective Scheduling, AI & ML in Sequencing, Smart Manufacturing Integration, Simulation-Based Sequencing.

MODULE – IV: GAME THEORY (10)

Game Theory: Concepts, Definitions and Terminology, Two Person Zero Sum Games, Pure Strategy Games (with Saddle Point), Principal of Dominance, Mixed Strategy Games (Game without Saddle Point), Significance of Game Theory in Managerial Application.

MODULE –V: PROJECT MANAGEMENT (09)

Project Management: Network Analysis, Definition, objectives, Rules for constructing network diagram-Determining Critical Path, Earliest & Latest Times, Floats, Application of CPM and PERT techniques in Project Planning and Control, PERT Vs CPM. (exclude Project Crashing).

V. TEXTBOOKS:

1. R.Pannerselvam, "Operations Research", PHI Publications**,** Second Edition, 2016.
2. A.M.Natarajan, P.Balasubramani,A, "Operations Research", Tamilarasi/Pearson Education, Second Edition, 2014.
3. S.S.Rao, "Engineering Optimization: Theory and practice", New Age International (P) Limited, Second Edition, 2013.

VI. REFERENCE BOOKS:

1. ND Vohra "Quantitative Techniques in Management", Tata McGraw Hill, 4th Edition, 2011.
2. Hiller &Lieberman, "Introduction to Operations Research", (TMH), McGraw Hill Higher Education; 7th Edition, 2002.
3. Maurice Saseini, ArhurYaspan and Lawrence Friedman, "Operations Research: Methods and Problems", Literary Licensing, LLC, 2013.
4. Barry Render, Ralph M. Stair, Jr and Michael E. Hanna, "Quantitative Analysis for Management", Pearson Education, 2022.
5. Wagner, "Operations Research", Prentice Hall India Learning Private Limited; 2nd Edition, 1980.

VII. ELECTRONICS RESOURCES

1. https://onlinecourses.swayam2.ac.in/cec20_ma10/preview
2. https://onlinecourses.nptel.ac.in/noc20_ma23/preview
3. https://onlinecourses.nptel.ac.in/noc19_ma29/preview

VIII. MATERIALS ONLINE

1. Course template

2. Tutorial question bank
3. Tech talk topics
4. Open-ended experiments
5. Definitions and terminology
6. Assignments
7. Model question paper – I
8. Model question paper – II
9. Lecture notes
10. PowerPoint presentation
11. E-Learning Readiness Videos (ELRV)