

Code No.: MDS 507

Course Title: **Linear and Integer Programming**

Nature: Theory+Practical (Elective)

Full Marks: 75

Credit: 3

Course Description:

The course covers basic introduction of linear and integer based optimization problems, their few solution techniques and implementation of the solution techniques to solve real world problems formulated as linear programming problem and integer programming problem.

Course Objectives:

After the completion of this course, the students should be able to

- Know the concept and importance of convexity in optimization.
- Formulate real world problems in the form of linear programming problem(LPP) and integer programming problem (IPP).
- Solve LPP and IPP manually and using software as well.
- Solve the LPP and IPP using graphical and simplex methods.
- Know the total unimodularity, understand and implement cutting plane algorithm and branch and bound technique.

Course Contents:

Unit 1: Convexity and Optimization

[6Hrs.]

Affine and Convex Sets, Convex Function, Convex Optimization Problem.

Unit 2: Problem Formulation

[10 Hrs.]

Real world problems, Linear programming problem (LPP) formulation, Integer programming problem(IPP) formulation, Non-linear programming problem (NLP) formulation, Matlab and Python tutorial.

Unit 3: Linear Programming Problem

[12Hrs.]

Three forms of LPP, Graphical Method, The Simplex Method, The General Problem, Linear Equations and Basic Feasible Solutions, Introduction to the Simplex Method, Theory of the Simplex Method, The Simplex Tableau and Examples, Artificial Variables, Redundant Systems, A Convergence Proof, Linear Programming and Convexity, Spreadsheet Solution of a Linear Programming Problem.

Unit 4: Duality and Sensitivity Analysis

[10 Hrs.]

Introduction to Duality, Definition of the Dual Problem, Examples and Interpretations, The Duality Theorem, The Complementary Slackness Theorem Examples in Sensitivity Analysis, Matrix Representation of the Simplex Algorithm, Changes in the Objective Function, Addition of a New Variable, Changes in the Constant-Term Column Vector, The Dual Simplex Algorithm, Addition of a Constraint.

Unit 5: Integer Programming Problem

[10 Hrs.]

Introduction to Integer Programming, Total Unimodularity, Gomory's Cutting Plane Algorithm, A Branch and Bound Algorithm.

Practical Works:

The practical works includes Python and Matlabsoftwares.

References:

1. Stephen Boyd & Lieven Vandenberghe (2009) .*Convex Optimization*, Cambridge University Press.
2. Alexander Schrijver (1999).*Theory of Linear and Integer Programming*, John Wiley.
3. Paul R. Thie and G. E. Keough (2008).*An Introduction to Linear Programming and Game Theory*, John Wiley.
4. Laurence A Wolsey (1998).*Integer Programming*, John Wiley.
