

20MD007 OPTIMIZATION TECHNIQUES

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Course Description and Objectives:

Optimization is the process of obtaining the best result under given circumstances. In design, construction and maintenance of any engineering system, engineers have to take many technological and managerial decisions at several stages. The ultimate goal of all such decisions is either to minimize the effort required or to maximize the desired benefit. A number of optimization methods have been developed for solving different types of optimization problems. This course is designed to familiarize the students with the modeling of mechanical engineering systems and obtaining the optimum solution.

Course Outcomes:

Upon successful completion of this course student will be able to:

- formulate optimization problems;
- understand and apply the concept of optimality criteria for various type of optimization problems;
- solve various constrained and unconstrained problems in single variable as well as multivariable;
- apply the methods of optimization in real life situation.

SKILLS:

- to identify and resolve real life optimization problem the knowledge about various optimization techniques
- to know about various advanced optimization techniques like GA, PSO, ACO, TLBO

UNIT – I

L-12

Introduction & Linear Programming Problem: Terminology, Design Variables, Constraints, Objective Function, Problem Formulation. Engineering applications of optimization, classification of optimization problems.

Linear Programming Problem: Standard form of linear programming (LP) problem, Canonical form of LP problem, Elementary operations, Graphical method for two variable optimization problem, Simplex method, Applications of linear programming, Big-M method, Dual Simplex method

UNIT – II

L-12

Transportation Problems: Definition, Formulation, IBFS of TP-NWCM, LCEM, VAM; MODI method -Optimality test for transportation Problem, Special Cases of TP-Maximization case; Unbalanced type; Restricted case; Degeneracy case.

Assignment Problem: Definition, Formulation, mathematical Modelling of AP, Hungarian method to solve AP, Special Cases in AP- Restricted Assignment, Maximization type, Travelling Salesman Problem.

UNIT - III

L-12

Non – Linear Programming Problem: Single Variable objective function with or without constraints: Optimality Criterion, Interval Halving Method, Fibonacci Search Method, Golden Section Method. Gradient Based Methods: Newton-Raphson Method, Bisection Method, Secant Method

UNIT - IV

L-12

Multi Variable objective function with or without constraints: Solution by method of constrained variation method of Lagrange multipliers, Kuhn–Tucker conditions, Univariate method Pattern Direction, Gradient of a Function, Steepest descent method, Newton’s method

UNIT – V

L-12

Advanced Optimization Techniques: Genetic Algorithms, working principle, reproduction, crossover, mutation, advanced GA operators, GA for constrained optimization, PSO, ACO, TLBO, Modified TLBO, Introduction to Graph Theory and orthogonal arrays for optimization applications

TEXTBOOKS:

1. S.S.Rao, "Engineering Optimization", 3rd Edition, New Age Publishers, 2008.
2. Kalyanmoy Deb, "Optimization for Engineering Design", 1st Edition, PHI Publishers, 2009.