## MEPE3001 OPTIMIZATION METHOD IN ENGINEERING DESIGN (3-0-0)

**Course Objectives:**

This course introduces optimization techniques for engineering design, covering linear/nonlinear programming, multivariable algorithms, and global methods (GA, simulated annealing). Students will learn to formulate problems (variables, constraints, objectives) and apply methods like simplex, Fibonacci search, and Kuhn-Tucker conditions to solve real-world engineering challenges.

**Module-I: (06 Hours)**

Introduction and overview of optimization- Definition, Design variables, Constraints, Objective function, Classification of problems; Single-many variable problems, Single-many objectives problem.

**Module-II: (06 Hours)**

Single variable optimization algorithm, Linear programming, Simplex and BIG M method.

**Module-III: (06 Hours)**

Nonlinear Programming- Elimination methods, Exhaustive Search Method, Fibonacci Search method, Golden section search method, Cubic Search Method, Newton-Raphson method, Secant Method.

**Module-IV: (06 Hours)**

Multivariable Optimization Algorithms- Direct search methods. Simplex search method and Hooke-Jeeves pattern search method. Constrained Optimization Algorithms- Kuhn-Tucker conditions, penalty function.

**Module-V: (06 Hours)**

Global optimization using genetic algorithms and simulated annealing.

**Course Outcomes:**

CO1: Remembering (Knowledge): Define optimization terms (variables, constraints, objectives) and classify problem types.

CO2: Understanding (Comprehension): Explain linear/nonlinear programming methods (simplex, BIG M) and search algorithms (Fibonacci, Golden section).

CO3: Applying (Application): Implement single/multivariable optimization techniques (e.g., Hooke-Jeeves) for engineering problems.

CO4: Analyzing (Analysis): Evaluate constrained optimization solutions using Kuhn-Tucker conditions and penalty functions.

CO5: Creating (Synthesis): Design global optimization strategies using genetic algorithms or simulated annealing for complex systems.

**Reference Books**


1. Engineering Optimization: Theory and Practice- S.S. Rao
2. Optimization Methods for Engineering Design- R.L. Fox
3. Optimization methods- K. V. Mital and C. Mohan
4. Optimization and Probability in System Engineering- J.G. Rau