**Elective III: Optimization Techniques**

**Unit I:** Introduction: Engineering applications of optimization. Design variables. Constraints, objectives function, variable bounds, statement and formulation of an optimization problem, Example of Optimization problems, classification of optimization problems, different optimization algorithms.

**Unit II:** Optimal Point: Local optimal point, global optimal point and inflection point.

**Unit III:** Single Variable Optimization Techniques: Optimality criterion, Bracketing method (Bounding phase method), Region elimination methods (Internal halving method, Golden section search method), Point estimation method (successive quadratic estimation methods), Gradient-based methods (Newton-Raphson method, Bisection method, secant, Cubic search method.), Root finding using optimization techniques.

**Unit IV:** Multivariable Optimization Techniques: Optimality criterion, Unidirectional search method, Direct Search method (Hooke-Jeeves Pattern Search method, Powell’s conjugate direction method), Gradient-based methods (Steepest descent method, Newton’s method, and Marquardt’s methods)

**Unit V:** Constrained Optimization Algorithms: Kuhn-Tucker conditions, Transformation method (Penalty function method), direct search for constrained minimization (variable elimination method, complex search method)

**Unit VI:** Linear Programming: Linear programming problems, Simplex method of linear programming techniques.

**Text Book:** 1. Optimization for Engineering Design: Algorithms and Examples, Kalyanmoy Deb, PHI Learning, 2004. 34

**Reference Books:** 1. Engineering Optimization: Theory and Practice, Singiresu S. Rao, John Wiley 2009.

2. Optimization of Chemical Processes, T.I. Edgar & D.M. Himmelblau, McGraw Hill.

3. Optimization: Theory and Practice, Beveridge and Schecter, McGraw Hill.