Course Name:

Structural Optimization

Course Number:

20195

Credit:

3

Course Content (outline):

1. **Introduction**

Basic Concepts

Mathematical Formulation of Optimization Problems

Design Variables, Classification of Constraints and Feasible Domain

Linear and Nonlinear Programming Problems

Optimization Techniques- Classical Tools (Optimality Test) and Mathematical Programming Methods

2. **Linear Programming**

Definitions, Applications and Graphical Solution of LP Problems

The Simplex Method, the Canonical Form, Pivot Operations

Generating a Basic Feasible Solution

Duality in Linear Programming

3. **Unconstrained Optimization**

Local and Global Minimum Value

Univariate Search Technique

Minimization of Functions of Several Variables- Zeroth Order Methods (Powell's Conjugate Directions), Gradient Method (Steepest Descent Method), Newton's Method and Quasi-Newton Algorithms

4. **Constrained Optimization**

Lagrange Multiplier Method

The Kuhn-Tucker Conditions for Optimality

Convex Programming

Quadratic Programming

Computing the Lagrange Multipliers

Gradient Projection Method

Feasible Directions Method

Interior and Exterior Penalty Functions Methods

5. Sequential Approximate Optimization

Linearizing Constraints and Objective Function

The Linear and Reciprocal Approximations

Sequential Linear Programming

Sequential Quadratic Programming

Sensitivity Analysis, the Direct and Adjoint Methods

6. Aspects of The Optimization Process in Practice

Optimization of Cross-Section Area

Shape Optimization

Topological Optimization

References:

- Kirsh, Uri. Optimal Structural Design, MacGraw-Hill, 1981.
- Haftka, Raphael T. and Gurdal, Zafer. Elements of Structural Optimization, Kluwer Academic Publishers, 1992.
- Christensen, Peter W. and Klarbring, Anders. An Introduction to Structural Optimization, Springer, 2009.