

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.