# STRUCTURAL OPTIMIZATION

**(Professional Elective- IV)**

| **Course Code: 19CE2261** | **L** | **P** | **C** |
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Course Outcomes:

At the end of the course the student will be able to

CO1: Describe problem formulation for a given structure and learn to analysis by classical methods.
CO2: Prepare solutions for non-linear problems.
CO3: Discuss the basics and application of Genetic Algorithm for structures.
CO4: Explain the concept of Simulated Annealing technique in structures.
CO5: Use Artificial Neural Networks in structural application.

**UNIT–I** **(10-Lectures)**

**FORMULATION OF STRUCTURAL OPTIMIZATION PROBLEMS:**
Design variables - Objective function – constraints.
Classical methods of optimization for multivariable with equality or inequality constraints: solution by method of Lagrange Multiplier - Applications in structural engineering.
**LO1:** Describe classical methods of optimization.
**LO2:** Describe and learn the design variables.

**UNIT–II** (10-Lectures)

**NONLINEAR PROGRAMMING:** Unconstrained and Constrained optimization - Basic approach of the Penalty function method - Interior penalty function method and Exterior penalty function method– design of three bar truss, space truss, welded beam design, etc.
**LO1:** Prepare and learn the unconstrained and constrained optimization.
**LO2:** Prepare and learn the design of trusses.

**UNIT–III** **(10-Lectures)**

**GENETIC ALGORITHMS:**–Introduction–basic concept–working principle - Binary coding- Fitness function - Genetic Operators - Application to Two bar truss, 3-bar truss, optimum fiber orientation problem.

**LO1:** discuss the basic working principles.

**LO2:** discuss the applications of Genetic Algorithms.

**UNIT–IV** **(10-Lectures)**

**SIMULATED ANNEALING (SA)**: problem formulation- steps involved in SA-application to RCC retaining wall, and pre-stressed concrete structure design, etc.

**LO1:** Explain the problem formulation.

**LO2:** Explain the concept of structural design.

**UNIT–V** **(10-Lectures)**

Artificial Neural Networks (ANN) based approaches for structural optimization problems- Introduction- basic concept of ANN- Architectures and learning methods of NN- Back propagation networks- structural applications.

**LO1:** Use basic knowledge on Artificial Neural Networks.

**LO2:** Use the concept of Architectures methods.

Text Books

1. Rao,S.S.*"Engineering Optimization, Theory andApplications"*,3rd Edition, New Age International publication, New Delhi, 2010.

2. Arora,J.S. *"Introduction to Optimum Design"*, 2nd Edition, McGraw-Hill Book Company,2000.

*3.* Rajasekaran, S. and Vijaya Lakshmi Pai, G.A. –*Neural networks, Fuzzy logic, and genetic Algorithms, Synthesis andApplication",*

1st Edition, PHI, 2003

References

1. Morris A.J., *"Foundations of Structural Optimization - A Unified Approach"*, 3rdEdition, John Wiley and Sons,2003