ST5013 OPTIMIZATION OF STRUCTURES

DETAILED SYLLABUS

OBJECTIVE

To study the optimization methodologies applied to structural engineering

UNIT I BASIC PRINCIPLES AND CLASSICAL OPTIMIZATION TECHNIQUES

Definition - Objective Function; Constraints - Equality and inequality - Linear and non-linear, Side, Non-negativity, Behaviour and other constraints - Design space - Feasible and infeasible- Convex and Concave - Active constraint - Local and global optima. Differential calculus - Optimality criteria - Single variable optimization - Multivariable optimization with no constraints- (Lagrange Multiplier method) - with inequality constraints (Khun - Tucker Criteria).

UNIT II LINEAR AND NON-LINEAR PROGRAMMING

LINEAR PROGRAMMING: Formulation of problems - Graphical solution – Analytical methods - Standard form - Slack, surplus and artificial variables - Canonical form – Basic feasible solution - simplex method - Two phase method - Penalty method - Duality theory - Primal - Dual algorithm. NON LINEAR PROGRAMMING: One Dimensional minimization methods: Unidimensional - Unimodal function - Exhaustive and unrestricted search - Dichotomous search – Fibonacci Method - Golden section method - Interpolation methods. Unconstrained optimization Techniques.

UNIT III GEOMETRIC PROGRAMMING

Posynomial - degree of difficulty - reducing G.P.P to a set of simultaneous equations - Unconstrained and constrained problems with zero difficulty - Concept of solving problems with one degree of difficulty.

UNIT IV DYNAMIC PROGRAMMING

Bellman's principle of optimality - Representation of a multistage decision problem – concept of sub-optimization problems using classical and tabular methods.

UNIT V STRUCTURAL APPLICATIONS

Methods for optimal design of structural elements, continuous beams and single storied frames using plastic theory - Minimum weight design for truss members - Fully stressed design - Optimization principles to design of R.C. structures such as multistorey buildings, water tanks and bridges.

REFERENCES

1. Iyengar.N.G.R and Gupta.S.K, "Structural Design Optimization", Affiliated East West Press Ltd, New Delhi, 1997.

2. Rao,S.S. "Optimization theory and applications", Wiley Eastern (P) Ltd., 1984.

3. Spunt, "Optimization in Structural Design", Civil Engineering and Engineering Mechanics Services, Prentice-Hall, New Jersey 1971. 4. Uri Krish, "Optimum Structural Design", McGraw Hill Book Co. 1981.