

OPTIMIZATION TECHNIQUES

Course Code: 13EE1128

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Pre requisites: Partial differentiation, Matrices.

Course Educational Objectives:

- ❖ The objective of the course is to expose the student to the theory of classical optimization and also to present optimization techniques for solving practical problems in engineering systems
- ❖ Optimization Techniques are used to design and produce products and systems both economically and efficiently.
- ❖ Solving linear, non linear, dynamic and integer problems by using optimization techniques are to be discussed.

Course Outcomes:

- ❖ After the completion of the course, the student will be able to analyze any problem of optimization in an engineering system by formulating a mathematical model to the problem and solving it by the techniques that are presented to him.
- ❖ The student will be able to design and produce products and systems both economically and efficiently by using optimization techniques.
- ❖ The student will be able to solving linear, non linear, dynamic and integer problems by using optimization techniques.

UNIT-I

(12 Lectures)

INTRODUCTION AND CLASSICAL OPTIMIZATION TECHNIQUES:

Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems – Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality

constraints: Solution by method of Lagrange multipliers – multivariable Optimization with inequality constraints: Kuhn – Tucker conditions.

UNIT-II

(12 Lectures)

A. LINEAR PROGRAMMING:

Standard form of a linear programming problem – geometry of linear programming problems – motivation to the simplex method – simplex algorithm, dual LP.

B. TRANSPORTATION PROBLEM:

Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel’s approximation method – testing for optimality of balanced transportation problems.

C. INTEGER PROGRAMMING:

Gomory’s cutting plane method, Branch and bound method.

UNIT-III

(12 Lectures)

UNCONSTRAINED NONLINEAR PROGRAMMING:

One – dimensional minimization methods: Classification, Fibonacci method and Quadratic interpolation method, Univariate method, Powell’s method, steepest descent method, Davidon-Fletcher-Powell method.

UNIT-IV

(12 Lectures)

CONSTRAINED NON LINEAR PROGRAMMING:

Characteristics of a constrained problem, Classification, Basic approach of Penalty Function method; Basic approaches of Interior and Exterior penalty function methods. Introduction to Convex Programming problem.

UNIT-V

(12 Lectures)

DYNAMIC PROGRAMMING:

Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution - examples illustrating the tabular method of solution.

TEXT BOOK:

1. S.S.Rao, “*Engineering optimization: Theory and Practice*”, 4th edition, New Age International (P) Limited, 2009.

REFERENCES:

1. K.V. Mital and C. Mohan, “*Optimization Methods in Operations Research and systems Analysis*”, 3rd Edition, New Age International (P) Limited Publishers, 1996.
2. Kanthi Swarup, P.K.Gupta and Man Mohan, “*Operations Research*”, 15th Edition, Sultan Chand & Sons New Delhi, 2010.
3. S.D. Sharma, “*Operations Research*”, 15th Edition, Published by Kedarnath& Ramnath, 2009.
4. G. Hadley, “*Linear Programming*”, 1st Edition Narosa Publishing House 1997.

