OPTIMIZATION METHODS IN ENGINEERING

Subject Code: 13ME2104 **L P C**
4 0 3

Course Outcomes:

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

CO1:Solve optimization problems using classical optimization techniques

CO2:Solve simple non-linear multivariable optimization problems

CO3:Solve optimization problems using geometric programming

CO4:Explain the working of different operators used in genetic algorithms for optimization

CO5:Explain concepts of stochastic programming and select a suitable technique for a specific engineering problem

UNIT-I

Introduction: Classification of optimization problems classical optimization techniques: single variable optimization–multivariable with no constraints-multivariable with equality constraints, direct substitution method, method of Lagrange multipliers

One-dimensional unconstrained optimization**:** unimodal function, methods of single variable optimization -, bisection method, unrestricted, Dichotomous, Fibonacci.

UNIT-II

Non-linear multivariable optimization without constraints: Univariate search, Pattern search methods- Hookes-Jeeves method, Powells method, Steepest descent method

Non-linear multivariable optimization with constraints: Penalty approach- interior and exterior penalty function methods.

UNIT- III

Geometric programming: solution from differential calculus point of view - solution from arithmetic-geometric inequality point of view - degree of difficulty - optimization of zero degree of difficulty problems with and without constraints- optimization of single degree of difficulty problems without constraints.

UNIT-IV

Genetic algorithms (GA): Differences and similarities between conventional and evolutionary algorithms, working principle, reproduction, crossover, mutation, termination criteria, different reproduction and crossover operators, GA for constrained optimization, drawbacks of GA.

UNIT-V

Basic concepts of Stochastic programming, multi-stage optimization, and Multi-objective optimization

Engineering applications: Minimization of weight of a cantilever beam, truss, shaft; optimal design of springs.

TEXT BOOK:

1. Singiresu S. Rao, "*Engineering Optimization -Theory and Practice*", Wiley, 4th edition, 2009.

REFERENCES:

1. Kalyanmoy Deb, "*Optimization for Engineering Design-Algorithms and Examples*", PHI, 8th reprint, 2005.

2. Ashok D. Belegundu and Tirupathi R. Chandrupatla, "*Optimization concepts and applications in engineering*", PHI, 2nd edition, 2011.