OPTIMIZATION TECHNIQUES AND APPLICATIONS
(Elective-II)

Course Code: 13ME2314   **L   P   C**
                                                               4   0   3

Pre requisites: Basic concepts mathematics and statistics
Course Educational Objectives:
To make the student learn
1. basic mathematical concepts of optimization
2. methods of modelling and formulating optimization problems
3. different methods of solving optimization problems
4. ways of interpreting solution of optimization problems in engineering in general and mechanical engineering problems in particular

Course Outcomes:
The student will be able to
1. explain the importance and basic principles of optimization
2. apply the theory to formulate design problems as mathematical optimization problems
3. solve optimization problems using different methods or algorithms
4. learn different methods of solving unconstrained and constrained optimization problems
5. 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.
Unimodal function, methods of single variable optimization -, bisection method, unrestricted,
 Dichotomous, Fibonacci.

UNIT-II
Univariate search, Pattern search methods- Hookes-Jeeves method, Powell's method, steepest descent method. 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 **-** 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

Integer Programming- Introduction – formulation – Gomory cutting plane algorithm – Zero or one algorithm, branch and bound method. Stochastic programming - Basic concepts of probability theory, random variables- distributions-mean, variance, correlation, co variance, joint probability distribution- stochastic linear, dynamic programming.

TEXT BOOK:

1. Singiresu S. Rao, *"Engineering Optimization -Theory and Practice"*, 4th Edition, Wiley, 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"*, 2nd Edition, PHI, 2011.