

I YEAR M. TECH (MACHINE DESIGN) SECOND SEMESTER

17MEMD2T2 ADVANCED OPTIMIZATION TECHNIQUES Credits 4

Lecture: 4 periods/week

Internal assessment: 40 marks

Tutorial: - -

Semester end examination: 60 marks

COURSE OBJECTIVES:

To enable the student to

- Enumerate the fundamental knowledge of Linear Programming and Dynamic Programming problems.
- Learn classical optimization techniques and numerical methods of optimization.
- Know the basics of different evolutionary algorithms.
- Explain Integer programming techniques and apply different optimization techniques to solve various models arising from engineering areas.

COURSE OUTCOMES:

Upon completion of the subject, students will be able to:

1. Explain the fundamental knowledge of Linear Programming and Dynamic Programming problems.
2. Use classical optimization techniques and numerical methods of optimization.
3. Describe the basics of different evolutionary algorithms.
4. Enumerate fundamentals of Integer programming technique and apply different techniques to solve various optimization problems arising from engineering areas.

UNIT- I

LINEAR PROGRAMMING (L.P):

Revised Simplex Method, Dual simplex Method, Sensitivity Analysis

DYNAMIC PROGRAMMING (D.P):

Multistage decision processes. Concepts of sub optimization, Recursive Relation-calculus method, tabular method, LP as a case of D.P.

UNIT-II

CLASSICAL OPTIMIZATION TECHNIQUES:

Single variable optimization without constraints,

Multi variable optimization without constraints, multivariable optimization with constraints – method of Lagrange multipliers, Kuhn-Tucker conditions.

NUMERICAL METHODS FOR OPTIMIZATION:

Nelder Mead's Simplex search method, Gradient of a function, Steepest descent method, Newton's method.

UNIT-III

MODERN METHODS OF OPTIMIZATION:

GENETIC ALGORITHM (GA):

Differences and similarities between conventional and evolutionary algorithms, working principle, Genetic Operators- reproduction, crossover, mutation

GENETIC PROGRAMMING (GP):

Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, Random population generation.

Fuzzy Systems: Fuzzy set Theory, Optimization of Fuzzy systems

UNIT-IV

INTEGER PROGRAMMING:

Graphical Representation, Gomory's Cutting Plane Method, Balas' Algorithm for Zero-One Programming, Branch-and-Bound Method.

APPLICATIONS OF OPTIMIZATION IN DESIGN AND MANUFACTURING SYSTEMS:

Formulation of model- optimization of path synthesis of a four-bar mechanism, minimization of weight of a cantilever beam, general optimization model of a machining process, optimization of arc welding parameters, and general procedure in optimizing machining operations sequence.

Learning Resources

Text books:

1. Engineering Optimization (4th Edition) by S.S.Rao, New Age International,

References:

1. Optimization for Engineering Design by Kalyanmoy Deb, PHI Publishers
2. Genetic algorithms in Search, Optimization, and Machine learning – D.E.Goldberg, Addison-Wesley Publishers
3. Operations Research by Hillar and Liberman, TMH Publishers
4. Optimal design – Jasbir Arora, Mc Graw Hill (International) Publishers