

## (ME 508) OPTIMIZATION TECHNIQUES

### **Objective of the Course :**

To familiarize the students with the modeling of mechanical engineering systems and obtaining the optimum solution.

### **UNIT - I**

#### **Introduction & Linear Programming Problems :**

**Introduction:** Engineering applications of optimization, statement of an optimization problem, classification of optimization problems.

**Linear programming:** Simplex method, Applications of linear programming, Two-phases of simplex method, Big-M method.

### **UNIT - II**

**Transportation & Assignment Problems : Allocation problems:** Formulation - Optimal solution, unbalanced transportation problems. Assignment problem – Formulation – Optimal solution – Variations i.e., non (m x n) Matrix.

### **UNIT - III**

**Classical optimization techniques :** Single variable optimization with and without constraints, multivariable optimization without constraints, multi – variable optimization with constraints – solution by method of constrained variation method of Lagrange multipliers, Kuhn – Tucker conditions.

**Non linear programming unconstrained optimization techniques:** (Numerical methods for optimization)

**Direct search methods** – Random search methods; Univariate method Pattern Directions, Hooke and Jeeves' method, Powell's method, Nelder Mead's Simplex search method.

### **UNIT - IV**

#### **Non Linear programming unconstrained optimization techniques:**

**Indirect search methods:** Gradient of a function, Steepest descent method, Newton's method. Davidon-Fletcher – Powell method, types of penalty methods for handling constraints.

### **UNIT - V**

**Non – traditional optimization algorithms:** Genetic algorithms (GA) – working principle, reproduction, crossover, mutation, advanced GA operators. GA for constrained optimization, multi-modal function optimization.

Simulated annealing, working principle, Metropolis algorithm, differences and similarities between conventional and non-conventional algorithms, introduction to Neural networks and fuzzy logic as an optimization tool.

### **TEXT BOOKS:**

1. S.S.Rao, "Engineering Optimization", 3<sup>rd</sup> Edition, New Age Publishers, 2008.
2. Kalyanmoy Deb, "Optimization for Engineering Design", 1<sup>st</sup> Edition, PHI Publishers, 2009.

### **REFERENCE BOOKS:**

1. Jasbir Arora, "Optimal Design", Mc Graw Hill (International) Publishers.
2. D.E.Goldberg, "Genetic algorithms in Search, Optimization and Machine Learning", 1<sup>st</sup> Edition, John Wiley Publishers, 2009.
3. Kalyanmoy Deb, "Multi Objective Optimization Using Evolutionary Algorithms", 1<sup>st</sup> Edition, PHI Publishers, 2003.