OPTIMIZATION IN CHEMICAL PROCESSES
(Elective-II)

Course Code : 13CH2116

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Prerequisites: The student should have knowledge of matrices, Eigen values and graphical interpretation.

Course outcomes:

On successful completion of the course, the student should be able to

CO1 : Classify and recognize the optimization problem.

CO2 : Identify and describe the methods applicable for a particular optimization problem.

CO3 : Relate how unconstrained optimization methods can be used to solve a more general constrained optimization problem.

CO4 : Review the concepts of multi objective optimization techniques and more advanced methods like genetic algorithms and simulated annealing.

CO5 : Formulate and optimize a given optimization problem.

UNIT-I

Introduction to process optimization: Formulation of various process optimization problems and their classification, constrained and unconstrained optimization. Classification of points in the 2D space. Basic concepts of optimization-convex and concave functions, necessary and sufficient conditions for stationary points.

UNIT-II

Linear programming: SIMPLEX algorithm, duality in linear programming**.**

Transportation Problem: Solution of Balanced problems using East-West Rule.

UNIT-III

Unconstrained Optimization: Optimality Criteria, Unidirectional search, Powell's Conjugate direction method, Gradient based method: Cauchy's steepest Descent method; Newton's method.

Constrained Optimization Algorithms: Kuhn-Tucker conditions, Transformation methods: Penalty function method, method of multipliers.

UNIT-IV

Multi objective optimization (MOO): Different methods to solve MOO like Utility function method and bounded function method. Solving 2D MOO problems graphically, identifying the Pareto set.

UNIT-V

Specialized Optimization techniques

Discrete Optimization: Enumeration techniques and Branch and Bound methods to solve discrete optimization problem**.**

Genetic Algorithm, Working principles, differences between GAs and traditional methods. Various operations like crossover and mutation**.**

Simulated annealing. (Qualitative treatment of GA and SA only).

TEXTBOOKS:

1. Kalyanmoy Deb, *"Optimization for Engineering Design",* Prentice Hall of India, 2005.
2. Edgar T.F.and Himmelblau D.M., *"Optimization of Chemical Processes"* 2nd Ed, McGraw Hill, International editions, Chemical Engineering series, 2001.
3. Rao SS, *"Engineering Optimization-Theory & Practices"* New Age International Publishers, New Delhi, 1996

REFERENCES:

1. Beveridge G.S. and Schechter R.S., *"Optimization theory and practice",* McGraw Hill New York, 1970.
2. Ravindran, A., and Ragdell, Reklaitis, G.V K.M., *"Engineering Optimization-Methods and Application",* John Wiley, NewYork,1983.

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