OPTIMIZATION IN CHEMICAL PROCESSES

(Elective-III)

Course Code: 15CH2118	**L**	**P**	**C**
	3	**0**	**3**

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 (10-Lectures)

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 (10-Lectures)

Linear programming: SIMPLEX algorithm, duality in linear programming.

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

UNIT-III (10-Lectures)

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 (10-Lectures)

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 (10-Lectures)

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.
3. Edgar T.F. and Himmelblau D.M., *"Optimization of Chemical Processes"* 2nd Ed, McGraw Hill, International editions, Chemical Engineering series, 2001.
4. 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.