PCH111 PROCESS OPTIMIZATION

L	T	P	Cr
3	1	0	3.5

Course Objective:

To learn the modeling skills necessary to describe and formulate optimization problems arising in process systems engineering.

Introduction: Process optimization, Formulation of various process optimization problems and their classification, Basic concepts of optimization: Convex and concave functions, necessary and sufficient conditions for stationary points.

Optimization of One Dimensional Functions: Unconstrained multivariable optimization: Direct search methods, Bracketing methods: Exhaustive search method, bounding phase method, Region elimination methods: Interval halving method, Fibonacci search method, golden section search method, PointEstimation method: Successive quadratic estimation, Solutions for one dimensional problems using MATLAB.

Indirect First Order and Second Order Method: Gradient-based methods: Newton-Raphson method,bisection method, secant method, cubic search method, Root-finding using optimization techniques.

Multivariable Optimization Algorithms: Optimality criteria, Unidirectional search, Direct search methods: Evolutionary optimization method, simplex search method, Powell's conjugate direction method, Gradient based methods: Cauchy's (steepest descent) method, Newton's method.

Constrained Optimization Algorithms: Kuhn-Tucker conditions, Transformation methods, Penalty function method, Method of multipliers, Sensitivity analysis, Direct search for constraint Minimization, Variable elimination method, Complex search method, Successive linear and quadratic programming, Optimization of staged and discrete processes.

Specialized and Non-traditional Algorithms: Integer Programming: Penalty function method, Genetic Algorithms (GA), Gas for constrained optimization, Advanced GA's.

Course learning outcomes (CLOs):

The students will be able to

1. formulate the objectives functions for constrained and unconstrained optimization problems
2. use different optimization strategies
3. solve problems using non-traditional optimization techniques
4. solve optimization problems using various optimization techniques

Recommended Books:

1. *Edgar, T.F.,and Himmelblau, D.M., Optimization of Chemical Processes, McGraw-Hill (1988).*
2. *Kalyanmoy, D., Optimization for Engineering Design, Prentice Hall (1998).*
3. *Beveridge, G.S., and Schechter,R.S., Optimization: Theory and Practice, McGraw-Hill Book Co., New York (1970).*
4. *Husain, A., and Gangiah, K., OptimizationTechniques for Chemical Engineers, Macmillan Co. of India (1976).*
5. *Venkataraman, P., Applied Optimization with MATLAB programming, Wiley (2009).*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	30
2.	EST	45
3.	Sessional (may include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	25