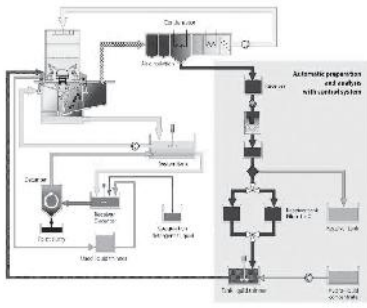


16CH403 OPTIMIZATION OF CHEMICAL PROCESSES



Hours Per Week :

L	T	P	C
3	1	-	4

Total Hours :

L	T	P
45	15	-

WA/RA	SSH/HSB	CS	SA	S	BS
20	40	-	-	5	5

Course Description and Objectives:

This course deals with optimization algorithms, modeling skills to describe and formulate optimization problems. The objective of this course is to familiarize the student with formulation of optimization problems, single and multivariable optimization, linear programming and optimization of chemical processes.

Course Outcomes:

The student will be able to:

- identify different types of optimization problems.
- understand different optimization techniques.
- solve single and multivariable optimization problems.
- solve problems by using least square analysis.

SKILLS:

- ✓ *Formulation of optimization problems.*
- ✓ *Usage of commercial flow sheeting software to simulate processes and design process equipment.*
- ✓ *Integrate process design and simulation with the optimization techniques to achieve the best flow diagram of a process plant.*
- ✓ *Estimate minimum cost for process operations.*
- ✓ *Estimate maximum profit from process industries.*
- ✓ *Optimize process industries.*

UNIT - 1**L-10, T-3**

NATURE AND ORGANIZATION OF OPTIMIZATION PROBLEMS : What optimization is all about, Why optimize, Scope and hierarchy of optimization, Examples of applications of optimization, Essential features of optimization problems, General procedure for solving optimization problems.

FITTING MODELS TO DATA : Classification of models, How to build a model, Fitting functions to empirical data, Method of least squares, Factorial experimental designs, Fitting a model to data subject to constraints.

UNIT - 2**L-9, T-3**

BASIC CONCEPTS OF OPTIMIZATION : Continuity of functions, Unimodal versus multimodal functions. Convex and concave functions, Convex region.

OPTIMIZATION OF UNCONSTRAINED FUNCTIONS ONE-DIMENSIONAL SEARCH : Numerical methods for optimizing a function of one variable, Scanning and bracketing procedures, Newton's, Quasi-Newton's and secant methods of uni-dimensional search, Region elimination methods.

UNIT - 3**L-8, T-3**

UNCONSTRAINED MULTIVARIABLE OPTIMIZATION : Direct methods - Random search, Grid search, Univariate search, Simplex method, Conjugate search, Powell's methods. Indirect methods - first order: Gradient method, Conjugate method. Indirect methods - second order: Newton's method.

UNIT - 4**L-9, T-3**

LINEAR PROGRAMMING AND APPLICATIONS : Basic concepts in linear programming, Degenerate LP's – graphical solution, Natural occurrence of linear constraints, Simplex method of solving linear programming problems, Standard LP form, Obtaining a first feasible solution, Sensitivity analysis, Duality in linear programming, LP applications.

UNIT - 5**L-9, T-3**

OPTIMIZATION OF UNIT OPERATIONS : Recovery of waste heat, Shell and tube heat exchangers, Evaporator design, Liquid-liquid extraction process, Optimal design of staged distillation column, Optimal pipe diameter, Optimal residence time for maximum yield in an ideal isothermal batch reactor, Optimization of thermal cracker using linear programming.

TEXT BOOK:

1. T. F. Edgar and Himmelblau D.M, "Optimization of Chemical Processes", 2nd edition, McGraw-Hill, 2001.

REFERENCE BOOK:

1. K. M. Deb, "Optimization for Engineering Design", 2nd edition, Prentice Hall of India, 2012.

ACTIVITIES:

- Formulation of objective functions.
- Simulation using numerical methods and computer programming.
- Graphical method using computational tool.
- Simplex method using computational tool.