Elective-IV

IV Year B.Tech. Chemical Engg. I - Semester	L	T	P	To	C
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CH415 OPTIMIZATION OF CHEMICAL PROCESSES

Course Description & Objectives

To study optimization algorithms, provide modeling skills to describe and formulate optimization problems, solve several types of optimization problems arising in process systems engineering.

This course covers organization of problems, basic concepts, single and multivariable optimization, linear programming and optimization of chemical processes.

Course Outcomes:

1. *Identify different types of optimization problems*
2. *Understanding of different optimization technique*
3. *Ability to solve various single and multivariable optimization problems*
4. *Ability to solve problems by using least square analysis.*

UNIT I - Nature and Organization of Optimization Problems

What optimization is all about, Why optimize, scope and hierarchy of optimization, examples of applications of optimization, the 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, the method of least squares, factorial experimental designs, fitting a model to data subject to constraints.

UNIT II - Basic Concepts of Optimization

Continuity of functions, unimodal versus multimodel functions. Convex and Concave functions, Convex region, Necessary and sufficient conditions for an extremum of an unconstrained function.

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, polynomial approximation methods.

UNIT III - Unconstrained Multivariable Optimization

Direct methods: Random search, grid search, uni-variate search, simplex method, conjugate search, Powell's methods. Indirect methods- first order: Gradient method, conjugate method. Indirect methods - second order: Newton's method, movement in the search direction, termination, summary of Newton's method, relation between conjugate gradient methods and Quasi-Newton method.

UNIT IV - Linear Programming and Applications

Basic concepts in linear programming, Degenerate LP's – graphical solution, natural occurrence of linear constraints, the simplex method of solving linear programming problems, standard LP form, obtaining a first feasible solution, the revised simplex method, sensitivity analysis, duality in linear programming, the Karmarkar algorithm, LP applications.

UNIT V - Optimization of Unit Operations

Recovery of waste heat, shell & 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, chemostat, optimization of thermal cracker using liner programming.

TEXT BOOK

1. T.F.Edgar and Himmelblau DM, "Optimization of Chemical Processes", McGraw Hill, 2001.

REFERENCE BOOK

1. Kalyan Moy Deb, "Optimization for Engineering Design", PHI, 2000.