

UCH 711 MATHEMATICAL TECHNIQUES IN CHEMICAL ENGINEERING

L	T	P	Cr
3	1	0	3.5

Course Objectives:

To learn various computational techniques for analysing and solving chemical engineering problems.

Solution of Algebraic Equations: Solution of Non-linear and transcendental equations in one or more than one variable (bisection, false position, iteration, Newton Raphson, Secant methods)

Solution of linear simultaneous equations (Matrix inversion, Gauss elimination, Gauss Jordan, LU decomposition methods, ill-conditioned systems).

Solution of Ordinary Differential Equations: Initial Value Problem (Euler, Modified Euler, RK class and predictor corrector class methods, Stiff ODE's and Gear's methods;

Boundary Value Problem- Shooting methods, Finite difference method, Use of Method of weighted residuals and orthogonal collocation and Galerkin technique to solve BVP in ODEs.

Solution of Partial Differential Equations: Classification of PDEs- Parabolic, elliptical and hyperbolic equation, Finite difference techniques to solve partial differential equation; Application to chemical engineering systems.

Concept of finite element; Finite element methods to solve PDEs with application to Chemical Engineering systems.

Use of EXCEL Sheet and MATLAB: Application of EXCEL Sheet and MATLAB to solve the Chemical Engineering problems.

Course learning outcomes (CLOs):

The students will be able to:

1. solve problems of algebraic and differential equations, simultaneous equation, partial differential equations
2. convert problem solving strategies to procedural algorithms and to write program structures
3. solve engineering problems using computational techniques
4. assess reasonableness of solutions, and select appropriate levels of solution sophistication

Text Books:

1. *Gerald, C. F., Wheatley P. O., Applied Numerical Analysis, Pearson Education (2006).*
2. *Gupta, S. K., Numerical Methods for Engineers, New Age Publishers (2005).*

Reference Books:

1. *Finlayson, B. A., Introduction to Chemical Engineering Computing, Wiley Interscience (2006).*
2. *Loney, N. M., Applied Mathematical Methods for Chemical Engineers, CRC Press (2006).*

3. *Davis, M., Numerical Methods and Modeling for Chemical Engineers, John Wiley (1984).*
4. *Jain, M. K., Iyengar, S. R. K. and Jain, R.K., Computational Methods for PDE, Wiley Eastern (1994).*

Evaluation Scheme:

S. No.	Evaluation Elements	Weightage (%)
1	MST	30
2	EST	45
3	Sessional (may includes tutorials/ assignments/ quiz's etc)	25