

COURSE TITLE	NUMERICAL METHODS IN CHEMICAL ENGINEERING
COURSE CODE	01MA0401
COURSE CREDITS	4

Objective:

- 1 To impart knowledge of solving the mathematical problems related to chemical engineering by using numerical methods.
- 2 To impart knowledge of solving the mathematical problems related to chemical engineering by using numerical methods

Course Outcomes: After completion of this course, student will be able to:

- 1 Understand the basic concepts of numerical methods.
- 2 Apply the concept of Interpolation on various data set.
- 3 Solve the algebraic equations and numerical integration problems using numerical methods.
- 4 Solve the ordinary and partial differential equation using best suitable numerical techniques.

Pre-requisite of course:None

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	Solution of Equations Finding the roots of a transcendental and algebraic equation,, Direct and Indirect methods, Bisection method,, Regula-Falsi method, Newton-Raphson's method,, Solution for Simultaneous linear system of equations: Gauss Jacobi method, Gauss-Siedel method. Overview of non-linear system of equation	10
2	Interpolation Finite difference, Forward and backward differences, Interpolation, Newton's forward interpolation, Newton's backward interpolation, Lagrange's interpolation, Newton's divided difference interpolation.	8
3	Numerical Integration Introduction to numerical methods, Trapezoidal method, , Simpson's 1/3rd rule, , Simpson's 3/8th rule, Gaussian one point, two-point, three-point quadrature.	8

Contents : Unit	Topics	Contact Hours
4	Ordinary and Partial Differential Equations Numerical solution of Ordinary differential equation: Euler's Method, Predictor-corrector technique, Runge-Kutta methods, Boundary Value Problems, Numerical solution to elliptic, parabolic and hyperbolic partial differential equations	12
Total Hours		38

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	Tutorials Tutorial on forward and backward differences., Tutorial on Bisection method., Tutorial on Linear and Non-Linear curve fitting on given data set., Tutorial on Regula-Falsi method, Tutorial on Polynomial root finding techniques: Newton Raphson's Method., Tutorial on numerical integration: Trapezoidal rule and Simpson 1/3 rule, Numerical on forward and backward difference interpolation., Tutorial on Lagrange's and Newton's divided difference interpolation., Tutorial on Euler's Method for solving ordinary differential equations, 10. Tutorial on solving ODE by Runge-Kutta method.	20
Total Hours		20

Textbook :

- 1 Introductory Methods of Numerical Analysis, S.S. Sastry, Prentice Hall of India, 2012
- 2 Miller and Freund's Probability and Statistics for Engineers, Richard A Johnson, Prentice Hall of India, 2011

References:

- 1 Numerical Methods For Engineers, Numerical Methods For Engineers, Santosh K. Gupta, New Age Intl. Publishers, 2010
- 2 Numerical Methods for Engineers, Numerical Methods for Engineers, S. C. Chapra and R. P. Canale, McGraw Hill, 2006

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery					
Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
20.00	30.00	25.00	15.00	10.00	0.00

Instructional Method:

- 1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
- 2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- 3 Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
- 4 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

Supplementary Resources:

- 1 <https://nptel.ac.in/courses/103106112>
- 2 <https://nptel.ac.in/courses/103106118>
- 3 <http://numericalmethods.eng.usf.edu>