

GUJARAT TECHNOLOGICAL UNIVERSITY

CHEMICAL ENGINEERING (30)

NUMERICAL METHODS AND STATISTICAL ANALYSIS FOR CHEMICAL ENGINEERING

SUBJECT CODE: 2713007

SEMESTER: I

Type of course: Mathematics in Chemical Engineering

Prerequisite: Engineering Mathematics

Rationale: The increasing importance of numerical methods in various branches of science and engineering have led to enhanced demand for courses dealing with the techniques of numerical analysis as numerical methods give the solution of applied problems when ordinary analytical methods fail. It is therefore clear training in engineering would be incomplete without an adequate understanding of numerical methods. Statistics deals with the collection, presentation, analysis and use of data to make decisions, solve problems and design products and processes.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
			ESE (E)	PA (M)	PA (V)		PA (I)			
					ESE	OEP	PA	RP		
3	2	0	4	70	30	30	0	10	10	150

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	Approximations and Errors: Types of Errors, Significant figures, Accuracy of Numbers, Precision, Error Propagation	4	7
2	Solution of Non Linear Algebraic Equations: Bracketing Methods (Bisection, Method of False Position or Regula Falsi, etc.) and Newton- Raphson Method	7	13
3	Solution of Linear Algebraic Equations: Matrix inversion, Gauss Elimination, Gauss-Jordan Method, Gauss-Seidel Iteration Method	8	15
4	Interpolation & Curve Fitting: Method of Least Squares, Linear and Polynomial Regression, Lagrange Interpolating Polynomials, Spline Interpolation, Cubic Spline	8	15
5	Numerical Integration: Newton-Cotes Integration Formulas, Trapezoidal Rule and Simpson's Rules	7	13
6	Ordinary Differential Equations : Euler's Method, Modifications and Improvements in Euler's Method. Runge-Kutta Methods, Boundary Value Problems, Shooting method	8	15
7	Partial Differential Equations: Parabolic, Hyperbolic, Elliptic (Explicit method-finite difference)	6	11
8	Probability and Statistics: Probability Distributions, Random Variables, Sampling Distributions, Confidence Interval, Stochastic Processes,	6	11

	Standard Deviation, Variance, etc		
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Reference Books:

1. S C Chapra and R P Canale, Numerical Methods for Engineers, McGraw Hill International Edition.
2. M K Jain, S R K Iyengar and R K Jain, Numerical Methods for Scientific and Engineering Computation, Wiley Eastern.
3. S S Shastry, Introductory Methods of Numerical Analysis, Prentice Hall of India.
4. B. S. Grewal, Numerical Methods in Engineering & Science, Khanna Publishers.
5. W.J. DeCoursey, Statistics and Probability for Engineering Applications With Microsoft Excel , Newnes.
6. Montgomery, D.C. and Runger, G.C. Applied Statistics and Probability for Engineers, John Wiley & Sons, 2011

Course Outcome:

After learning the course the students should be able to:

1. Solve different mathematical problems through effective application of various numerical methods.
2. Solve rigorous process models in mass transfer, heat transfer and other allied areas of chemical engineering using effective application of numerical methods.
3. Efficiently plan experiments, collect data, analyze and interpret the data, and understand how the observed data are related to the proposed model for the problem under study.

List of Open Source Software/learning website:

1. Students can refer to video lectures available on the websites including NPTEL lecture series.
2. Students can refer to the CDs available with some reference books for the solution of problems using softwares/spreadsheets. Students can develop their own programs/spreadsheets for the solution of problems.