

GUJARAT TECHNOLOGICAL UNIVERSITY

NUMERICAL METHODS FOR COMPUTER ENGINEERING

SUBJECT CODE: 2710210

SEMESTER: I

Type of course: Foundation

Prerequisite: Differentiation, Integration, Matrix operation, Various Mathematical Series, Fundamental Mathematics

Rationale: To Know about various types of Errors, Calculate the error correction and get actual root. To Understand different solution methods of the equation and compare them. This subject give the idea of solution of the mathematical equations, differential equations and system of linear equations and its application. It also covers importance of Curve fitting, Numerical Integration methods and fundamentals of Statistical Methods for Data Analysis.

Teaching and Examination Scheme:

Teaching Scheme			Credits	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	Modeling, Computers and error analysis : Mathematical modeling and engineering problem solving. Role of computers and software. Approximations and errors. Significant figures, accuracy and precision, Errors, round-off and truncation errors, error propagation,	6	15
2	Roots of Equations : Mathematical background, Bisection, Regula Falsi, NR method, Secant, Successive approximation method, Budan's Theorem, Barristow's method, case studies.	6	15
3	Systems of linear algebraic equations: Mathematical background, Gauss elimination; pitfalls and techniques for improvement, matrix inversion and Gauss-Seidel methods, III Conditional equations, Predictor-Corrector methods, case studies.	6	15
4	Curve Fitting: Mathematical background, Least squares linear and polynomial regression, Lagrange interpolating polynomials. Spline interpolation, Case studies	4	15
5	Numerical Integration : Newton-Cotes integration formulas; trapezoidal rule and Simpson's rules: Interpolation, case studies.	4	15
6	Ordinary differential equations: Euler's method, Runge-Kutta methods. General methods for boundary value problems, Automatic error monitoring and change of step size stability of solution. Case studies	6	15
7	Statistical Methods: Frequency distributions, Data analysis, Expectations and moments, Correlation and regression, Trend analysis, Seasonal effects, Cyclical fluctuation, Moving average, MSE, Predictions..	4	10

Reference Books:

- 1) Numerical Methods for engineers. S C Chapra and R P Canale . McGrow Hill International Edition
- 2) Numerical Methods for Scientific & Engineering Computation, M. K. Jain, S.R.K.
- 3) Introduction to Numerical Analysis - By S. S. Sastry., PHI .
- 4) Numerical Methods in Science & Engineering Prog.- By Dr. B. S. Grawal, Khanna Pub., New Delhi.
- 5) Computer Oriented Numerical Methods, R. S. Salaria., Khanna Publisher.
- 6) Miller & Freund's Probability and Statistics for Engineers – By Richard A Johnson., PHI

Course Outcome:

After learning the course the students should be able to:

1. Apply Mathematical Modeling and for Engineering Problem Solving.
2. Solve Mathematical Equations by various methods.
3. Solve system of linear equations.
4. Find Best Curve fitting for given data.
5. Apply Numerical Integration.
6. Solve Differential Equations.
7. Understand Statistical Methods for Data Analysis.

List of Tutorials/Presentation:

Tutorials based on all methods covered in the syllabus and Presentation is to be prepared to implement various methods with illustration.

Every Student should be allocated a chapter each and find Engineering applications for that chapter. He/ She should prepare a write up including graphics/pictures/video to illustrate the application. These should be submitted online to GTU on the portal. The write up should give proper references along with a certificate that it is not a plagiarized material.

Major Equipments: Desktop, Laptop**List of Open Source Software/learning website:**

- 1) www.nptel.ac.in