



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Civil and Infrastructure Engineering

Subject Code: 3144006

Semester – IV

Subject Name: Numerical and Statistical Methods

Type of course: Basic Science Course

Prerequisite: The students are required to have a reasonable understanding of Calculus, Differential equations and Linear algebra and introductory knowledge of probability and statistics.

Rationale:

There is different kind of systems which requires through mathematical analysis tools. The type of systems which requires such tools are linear systems, nonlinear systems and dynamical systems. Apart from them, it requires systematic study of uncertainty (randomness) by probability - statistics and curve fitting. The different methods like numerical methods are required to be studied.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	2	0	5	70	30	0	0	100

Content:

Sr. No.	Content	Total Hours	% Weightage
Numerical Methods			
01	Numerical Solutions: Roots of Algebraic and Transcendental Equations: Bisection, false position, Secant and Newton-Raphson methods.	3	7%
02	Interpolation: Finite Differences, Newton's Forward and Backward interpolation, Newton's divided formulae and Lagrange's interpolation formulae for unequal intervals.	3	7%
03	Numerical Integration: Newton-Cotes formula, Trapezoidal and Simpson's formulae, Gaussian quadrature formulae.	3	7%
04	Numerical solution of ODE: Taylor's series method, Euler methods and Runge - Kutta methods.	3	7%
Statistical Methods			
05	Probability: Classical & Set theoretic approach, Conditional probability, Bayes' theorem, Probability distribution, probability mass function, probability density function, Expectation, Poisson distribution, Normal distribution.	10	24%
06	Basic Statistics: Measures of central tendency, dispersion, Moments, skewness, kurtosis, Correlation and Regression.	7	17%
07	Curve fitting: Curve fitting by of method of least squares, fitting of straight lines, second degree parabola and more general curves.	3	07%



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08	Applied Statistics: Sampling and Estimation: Formation of Hypothesis, Test of significance: Large sample test for single mean & proportion, Difference of means & proportions. Test of significance for Small samples: t- test for single mean, difference of means, t-test for correlation coefficients, F- test for ratio of variances, Chi-square test for goodness of fit and independence of attributes.	10	24%
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Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	30	30	0	0	0

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

- (1) E. Kreyszig, Advanced Engineering Mathematics, John Wiley (1999)
- (2) J. L. Devore, Probability and Statistics for Engineering and the Sciences, Cengage Learning
- (3) Chapra S.C, Canale, R P, Numerical Methods for Engineers, Tata McGraw Hill, 2003.
- (4) Gerald C. F. and Wheatley P.O., Applied Numerical Analysis (5th Edition), Addison-Wesley, Singapore, 1998
- (5) P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall.
- (6) S. Ross, A First Course in Probability, 6th Ed., Pearson Education India.
- (7) W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, Wiley.
- (8) D. C. Montgomery and G. C. Runger, Applied Statistics and Probability for Engineers, Wiley.

Course Outcomes:

After learning the course, the students should be able to:

Sr. No.	CO statement
CO-1	solve algebraic equation related to civil and infrastructure engineering problem by using numerical and understand convergent of it
CO-2	find unknown value of given data by using various interpolation methods and calculate integration and solve differential equations by using numerical methods
CO-3	understand the terminologies of basic probability and analyze the behavior of various discrete and continuous probability distributions.
CO-4	understand the central tendency, correlation, regression and curve fitting.
CO-5	apply the statistics for testing the significance of the given large and small sample data by using z-test, t- test, F- test and Chi-square test.

List of Open Source Software/learning website:

- E-materials available at the website of NPTEL- <http://nptel.ac.in/>