GUJARAT TECHNOLOGICAL UNIVERSITY

CIVIL & INFRASTRUCTURE ENGINEERING (40)

NUMERICAL AND STATISTICAL METHODS FOR CIVIL ENGINEERING

SUBJECT CODE: 2140606

B.E. 4th Semester

Type of course: Engineering Mathematics

Prerequisites: The students are required to have a reasonable mastery over calculus, Differential equations and Linear algebra and introductory knowledge of probability and statistics.

Rationale: Mathematics is a language of Science and Engineering.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	2	0	5	70	20	10	30	0	20	150

L- Lectures; T- Tutorial/Teacher Guided Student Activity; P- Practical; C- Credit; ESE- End Semester Examination; PA- Progressive Assessment

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
	Probability		
1	**Reorientation:** Definition of probability, Exhaustive events, Pair wise independent events, Multiplicative law of probability, Conditional probability, Baye's theorem	03	07
2	**Probability Distributions:** Random variable, Mathematical Expectation, Standard Deviation, Binomial, Poisson and Normal distributions, Mean, Median, Mode	05	12
	Statistics		
3	**Descriptive Statistics:** Mean, Median, Mode, Standard deviation, Skewness	03	08
4	**Correlation and Regression:** Bivariate distribution, Correlation coefficients, Regression lines, Formulas for Regression coefficients, Rank correlation	04	10
5	**Curve Fitting:** Fitting of Linear, Quadratic, Exponential and Logarithmic curves, Least squares method	03	08
	Numerical Methods		
6	**Finite Differences and Interpolation:** Finite Differences, Forward, Backward and Central operators, Interpolation by polynomials: Newton's forward ,Backward interpolation formulae, Gauss & Stirling's central difference formulae , Newton's divided and Lagrange's formulae for unequal Intervals	08	15

7	**Numerical Integration:** Newton-Cotes formula, Trapezoidal and Simpson's formulae, error formulae, Gaussian quadrature formulae	03	08
8	**Solution of a System of Linear Equations:** Gauss elimination, partial pivoting , Gauss-Jacobi and Gauss-Seidel methods	03	07
9	**Roots of Algebraic and Transcendental Equations:** Bisection, false position, Secant and Newton-Raphson methods, Rate of convergence	04	10
10	**Numerical solution of Ordinary Differential Equations:** Taylor series method, Euler method, Runge-Kutta method of order four, Milne's Predictor-Corrector method	06	15

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks				
R Level	U Level	A Level	N Level	E Level
10	15	20	20	35

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate 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:
Reference Books:

1. E. Kreyszig, Advanced Engineering Mathematics(8^{th} Edition), John Wiley (1999)
2. S. D. Conte and Carl de Boor, Elementary Numerical Analysis-An Algorithmic Approach (3^{rd} Edition), McGraw-Hill, 1980
3. C.E. Froberg, Introduction to Numerical Analysis (2^{nd} Edition), Addison-Wesley,1981
4. Gerald C. F. and Wheatley P.O. , Applied Numerical Analysis (5^{th} Edition), Addison-Wesley, Singapore, 1998
5. Johnson Richard A., Miller and Freund's - Probability and Statistics (8^{th} Edition) , PHI.
6. S.C. Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics (11^{th} Edition), Sultan Chand & Sons.

Course Outcomes:

After learning the course the students should be able to :

- Understand and apply the basic concepts of probability, random variables, probability distribution.
- Use statistical methodology and tools in the engineering problem solving process.
- Compute and interpret descriptive statistics using numerical and graphical techniques
- Understand the basic concepts of regression and curve fitting
- Calculate finite differences of tabulated data.
- use numerical methods to find integration and differentiation
- find an approximate solution of algebraic equations using appropriate method.

- Find an approximate solution of ordinary differential equations using appropriate iterative method.

List of Open Source Software/learning website:

http://nptel.ac.in/courses/111101003/
http://nptel.ac.in/syllabus/syllabus.php?subjectId=111101004
http://nptel.ac.in/courses/111105038/
http://nptel.ac.in/courses/111107063/
http://nptel.ac.in/courses/111105041/
http://nptel.ac.in/courses/111104079/

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.