# GUJARAT TECHNOLOGICAL UNIVERSITY

## CIVIL (CONSTRUCTION ENGINEERING AND MANAGEMENT)(14)

NUMERICAL METHODS AND STATISTICAL ANALYSIS

**SUBJECT CODE**: 2711304

M.E. 1st SEMESTER

**Type of course:** Engineering Science

**Prerequisite:** Zeal to learn the subject

**Rationale:** The course is intended to strengthen fundamentals of applied mechanics of solids and build understanding of design and analysis of machine components under dynamic loading. The course introduces loading design and analysis of machine components at elevated temperature. The course also includes fundamentals and application of fracture mechanics and surface failures in machine component design.

**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) | | |
| | | | | | | ESE | OEP | PA | RP | |
| 3 | 2 | 0 | 4 | 70 | 30 | 30 | 0 | 10 | 10 | 150 |

**Content:**

| Sr. No. | Topics | Teaching Hrs. | Module Weightage |
|---|---|---|---|
| **1** | Motivation, Data and Decisions, Measurement Uncertainties, Random processes. Various Statistical Measures. | 3 | 7 |
| **2** | Basic Probability, Sample Space, Events, Axioms of Probability, Sample space with equality likely outcomes, Conditional probability, Independent events. | 4 | 9 |
| **3** | Random number generation. Sample statistics, empirical distributions, goodness of fit, and sampling from normal populations. | 4 | 9 |
| **4** | Random Variables, Continuous/Discrete random variables, exception, valance, convenience, conditional distributions, moment generating functions. Multiple regressions. | 4 | 9 |
| **5** | Distributions, Bernoulli, Binomial, Poisson, Uniform, Normal, Exponential, Chi square test, t-test and F-test. Interpolation And Curve Fitting | 4 | 9 |
| **6** | Hypothesis testing, Significance Intervals. | 4 | 9 |
| **7** | Parameter estimation, moment method, maximum likelihood, interval estimation. | 4 | 9 |
| **8** | Numerical Methods<br>Basic: Summary of basic concepts from Linear algebra and numerical analysis, Matrices. Operation counts, Matrix Norms, Type of Errors in Numerical computation. | 4 | 9 |
| **9** | Numerical Integration<br>Gaussian Quadrature, Romberg Integration, Adaptive Quadrature. | 4 | 9 |
| **10** | Matrix Factorization and Linear System<br>Cholesky Factorization, QR factorization by House holder matrices Lufactorization and Gaussian elimination, partial pivoting, error | 6 | 12 |

| | | | |
|---|---|---|---|
| | Analysis (statement of result) soling triangular system by substitution, solving full systems by factorization.<br>Lu-factorization for banded and sparse matrices, storage schemes, Iterative Methods, Jacobi, Gauss - Seidal and SOR Iterations, Conjugate gradient method, preconditioning. | | |
| **11** | Interpolation and Curve fitting | 4 | 9 |

**Reference Books:**


1. Probability and Statistics for Engineers -Miller, Freund-Hall, Prentice India Ltd.
2. Probability and Statistics for Engineers -Johnson Richard, Prentice India Ltd.
3. Introduction to Probability & Statistics for Engineers & Scientists-Ross Sheldon ,Elsevier Pub
4. Sampling techniques-Cochran, Wiley Series.,
5. Statistics-Concepts and Controversies-David S. Moore-Freeman Company, New York.
6. MATLAB an Introduction with Application, Gilat Amos. Willey Pub.
7. Getting Started with MATLAB -PratapRudra -Oxfor Pub
8. Mastering MATLAB 7 -Hanselman-Pearson
9. Programming in MATLAB for Engineers-Chapman S.J.-Cengage Pub.
10. Effective Technical Communication -Rizvi Ashraf-Tata McGraw Hill Pub.
11. Numerical Methods -Balagurusamy E- Tata McGraw Hill Pub.
12. Numerical Methods-Jain M.K.-New Age Pub.
13. Numerical Methods for Engineers-Chapra Steven- Tata McGraw Hill Pub.
14. Computer Oriented Numerical Methods-Rajaraman V.-PHI Pub


**Course Outcome:**

After learning the course the students should be able to:

Apply basic principles and different techniques of statistics and numerical methods along with the use of different software.

Assignment work on

- Probability distribution
- Sampling distribution
- Correlation
- Regression analysis
- Multivariate analysis
- Hypothetical testing

Solving the prescribed problems of with MATLAB / Excel Application

Major Equipments:

List of Open Source Software/learning website:

R, Scilab