GUJARAT TECHNOLOGICAL UNIVERSITY

M E (Civil) CONSTRUCTION ENGINEERING AND MANAGEMENT

STATISTICAL AND NUMERICAL ANALYSIS

The main objective of this course is to make the students aware of basic principles and different techniques of statistics and numerical methods along with the use of software.

- Motivation, Data and Decisions, Measurement Uncertainties, Random Processes.
- Various Statistical Measures.
- Basic Probability, Sample Space, Events, Axioms of Probability, sample space with Equality likely outcomes, conditional probability, independent events.
- Random variables, continuous/Discrete random variables, exception, valance, convenience, conditional distributions, moment generating functions.
- Multiple regressions.
- Distributions, Bernoulli, Binomial, Poisson, Uniform, Normal, Exponential, Chi-square T and F.
- Random number generation.
- Sample statistics, empirical distributions, and goodness of fit, sampling from normal populations.
- Parameter estimation, moment method, maximum likelihood, interval estimated.
- Hypothesis Testing, Significance Intervals.

NUMERICAL METHODS

Basic: Summary of basic concepts from Linear algebra and numerical analysis, Matrices. Operation counts, Matrix Norms, Type of Errors in Numerical computation.

NUMERICAL INTEGRATION

Gaussian Quadrature, Romberg Integration, Adaptive Quadrature.

MATRIX FACTORIZATION AND LINEAR SYSTEM :

Cholesky Factorization, QR factorization by House holder matrices Lufactorization and Gaussian elimination, partial pivoting, error Analysis (statement of result) soling triangular system by substitution, solving full systems by factorization.

Lu-factorization for banded and sparse matrices, storage schemes, Iterative Methods, Jacobi, Gauss – Seidal and SOR Iterations, Conjugate gradient method, preconditioning.

INTERPOLATION AND CURVE FITTING

PRACTICAL

INTRODUCTION TO: SPSS / SAS software / Matlab Statistical Tool Box.

USE OF MATHEMATICAL SOFTWARE

MATLAB: Essentials of MATLAB, Vectors, Matrices and the colon operators, M Files, Scripts and functions, Input and Output Graphics, Control Structures and Logical Tests. Symbolic Math Tool Box. Advanced MATLAB Features.

- Graphical representation of data bar diagram, Histogram, Pi charts, frequency polygon.
- Random number generation and generating a random sample using various sampling techniques.
- Compute correlation co-efficient between two sets of data points and plot regression lines.
- Fitting of curves.
- Multiple regression techniques to linear and non-linear problems.
- Testing of hypothesis – practical examples of Type I and II.
- Computation of Confidence intervals for mean, proportionate.
- Testing with Chi-Square, t-Distribution and F-ratio application.
- Study of numerical methods using software.
- Solution of linear system of equation
- Solution of numerical integration
- Interpolation

References

Probability and Statistics for Engineers –Miller, Freund-Hall, Prentice India Ltd. Applied Mathematics for Engineers and Physiscists-pipes and Harvill. McGraw Hill International Edition.

1. Sampling techniques-Cochran, Wiley Series.
2. Statistics-Concepts and Controversies-David S. Moore-Freeman Company, New York.
3. Numerical methods, E. Balaguruswami, Mc Graw Hill publication.
4. Numerical Methods: Problems & Solutions, Jain Mk ,Iyengar Srk,Jain Rk, Wiley Eastern Ltd.
5. Advanced Engineering Mathematics with Mathematics and Matlab by Reza Malek – Madani, Addison-Wesley Pub.