Marwadi University

Master of Technology

Transportation Engineering

01GT1104: APPLICATION OF NUMERICAL & STATISTICAL METHODS IN CIVIL ENGINEERING

Objective of the Course:

Objectives of introducing this subject at first year level in Masters of civil engineering are: Enable students to apply the knowledge of numerical methods to solve the real-world problems of civil engineering.

Credit Earned: 4

Students learning outcomes:

After successful completion of the course, it is expected that student will be able to

After successful completion of the course, it is expected that student will be able to
1. Differentiate accuracy and precision in real-life problems
2. Apply the of solution techniques of linear system to frame civil engineering problems
3. Formulate seepage problems and its solution by Euler's equation
4. Understand the use of FDM in civil engineering problems
5. Apply Numerical Integration in civil Engineering
6. Analyze the statistical approach in civil engineering

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	CSE (I)	IA (M)	Viva (V)	Term Work (TW)	
3	2	0	4	50	20	30	25	25	150

Detailed Syllabus

Sr. No.	Title of the unit	Number of hours
1	**Introduction Significance of numerical methods.**	3
	Sources of error in numerical solutions: truncation Error, round of error, Order of accuracy & Precision.	
2	**Solution of simultaneous Linear systems Direct solution**	8
	Iterative solutions: Jacobi iteration. Gauss Seidel iteration. Convergence criteria, Solution of non-linear algebraic equations, Gauss elimination, Gauss Jordan elimination with and without	

	pivoting Factorization, Cholesky's decomposition, singular value Decomposition, Iterative solutions: Jacobi iteration. Gauss Seidel iteration, SOR iteration	
3	**Solution to algebraic non–linear equations**	**7**
	Bisection Method, Regular Falsi method, Secant method, Newton Raphson iterations to find roots of a 1D nonlinear equation 2 Newton Iterations, Quasi Newton iterations	
4	**Solution of Partial Differential Equations:**	**5**
	partial differential equations using finite difference method, Eigen value problems & Solutions	
5	**Numerical Quadrature:**	**4**
	Trapezoidal rule, Simpsons Rule, Gauss Quadrature, Romberg integration	
6	**Correlation & Regression**	**8**
	Types of Correlation, spearman's rank method, Karl Pearson's method, Regression coefficients, Regression lines, Multiple regression, Principle of least squares.	
7	**Hypothesis testing**	**7**
	Hypothesis testing, significance intervals, Chi-square, t-test and F-test	

List of Tutorials:
Solve minimum 2 problems from each of the above topics.

Suggested Theory Distribution
The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution Serves as guidelines for teachers and students to achieve effective teaching-learning process Distribution of Theory for course delivery and evaluation

Remember	Understand	Apply	Analyze	Evaluate	Create
10%	15%	10%	35%	20%	10%

Instructional Method and Pedagogy:

1. Use of Learning Management system like canvas
2. Demonstration through power point presentations and videos and lectures
3. Brainstorming and group discussion sessions
4. Collaborative learning

Recommended Study Material:

Reference Book:

1. Numerical methods in Engineering - Salvadori& Baron
2. Numerical Methods in Finite Element Analysis - Bathe & Wilson

3. Advanced Mathematics - Kresysig
4. Numerical Analysis – Scarborough
5 Fundamental of mathematical statistics-S.C.Gupta ,V.K.Kapoor,Sultan chand & sons
6. Probability and Statistics for Engineers -Johnson Richard, Prentice India Ltd.
7. Sampling techniques-Cochran, Wiley Series

Web Resources

1. www.scilab.org/
2. http://nptel.ac.in/
3. http://ocw.mit.edu/