Marwadi University

Syllabus for Master of Technology

Geotechnical Engineering

APPLICATION OF NUMERICAL & STATISTICAL METHODS IN GEOTECHNICAL ENGINEERING

01GT2104 (PEC)

Objective of the Course:

- Enable students to apply the knowledge of numerical methods to solve the real-world problems of structural engineering.

Credit Earned: 3

Students learning outcomes:

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

1. Understand the interpolation techniques in civil engineering problems.
2. Apply the of solution techniques of linear system to frame civil engineering problems
3. Understand the use of FDM in civil engineering problems
4. Apply Numerical Integration in civil Engineering
5. 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)	IA (M)	CSE (I)	Viva (V)	Term Work (TW)	
03	00	00	03	50	30	20	25	25	150

Detailed Syllabus

Sr. No.	Title of the unit	Number of hours
1	**Solution to algebraic non–linear equations**	**6**
	Bisection Method, Regular Falsi method, Secant method, Newton Raphson iterations to find roots of a 1D nonlinear equation 2 Newton Iterations, Introduction to Excel	
2	**Solution of simultaneous Linear systems Direct solution**	**6**
	Iterative solutions: Jacobi iteration. Gauss Seidel iteration. SOR Method Direct Solutions: Gauss elimination, Gauss Jordan elimination with and without pivoting, LU Decomposition	

3	**Finite differences and Interpolation**	**6**
	Finite differences, Newton's forward interpolation, Newton backward interpolation, Lagrange's interpolation, Newton divided difference method	
4	**Solution of Ordinary Differential Equations:**	**7**
	Taylor's method, Euler's method, Runge-Kutta second & fourth order method, Milne's Predictor-corrector method, finite difference method	
5	**Numerical Quadrature:**	**4**
	Trapezoidal rule, Simpsons Rule, Gauss Quadrature, Romberg integration	
6	**Correlation & Regression**	**7**
	Types of Correlation, spearman's rank method, Karl Pearson's method, Regression coefficients, Regression lines, Principle of least squares.	
7	**Probability & Distribution**	**6**
	Probability Conditional Probability, Bayes' theorem, Random variable, Mathematical expectations, Normal Distribution	
	TOTAL HOURS	**42**

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
5%	5%	20%	25%	25%	20%

Instructional Method and Pedagogy:

1. Use of Learning Management system like canvas
2. Demonstration through presentations on power point 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.