Numerical Methods in Geotechnical Engineering
0MGT104 (ES-PC)

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 Geotechnical engineering

Credits Earned: 4

Students learning outcomes:

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 geotechnical engineering problems
3. Formulate seepage problems and it solution by Euler's equation
4. Understand the use of FDM in geotechnical problems

Teaching and Examination Scheme

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

C. Detailed Syllabus

Sr. No.	Title of the unit	Number of hours
1	**introduction**	
	Significance of numerical methods.	1
	Sources of error in numerical solutions: truncation Error, round of error. Order of accuracy & Precision	2
2	**Solution of simultaneous Linear systems**	
	Direct solution: Gauss elimination, Gauss Jordan elimination with and without pivoting Factorization, Cholesky decomposition, singular value Decomposition.	5
	Iterative solutions: Jacobi iteration. Gauss Seidel iteration. Convergence criteria	3
	Solution of non-linear algebraic equations,	
3	**Solution to algebraic non–linear equations** Newton Raphson iterations to find roots of a 1D nonlinear equation	2
	Newton Iterations, Quasi Newton iterations.	2
4	**Solution of Partial Differential Equations:**	
	partial differential equations using finite difference method, Eigen value problems & Solutions	6
5	**Transformation methods**	
	Laplace equation - Properties of harmonic functions - Fourier transform methods for Laplace equation, Euler's equation	7
6	**Numerical quadrature:** Trapezoidal rule, simpsons Rule, Gauss quadrature.	4
7	**Regression analysis**	
	Correlation and regression, Principles of least squares	4

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%	25%	10%	35%	20%	00%

Instructional Method and Pedagogy:

1. Use of Learning Management system like canvas
2. Demonstration through ppt 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 Methods" by D. Dahlquist, and A. Bork, Dan Prentice-Hall, Englewood Cliffs, NJ,. 1974.
5. Numerical Analysis - Scarborough

Web Resources:

1. http://nptel.ac.in/courses/105105043/
2. http://nptel.ac.in/courses/111107107/

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