GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering

Subject Code : 3736503

Name : NUMERICAL METHODS FOR CIVIL ENGINEERING APPLICATIONS

WEF Academic Year :	2023-2024
Semester :	3
Category of the Course :	Open Elective

Prerequisite :	**Engineering Mathematics**
Rationale :	To find solution of structural engineering problems, a mathematical model of the problem is formed and then its closed form or numerical solution is obtained using mathematics. Thus, the knowledge of application of various mathematical tools is essential for the solution of structural problems. The course on *Numerical Methods* equips the students with the applications of numerical and statistical methods to solve problems related to structural engineering.

Course Scheme :

Teaching Scheme			Total Credits	Assessment Pattern and Marks				Total Marks
				Theory		Practical		
L	T	PR	C	ESE (E)	PA(M)	ESE (V)	PA (I)	
2	0	2	3	70	30	30	20	150

Course Content:

Sr. No.	Course Content	No. of Hours	% of Weightage
1	Error analysis ,types of errors, accuracy& precision, stability in numerical analysis	02	05
2	Empirical laws and curve fitting.	04	10
3	Interpolation & extrapolation, general, interpolation formulae, numericaldifferentiation&integration/solutionoflargesystemsoflinearequations, Use of software, solution of banded equations.	06	15
	Solution of non-linear algebraic and transcendental equations, Newton-Raphson		

4	iterative method, numerical solutions of ordinary differential equations and partial differential equations using finite difference technique, its applications to structural engineering problems.	06	20
5	Solution of Eigen value problems, iterative methods & transformation methods. Applications to Structural Dynamic problems, stress problems, Buckling of columns. Application of numerical methods in civil engineering	04	15
6	Laplace transform methods, Laplace equation-Properties of harmonic functions –Fourier transform methods for Laplace equation	04	15
7	Euler's equation- Functional dependant on first and higher order derivatives	02	10
8	Correlation and regression, Principles of least squares.	02	10
	Total	**30**	**100**

Reference Book:

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level*
01	Solve algebraic equations,	AN
02	Obtain numerical solution fordinary and partial differential equations,	AN
03	Apply integration method/s for structural analysis,	AN
04	Carry out interpolations and curve fitting,	AN
05	Obtainsolutionofeigenvalueproblemsandfourierseriesforstructuralanalysis,	AP
06	Apply iterative and transformation methods in structural engineering	AP

*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create

List of Practicals Examples based on:

1. Algebraic equations
2. Ordinary and partial differential equation
3. Integration methods
4. Curve fitting
5. Eigenvalue problems
6. Iterative and transformations methods

Open Ended Problems:

Apart from above tutorials/ experiments a group of students has to undertake one open ended problem/ design problem. Few examples of the same are given below:

1. Real life application of Numerical Methods for solving engineering problems.
2. Developing computer codes for various Numerical Methods using open source/ commercial programme.
3. Application open source/commercial software tools for solving numerical problems.

Major Equipments: --

List of Open Source Software/learning website:

www.scilab.orghttp://nptel.ac.inhttp://ocw.mit.edu/

Suggested Course Practical List:

List of Laboratory/Learning Resources Required:

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