

Branch Name:	Structural Engineering
Program Code:	ET206
Course Name:	Numerical Methods for Civil Engineering
Course Code:	2ET2060101T
Pre-requisite Course:	Engineering Mathematics

Course Objectives:

CO-1 Fundamental principles and basics of numerical methods will be covered.

CO-2 To review and implement the basic principles of interpolation and polynomial approximation, numerical integration, solving simple ordinary differential equations and partial differential equations

CO-3 Develop algorithms and programs for solving civil engineering problems involving: (i) multi-dimensional integration, (ii) multivariate differentiation, (iii) ordinary differential equations, (iv) partial differential equations

CO-4 The course on Numerical Methods equips the students with the applications of numerical and statistical methods to solve problems related to structural engineering

Teaching and Examination Scheme

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								
					Theory (Marks)				Practical (Marks)				Total (Marks)
	L	T	P	Total	SEE		CCA		SEE		CCA		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
4	3	1	-	4	24	60	16	40	-	-	-	-	100

Subject Contents:

Sr. No.	Topics	Total Hours	Weightage (%)
1.	Error analysis, types of errors, accuracy & precision, stability in numerical analysis	2	5
2.	Empirical laws and curve fitting	4	10
3.	Interpolation & extrapolation, general, interpolation formulae, numerical differentiation & integration / solution of large systems of linear equations, use of software, solution of banded equations.	8	15
4.	Solution of non-linear algebraic and transcendental equations, Newton-Raphson iterative method, numerical solutions of ordinary differential equations and partial differential equations using finite difference technique, its applications to structural engineering problems.	8	20
5.	Solution of Eigen value problems, iterative methods & transformation methods. Applications to Structural Dynamic problems, stress problems, buckling of columns.	6	15
6.	Laplace transform methods, Laplace equation - Properties of harmonic functions - Fourier transform methods for Laplace equation.	6	15
7.	Euler's equation - Functional dependent on first and higher order derivatives.	4	10
8.	Correlation and regression, Principles of least squares.	4	10

Text Books

1. Numerical and Statistical methods by Dr. K.R. Kachot, 4th Edition.

Reference Books:

1. Numerical methods in Engineering - Salvadori & Baron
2. Numerical Methods in Finite Element Analysis - Bathe & Wilson
3. Advanced Mathematics – Kresysig
4. Numerical Analysis – Scarborough

List of Open Source Software/learning website:

- www.scilab.org/
- <http://nptel.ac.in/>
- <http://ocw.mit.edu/>

Open Ended Problems:

Apart from 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.

LAB/Practical- NA

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Find an approximate solution of algebraic equations using appropriate method	2 Understanding 5 Evaluate
CLO2	Obtain numerical solution of ordinary and partial differential equations.	2 Understanding, 3 Applying
CLO3	Apply integration methods for structural analysis.	3 Applying
CLO4	Calculate finite differences of tabulated data	5 Evaluation
CLO5	Obtain solution of eigen value problems and Fourier series for structural analysis	3 Applying 5 Evaluate
CL06	Apply iterative and transformation methods in structural engineering	3 Applying 4 Analyze

Mapping of CLOs with Pos & PSOs

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes(PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CLO1	L	H	H													
CLO2	M	H	H		H											
CLO3	M	H	M													
CLO4	L	H	M		L											
CLO5	M	H	H													
CLO6	H	M	H		M											

H:High, M:Medium, L: Low