

Branch Name:	Mechanical Engineering (Production Technology)
Program Code:	ET209
Subject Title:	Finite Element Methods
Subject Code:	1ET2010202
Pre-requisite Subject:	Knowledge of Applied Mathematical Techniques, Numerical Methods

Course Objective: To equip students with fundamentals of finite element principles so as to enable them to understand the behavior of various finite elements and to be able to select appropriate elements to solve physical and engineering problems.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture	Tutorial	Practical	Credit	Theor y		Practical		Total
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
03	00	02	05	60	40	30	20	150

Subject Contents			
Sr. No	Topic	Total Hours	Weight (%)
1.	Approaches of FEM: Discrete, Variational and Weighted Residual;	05	15
2.	Direct Problems: Spring, Hydraulic Network; Resistance Network and Truss Systems.	08	25
3.	1-D Field and Beam Bending Problems: Formulation using Galerkin and Raleigh-Ritz approaches, Derivation of elemental equations and their assembly, Solution and its post processing.	08	25
4.	2-D and Axisymmetric Field and Stress Problems: Formulation using Galerkin and Raleigh-Ritz approaches, Derivation of elemental equations and their assembly, Solution and its post processing.	07	20
5.	3-D Field and Stress Problems: Formulation using Galerkin and Raleigh-Ritz approaches, Derivation of elemental equations and their assembly, Solution and its post processing; Eigen value and time dependent problems; Discussion about Preprocessors, postprocessors and finite element packages.	07	15
		35	100

Review Presentation: The student is expected to spend minimum 1 hours per week (as mentioned in the teaching and evaluation scheme) to refer at least two peer reviewed journal papers related to this domain/subject. The student is expected to identify issues/challenges and emerging trends in the domain/subject. Student is supposed to explore various video lectures (E.g. NPTEL) available in the domain/subject. Student is required to make a review-presentation on the work carried out for the same. Recommended sites for journal papers are (1) asmedigitalcollection.asme.org (2) springer.com (3) sciencedirect.com (5) ieeexplore.ieee.org (6) scholar.google.co.in or others of similar repute.

Course Outcome:

After successful completion of the course, student will be able to

1. Formulate the structural engineering, heat transfer problem into finite element model.
2. Derive and solve the stiffness matrix, displacement matrix and load vectors for one / two

dimensional structural and heat transfer problems.

3. Apply the capabilities of finite element software to solve the structural engineering and heat transfer Problems.
4. Interpret and evaluate the quality of results obtained using FE software.
5. Appreciate the applications and limitation.

List of References:

1. An Introduction to the Finite element Method, Reddy, J.N, McGraw – Hill.
2. Finite Element Method in Engineering , Rao, Pergammon Press.
3. Introduction to Finite Elements in Engineering, Chandrupatla T. R. and Belegunda A. D., PHI.
4. Text book of Finite Element Analysis, Seshu P., PHI.

List of Experiments:

1. Introduction to Finite Element Analysis software.
2. Solve 1D – Structural, thermal and fluid problems using FEA software.
3. Solve Plane truss problems, using FEA software. Include problems with symmetry.
4. Solve Beam problems with different boundary and loading conditions using FEA software.
5. Solve 2D problems using different element types in a FEA software.
6. Solve 3D problems using FEA software.
7. Solve plate and shell problems using FEA software.
8. Solve Dynamic problems using FEA software.



Sankalchand Patel University
Faculty of Engineering and Technology
**First Year Master of Technology - Mechanical Engineering (Production
Technology) In Effect from Academic Year 2021-22**