FINITE ELEMENT TECHNIQUES -EL 1
Semester II (Production Engineering) SUB CODE: MEPR205-B
Teaching Scheme (Credits and Hours)

Teaching Scheme				Total Credit	Evaluation Scheme					Total Marks
L	T	P	Total		THEORY		IE	CIA	PR. / VIVO	
					Hrs	Marks	Marks	Marks	Marks	
Hrs	Hrs	Hrs	Hrs							
3	0	2	5	4	3	70	30	20	30	150

LEARNING OBJECTIVES:
The objective of this course is

- To learn various concepts related to FEM Analysis

LESSON PLANNING

SR.NO	CHAPTER NO	DATE/WEEK	%WEIGTAGE
1	1,2	1st 2nd 3rd	20
2	3,4	4th 5th 6th	20
3	5,6	7th 8th 9th	20
4	7	10th 11th 12th	20
5	8	13th 14th 15th	20

Total hours (Theory): 45, Total hours (Practical): 30, Total hours: 75

DETAILED SYLLABUS

Chap. No.	Topic
1	**Introduction:** Introduction to Finite Element Method of solving field problems. Stress and Equilibrium. Boundary conditions. Strain-Displacement relations. Stress-strain relations. One Dimensional Problem: Finite element modeling. Local, natural and global coordinates and shape functions.
2	**Potential Energy approach** : Assembly of Global stiffness matrix and load vector. Finite element equations, treatment of boundary conditions. Quadratic shape functions
3	**Analysis of trusses and frames**: Analysis of plane truss with number of unknowns not exceeding two at each node. Analysis of frames with two translations and a rotational degree of freedom at each node.
4	**Analysis of Beams:** Element stiffness matrix for two noded, two degrees of freedom per node for beam element
5	**Finite element modeling of two dimensional** : Stress analysis problems with constant strain triangles and treatment of boundary conditions. Two dimensional four noded isoparametric elements and numerical integration.
6	**Finite element modeling of Axisymmentric**: Solids subjected of axisymmetric loading with triangular elements. Convergence requirements and geometric isotropy
7	**Steady state heat transfer analysis**: One dimensional analysis of a fin and two dimensional conduction analysis of thin plate. Time dependent field problems: Application to one dimensional heat flow in a rod. Dynamic

analysis: Formulation of finite element modeling of Eigen value problem for a stepped bar and beam. Evaluation of Eigen values and Eigen vectors. Analysis of a uniform shaft subjected to torsion using Finite Element Analysis

| 8 | **Finite element formulation of three dimensional** : Finite element formulation of three dimensional problems in stress analysis. Finite Element formulation of an incompressible fluid. Potential flow problems Bending of elastic plates. Introduction to non-linear problems and Finite Element analysis software |

LIST OF PRACTICALS

Sr. No.	Practical Content
1	PROBLEM SOLVING METHODOLOGY BY FEM
2	FINITE ELEMENT MODELINGOF ONE DIMENSIONAL PROBLEM
3	PROBLEM SOLVING BY POTENTIAL ENERGY APPROACH
4	FINITE ELEMENT MODELINGOF TWO DIMENSIONAL PROBLEM
5	ANALYSIS OF FRAMES WITH TWO TRANSLATIONS
6	ANALYSIS OF PLANE TRUSS WITH NUMBER OF UNKNOWNS NOT EXCEEDING TWO AT EACH NODE
7	FINITE ELEMENT MODELINGOF TWO DIMENSIONAL FOUR NODED ISOPARAMETRIC ELEMENTS
8	FINITE ELEMENT MODELING OF AXISYMMENTRIC LOADING WITH TRIANGULAR ELEMENTS
9	ONE DIMENSIONAL ANALYSIS OF A FIN AND TWO DIMENSIONAL CONDUCTION ANALYSIS OF THIN PLATE
10	FORMULATION OF FINITE ELEMENT MODELING OF EIGEN VALUE PROBLEM FOR A STEPPED BAR AND BEAM
11	ANALYSIS OF A UNIFORM SHAFT SUBJECTED TO TORSION USING FINITE ELEMENT ANALYSIS
12	FINITE ELEMENT MODELINGOF THREE DIMENSIONAL PROBLEMS IN STRESSANALYSIS
13	FINITE ELEMENT FORMULATION OF AN INCOMPRESSIBLE FLUID
14	POTENTIAL FLOW PROBLEMS BENDING OF ELASTIC PLATES
15	FINITE ELEMENT ANALYSIS OF NON-LINEAR PROBLEMS AND FINITE ELEMENT ANALYSIS SOFTWARE

INSTRUCTIONAL METHOD AND PEDAGOGY (Continuous Internal Assessment (CIA) Scheme)
- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal weightage should be given to all units while conducting teaching & examination.
- Attendance is compulsory in lectures and Tutorial.
- Viva Voce will be conducted at the end of the semester of 30 Marks.
- One internal exam of 30 marks is conducted as a part of Mid semester evaluation.

STUDENTS LEARNING OUTCOMES:
At the end of the course
- The students will gain an insight to FEM which can be used in various analysis of real life problems

Reference Books:
1. Tirupathi R Chandraputla and Ashok. D. Belegundu, Introduction of Finite Element in Engineering, Prentice Hall of India, 1997.
2. Rao S.S., The Finite Element Methods in Engineering, Pergamon Press, 1989.
3. Segerland. L.J., Applied Finite Element Analysis, Wiley Publication, 1984.
4. Reddy J.N. An Introduction to Finite Element Methods, Mc Graw Hill Company, 1984.