

FR. Conceicao Rodrigues College Of Engineering
 Father Agnel Ashram, Bandstand, Bandra-west, Mumbai-50
Department of Production Engineering

T.E. (Production) (semester V) (2019-2020)

Lecture Plan

Subject: Finite Element Analysis (PEDLO5012)

Credits-03

1. Syllabus.

Module	Contents	Hrs.
01	Introduction 1.1. Introductory Concepts: Introduction to FEM, Historical Background, General FEM procedure. Applications of FEM in various fields. Advantages and disadvantages of FEM. 1.2. Mathematical Modeling of field problems in Engineering, Governing Equations, Differential Equations in different fields. 1.3 Approximate solution of differential equations-- Weighted residual techniques, Galerkin methods.	09
02	FEA Procedure 2.1 Discrete and continuous models, Weighted Residual Methods –Ritz Technique –Basic concepts of the Finite Element Method. 2.2. Definitions of various terms used in FEM like element, order of the element, internal and external node/s, degree of freedom, primary and secondary variables, boundary conditions. 2.3. Minimization of a functional. Principle of minimum total potential. Piecewise Rayleigh-Ritz method. Formulation of “stiffness matrix”; transformation and assembly concepts.	05
03	One-Dimensional Problems 3.1. One Dimensional Second Order Equations Discretization–Element types-Linear and Higher order Elements – Derivation of Shape functions and Stiffness matrices and force vectors. 3.2. Assembly of Matrices -solution of problems in one dimensional structural analysis, heat transfer and fluid flow (Stepped and Taper Bars, Fluid Network, Spring-Cart systems) 3.3. Analysis of Plane Trusses, Analysis of Beams. 3.4. Solution of one Dimensional structural and thermal problems using FE Software, Selection of suitable Element Type, Modeling, Meshing,	10

	Boundary Condition, Convergence of solution, Result analysis, Case studies.	
04	Two Dimensional Finite Element Formulations 4.1 Introduction, Three noded triangular element, four noded rectangular element, four noded quadrilateral element. 4.2 Natural coordinates and coordinates transformations: serendipity and Lagranges methods for deriving shape functions for triangular and quadrilateral element 4.3. Introduction to Sub parametric, Isoperimetric, super parametric elements. Compatibility, Patch Test, Convergence criterion, Sources of errors.	08
05	Two Dimensional Vector Variable Problems 5.1 Equations of elasticity –Plane stress, plane strain and axisymmetric problems. 5.2. Jacobian matrix, stress analysis of CST. 5.3. Solution of 2 -D Problems using FE Software (structural and Thermal), election of element type, meshing and convergence of solution. (Can be covered during practical hours).	05
06	Finite Element Formulation of Dynamics and Numerical Techniques: 6.1. Applications to free vibration problems of rod and beam. Lumped and consistent mass matrices. 6.2. Solutions Techniques to Dynamic problems, longitudinal vibration, frequencies and mode shapes. Fourth Order Beam Equation, Transverse deflections and Natural frequencies of beams. 6.3 Finding frequencies of beam using FE Software (Can be covered during practical hours).	05

2. CO Statements.

Learner will be able to

PEDL05012.1	Solve ordinary and partial differential equation using Galerking method
PEDL05012.2	Develop the finite element equation to model engineering problems governed by 2 nd order partial differential equation.
PEDL05012.3	Apply the basic finite element formulation techniques to solve engineering problem
PEDL05012.4	Use commercial FEA software, to solve problem related to engineering.
PEDL05012.5	Prepare solution of 2-D problem using FEA software.
PEDL05012.6	Find solution technique to dynamic problems, longitudinal vibration, frequencies and mode shapes.

CO-PO-PSO Mapping.

CO# / PO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEDL05012.1	3	2	-	-	-	-	-	-	-	-	-	-
PEDL05012.2	3	3	2	-	-	-	-	-	-	-	-	-
PEDL05012.3	3	3	-	-	-	-	-	-	-	-	-	-
PEDL05012.4	3	3	-	-	2	-	-	-	-	-	-	-
PEDL05012.5	3	3	-	-	2	-	-	-	-	-	-	-
PEDL05012.6	3	3	-		2							

CO# / PSO#	PSO1	PSO2
PEDL05012.1	-	-
PEDL05012.2	-	-
PEDL05012.3	-	-
PEDL05012.4	-	2
PEDL05012.5	-	2
PEDL05012.6		2

3. CO Assessment tools with target.

Co Statement #	Target for Assessment Tools		
	Unit Test	End Semester Exam	Course Exit Survey
PEDL05012.1	60%	50%	60%
PEDL05012.2	60%	50%	60%
PEDL05012.3	60%	50%	60%
PEDL05012.4	60%	50%	60%
PEDL05012.5	60%	50%	60%
PEDL05012.6	60%	50%	60%

4. Curriculum Gap/Content beyond syllabus (if any).

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5. Lecture/Lab/Mini Project/Assignment Plan.

TE Production 2018-2019 Lesson Plan	
Teacher In-Charge:- Prof. Hitendra Vaishnav (Finit Element Analysis) elective	
Planned	Topic
01/07/2019	Introduction to FEA
03/07/2019	Advantage , Disadvantage and application of FEA
05/07/2019	Mathematical modelling of FEA
08/07/2019	Residual techniques
10/07/2019	Different method
12/07/2019	Problems
17/07/2019	Problems on solving differential equation
18/07/2019	Discreet and continues model
19/07/2019	Basic terms related to FEA
24/07/2019	Basic terms related to FEA
25/07/2019	Concept of Stiffness matrix
26/07/2019	Analysis of truss
31/07/2019	Analysis of truss
01/08/2019	Analysis of truss
02/08/2019	Analysis of Bar
07/08/2019	Analysis of Bar
08/08/2019	Analysis of Heat transfer
09/08/2019	Analysis of Heat transfer
14/08/2019	U.T.1
15/08/2019	U.T.1
16/08/2019	U.T.1
21/08/2019	Fluid network
22/08/2019	Fluid network
23/08/2019	Synergy
28/08/2019	Analysis of beam
29/08/2019	Analysis of beam
30/08/2019	Concept of functional and minimum potential energy
04/09/2019	Mid Term Break
05/09/2019	Mid Term Break
06/09/2019	Mid Term Break
11/09/2019	Two dimensional element
12/09/2019	Natural Coordinate transformation
13/09/2019	Shape function
18/09/2019	Sub parametric
19/09/2019	Iso parametric
20/09/2019	Vector variable problem
25/09/2019	Stress analysis of CST
26/09/2019	Axisymmetric problem
27/09/2019	CRMD
02/10/2019	Mahatma Gandhi Jyanti
03/10/2019	Vibrational problem

04/10/2019	Vibrational problem
09/10/2019	Lumped and consistent mass matrix
10/10/2019	Fourth order beam equation
11/10/2019	Revision
16/10/2019	U.T.2
17/10/2019	University problem
18/10/2019	University problem

