BASICS OF FINITE ELEMENT ANALYSIS - I

SWAYAM Prabha Course Code- M21

PROFESSOR'S NAME	PROF. NACHIKETA TIWARI
DEPARTMENT	Department of Mechanical Engineering
INSTITUTE	IIT Kanpur
COURSE OUTLINE	This course is intended for all those who want to learn FEA from an application standpoint.Currently, many users of FEA have limited understanding of theoretical foundation of thispowerful method. The consequence is that quite often they use commercial codes inaccurately, and do not realize that their results may be flawed. The course is intended to address this limitation by making the student aware of the underlying mathematics in easy to understand format.

COURSE DETAILS

S. No	Module ID/ Lecture ID	Lecture Title/Topic
1	M1L1	Introduction to Finite Element Analysis(FEA)
2	M1L2	Introduction of FEA, Nodes, Elements & Shape Functions
3	M1L3	Nodes, Elements & Shape Functions
4	M1L4	Polynomials as Shape Functions, Weighted Residuals, Elements & Assembly Level Equations
5	M1L5	Types of Errors in FEA, Overall FEA Process & Convergence
6	M1L6	Strengths of FE Method, Continuity conditions at Interfaces
7	M2L1	Key concepts and terminologies
8	M2L2	Weighted integral statements
9	M2L3	Integration by parts -Review

10	**M2L4**	Gradient and Divergence Theorems-Part I
11	**M2L5**	Gradient and Divergence Theorems Part-II
12	**M2L6**	Functionals
13	**M3L1**	Variational Operator
14	**M3L2**	Weighted Integral & Weak Formulation
15	**M3L3**	Weak Formulation
16	**M3L4**	Weak Formulation & Weighted Integral : Principle of minimum potential energy
17	**M3L5**	Variational Methods : Rayleigh Ritz Method
18	**M3L6**	Rayleigh Ritz Method
19	**M4L1**	Method of Weighted Residuals
20	**M4L2**	Different types of Weighted Residual Methods - Part I
21	**M4L3**	Different types of Weighted Residual Methods - Part II
22	**M4L4**	FEA formulation for 2nd order BVP - Part I
23	**M4L5**	FEA formulation for 2nd order BVP - Part II
24	**M4L6**	Element Level Equations
25	**M5L1**	2nd Order Boundary Value Problem
26	**M5L2**	Assembly of element equations
27	**M5L3**	Assembly of element equations, and implementation of boundary conditions
28	**M5L4**	Assembly process and the connectivity matrix
29	**M5L5**	Radially Symmetric Problems
30	**M5L6**	One dimensional heat transfer
31	**M6L1**	1D-Heat conduction with convective effects : examples
32	**M6L2**	Euler-Bernoulli beam

33	**M6L3**	Interpolation functions for Euler-Bernoulli beam
34	**M6L4**	Finite element equations for Euler-Bernoulli beam
35	**M6L5**	Assembly equations for Euler-Bernoulli beam
36	**M6L6**	Boundary conditions for Euler-Bernoulli beam
37	**M7L1**	Shear deformable beams
38	**M7L2**	Finite element formulation for shear deformable beams : Part - I
39	**M7L3**	Finite element formulation for shear deformable beams : Part - II
40	**M7L4**	Equal interpolation but reduced integration element
41	**M7L5**	Eigenvalue problems
42	**M7L6**	Eigenvalue problems : examples
43	**M8L1**	Introduction to time dependent problems
44	**M8L2**	Spatial approximation
45	**8L3**	Temporal approximation for parabolic problems : Part-I
46	**M8L4**	Temporal approximation for parabolic problems : Part-II
47	**M8L5**	Temporal approximation for hyperbolic problems
48	**M8L6**	Explicit and implicit method, diagonalization of mass matrix, closure

References if Any: