BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

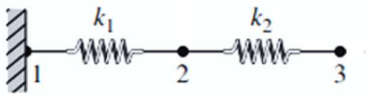
CLASS: M.TECH **SEMESTER : II**
BRANCH: CIVIL & ENVIRONMENTAL ENGINEERING **SESSION : SP/2025**

SUBJECT: CE506 FINITE ELEMENT METHOD

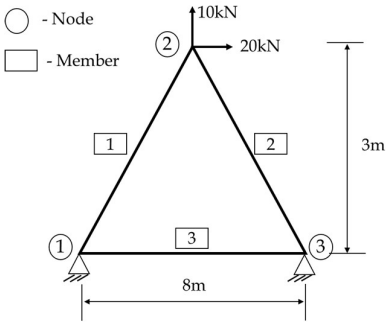
TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	For the spring assembly shown below, determine the unknown displacements U_2, U_3 and the nodal force F_1. Let k_1 and k_2 as 50 and 75 N/mm, respectively, and F_2 and F_3 as 75kN.	[5]	1	K1,K2,K3,K4

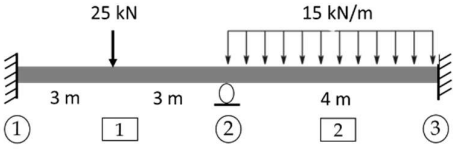


Q.1(b)	Find the unknown displacements for the truss shown below using the Direct Stiffness Method. (Assume AE = constant)	[5]	1	K1,K2,K3,K4



Q.2(a)	Define shape function and draw the shape functions for 2-node beam element shown below.	[5]	2	K1,K2,K3,K4

Q.2(b)	Find the unknown displacements for the beam shown below using the Direct Stiffness Method. (Assume EI = constant)	[5]	2	K1,K2,K3,K4



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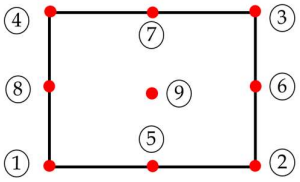
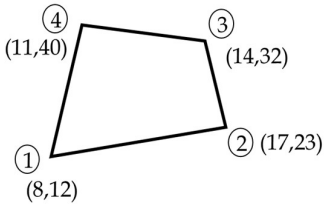
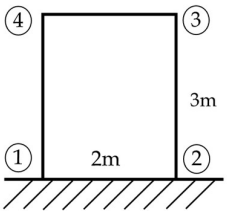
Q.3(a)	Find the shape functions for node 1, 2, 5, 6 and 9 for the 9-node rectangular element shown below.	[5]	3	K1,K2,K3,K4



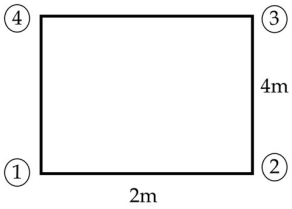
Q.3(b)	Define Iso-parametric formulation and find the Jacobian for the irregular rectangular geometry shown below.	[5]	3	K1,K2,K3,K4



Q.4	The cantilever beam shown in below figure is modelled as a plane stress problem. Discretize the structure into two triangular elements and derive the global stiffness matrix. Let E as 10^{10} N/m^2, μ as 0.15, thickness t as 20mm.	[10]	4	K1,K2,K3,K4



Q.5(a)	Find the stiffness component K_{11} for the 4-node rectangular plane stress element shown below. Let E as 10^{10} N/m^2, μ as 0.15, thickness t as 20mm.	[5]	4	K1,K2,K3,K4



Q.5(b)	What is pre-processing and post-processing in ABAQUS? Write briefly the steps involved pre-processing of a simply supported steel beam subjected to uniformly distributed load.	[5]	5	K4

::::::26/04/2025::::::E