Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

VII SEMESTER B.TECH (CIVIL ENGINEERING) END SEMESTER EXAMINATIONS

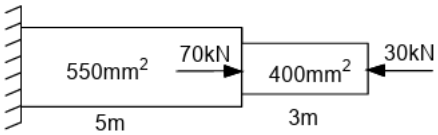
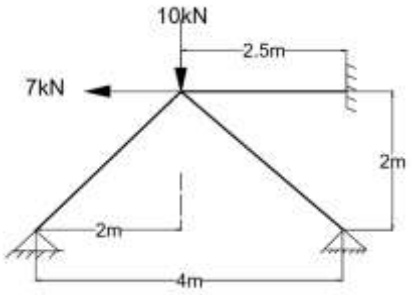
NOV/DEC-2023

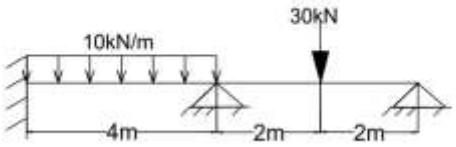
SUBJECT: FINITE ELEMENT METHOD OF ANALYSIS
[CIE 4065]

Date of Exam: Time of Exam: 3 hours Max. Marks: **50**

Instructions to Candidates:

- Answer ALL the questions & missing data may be suitably assumed
- Compulsorily write DOF numbers and node numbers wherever required.

1A.	Discuss the guidelines for assuming displacement model in detail and explain geometric invariance	**(5)**	**CO1**
1B.	Analyze the bar shown in figure using FEM and evaluate the stresses in members. Take modulus of elasticity as 200GPa. 	**(5)**	**CO2**
2A	Derive shape functions for a 2 noded bar element	**(3)**	**CO2**
2B	Derive transformation matrix for space truss element	**(3)**	**CO3**
2C	If a beam element of 4m length with one rotational degree of freedom for each node, has a nodal displacement vector of [-0.003 , +0,05] then, evaluate the midpoint displacement and slope.	**(4)**	**CO4**
3A	Analyze the truss shown in figure using FEM and find the displacements at the nodes. Take cross section area as 500mm^2 and E as 200GPa. 	**(6)**	**CO3**
3B	A space truss element has coordinates (0,0,1)m and (2,1,4)m respectively at node 1 and 2. If the displacement vector for the element in global direction is found to be [0, 0.001]m and [0.003, 0] m at node 1 and 2 respectively, then determine the displacement in local direction. Also evaluate stress and member force in the element. Comment on the nature of the member force. Take area of cross section as 400mm^2 and modulus of elasticity as 200GPa.	**(4)**	**CO3**
4A.	Analyze the beam shown in figure using FEM. Determine support moments only. Take EI= 3000 kNm^2.	**(5)**	**CO4**

			
4B	Determine nodal load vector for a beam element of length 6m loaded with a trapezoidal load of variation 10kN/m at one end and 20kN/m at the other end.	**(3)**	**CO4**
4C	Derive transformation matrix for a plane frame element.	**(2)**	**CO4**
5A	Determine nodal load vector for a CST element of coordinates { (0,0) , (2,0), (1,2) } m. Thickness of the element is 0.15m . Density of material is assumed to be $78kN/m^3$. One of its sides is subjected to a uniform vertical surface load of $10N/mm^2$ in positive direction.	**(3)**	**CO5**
5B	Determine Jacobian for a quadrilateral element defined by cartesian nodal coordinates {(0,0), (3,0),(2,2), (0.5 , 2)} units at (r,s)= (0, 0.5)	**(3)**	**CO5**
5C	Derive shape functions for a quadrilateral element in natural coordinates	**(4)**	**CO5**