Reg. No.										

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

I SEMESTER M.TECH. (STRUCTURAL ENGINEERING)

END SEMESTER EXAMINATIONS

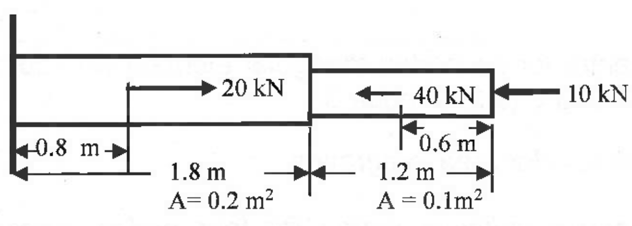
FEBRUARY-2021

SUBJECT: FINITE ELEMENT METHOD

[CIE 5173]

Date of Exam: 24-02-2021 Time of Exam: 3 Hours

Instructions to Candidates:
- Answer **ALL** the questions.
- Missing data may be suitabley assumed

Q. No		MARKS	CO
1A.	List the various steps of finite element method of analysis and obtain the equation of equilibrium relating the stiffness matrix, displacement vector and load vector using principle of minimum potential energy	04	CO1
1B.	Obtain the shape functions for three noded triangular element	03	CO1
1C.	Calculate the equivalent nodal load vector for three noded bar element of length 1.0 m due to the varying load defined by the equation q= $10x$ kN/m	03	CO1
2A.	Analyse the axially loaded structure shown in figure **Fig Q 2A**. Take modulus of elasticity as $2x10^7$ kN/m^2  **Fig. Q. 2 A**	05	CO2
2B	Two noded beam element of length 3m is subjected to i) uniformly distributed load of 5 kN/m and a point load of 10 kN acting at a distance of 1 m from node 2. If the displacements at the nodes 1 and 2 are as follows, calculate forces in the element Take EI= 1200 kNm^2	05	CO3

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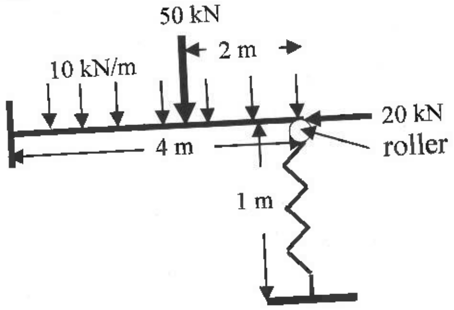
Node no	v (m)	Θ (rad)
1	0 m	0.001
2	0.0016 m	0.0

3A	Analyse the structure with fixed support at one end and supported by a spring as shown in figure **Fig. Q. 3A**. Take EI = 6400 kNm^2 for the horizontal member and AE= 1000 kN for the spring  **Fig Q 3A**	07	CO3
3B.	using the stiffness matrix of two noded bar element obtain the stiffness matrix for two noded space truss element	03	CO2
4 A	Obtain the shape functions N1 and N2 for three noded bar element in natural coordinate system using the shape functions in cartesian coordinate system	02	CO4
4B	Obtain the expression to calculate stiffness matrix for three noded triangular element	03	CO4
4C.	Obtain the matrix B at the centre for six noded triangular element with coordinates (0,0) at node 1, (1,0) at node 2 and (0,2) at node 3	05	CO4
5A.	Explain Gaussian Quadrature rule for area integration	02	CO4
5B	Explain the procedure to obtain stiffness matrix for four noded isoparametric element	04	CO4
5C	Calculate the equivalent nodal load vector for four noded element with coordinates (0,0) at node 1, (1.2, 0) at node 2, (1.2,1.2) at node 3 and (0,1.2) at node 4 due to the load varying from 5 kN/m at node 1 to 10 kN/m at node 2 acting along y-direction	04	CO4