Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

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(A constituent unit of MAHE, Manipal)

I SEMESTER MTECH (STRUCTURAL ENGINEERING)

END SEMESTER EXAMINATIONS, DEC 2023

SUBJECT: Finite element method [CIE 5128]

(05/12/2023)

Time: 3 Hours 9.30 am to 12.30 pm

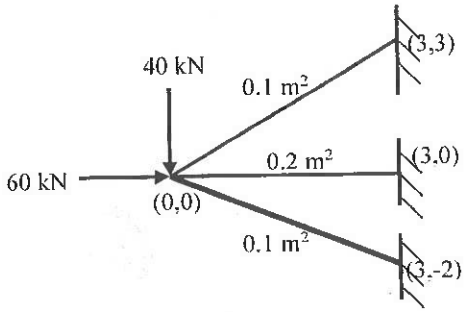
MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitable assumed.

Q. No		MARKS	COS	BL
1A	Illustrate the elements used for the analysis of two dimensional and three dimensional problems	2	CO1	2
1B	Illustrate the procedure to obtain shape functions for three noded bar element using displacement model	4	CO1	3
1C	Illustrate the procedure to obtain shape functions for four noded quadrilateral element using Lagrange interpolation functions	4	CO1	3
2A	Coordinates at nodes 1 and 2 and displacements along global direction for two noded space truss element are as shown in the table. If AE=2000 kN, evaluate the forces in element along local and global directions	3	CO2	4
2B	Evaluate the displacements at nodes and forces in any one member for the pin connected structure shown in figure. Take $E=2\times10^7$ kN/m^2	7	CO2	4

Node no	x	y	z	u	v	w
1	5	5	5	0	0	0
2	2	2	4	0.01	0.02	0.03



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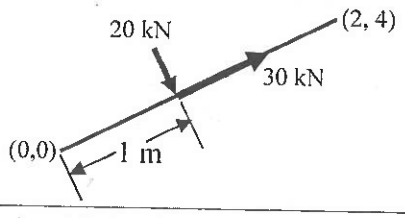
3A	Illustrate the procedure to obtain stiffness matrix for two noded beam element	4	CO3	3
3B	Two noded plane frame element shown in figure is subjected to two point loads 20 kN and 30 kN. Evaluate the equivalent nodal load vector in local and global directions. The coordinates at node 1 and node 2 are (0,0) and (2,4) as shown in figure 	4	CO3	4
3C	Illustrate the procedure to obtain shape functions for two noded bar element in natural coordinate system	2	CO4	3
4A	Evaluate the integral of $\int_A (2L1L2 + L3)dA$	2	CO4	4
4B	illustrate the procedure to obtain stiffness matrix for three noded triangular element	4	CO4	3
4C	Evaluate the equivalent nodal load vector for six noded triangular element with coordinates (1,1) at node 1, (3,1) at node 2 and (3,3) at node 3 due to the uniformly distributed load 20 kN/m acting along the side 2-3 along X direction	4	CO4	4
5A	Illustarte Gaussian quadrater rule for line integration	3	CO4	3
5B	Evaluate the equivalent nodal load vector for four noded quadrilateral element with coordinates (1,1) at node 1, (3,1) at node 2, (3,3) at node 3 and (1,3) at node 4 due to the point load 30 kN acting at x = 2 and y= 2 along Y direction	3	CO4	4
5C	Illustrate the procedure to obtain matrix B for four noded isoperimetric element	4	CO4	3