

Code No.: ME603PC

R20

H.T.No.

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CMR ENGINEERING COLLEGE: : HYDERABAD
UGC AUTONOMOUS
III-B.TECH-II-Semester End Examinations (Regular) - June- 2024
FINITE ELEMENT METHODS
(MECH)

[Time: 3 Hours]

[Max. Marks: 70]

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 20 marks. Answer all questions in Part A.

Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART-A

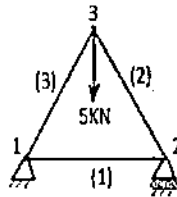
(20 Marks)

1. a) Define shape function. [2M]
- b) Write the steps in the concept of FEM formulation. [2M]
- c) Outline the differences between bar elements and beam elements? [2M]
- d) How many DOFs does a two-nodal, planar truss element have in its local coordinate system, Indicate with a proper diagram? [2M]
- e) Outline the important properties of CST element. [2M]
- f) Define isoparametric formulation. [2M]
- g) When do we consider a problem as steady state heat transfer problem? Give an example. [2M]
- h) Write the governing equation for convection heat transfer. [2M]
- i) What is the physical significance of mass matrices? [2M]
- j) What is meant by Eigen Vectors? [2M]

PART-B

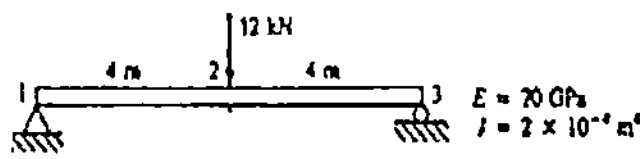
(50 Marks)

- 2.a) Explain the concept of finite element method. [5M]
 - b) Enlist the merits and demerits of finite element method. [5M]
- OR
3. Derive the shape function and stiffness matrix for 1-D 3 nodal quadratic element. [10M]
 4. Determine Nodal displacements in the truss shown in figure below. $E=80\text{GPa}$. Bar 1 area = 600 mm^2 , length = 500 mm, Bar 2 area = 600 mm^2 , length = 600 mm, Bar 3 area = 600 mm^2 , length = 500 mm. [10M]

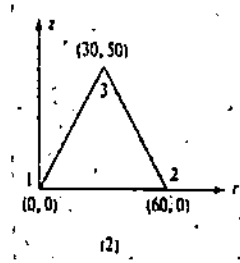


OR

5. For the beam shown in figure below. Determine displacement and slopes at the nodes, [10M] for each element.

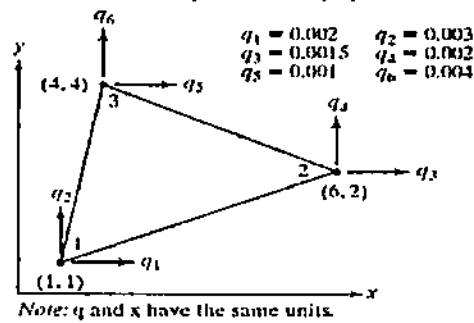


6. For the axi-symmetric elements shown in figure below, determine the element stresses. Let $E = 210 \text{ GPa}$, $\nu = 0.25$. The coordinates (in millimeters) are shown in the figures, and the nodal displacements for each element are: $u_1 = 0.05 \text{ mm}$, $w_1 = 0.03 \text{ mm}$, $u_2 = 0.02 \text{ mm}$, $w_2 = 0.02 \text{ mm}$, $u_3 = 0.0 \text{ mm}$, $w_3 = 0.0 \text{ mm}$. [10M]



OR

7. For the triangular element shown in figure, obtain the strain-displacement relation matrix B. The nodal deformations are represented by q. [10M]



8. Determine the temperature distribution along a circular fin of length 5 cm and radius 1 cm. The fin is attached to boiler whose wall temperature 140°C and the free end is open to the atmosphere. Assume $T_\infty = 40^\circ\text{C}$, $h = 10 \text{ W/cm}^2 / ^\circ\text{C}$, $k = 70 \text{ W/cm}^\circ\text{C}$. [10M]

OR

9. Derive the heat conduction matrix for two-dimensional steady state heat transfer problem. [10M]
10. Write a detailed note on finite element analysis for 3D stress problems. [10M]

OR

- 11.a) State the properties of Eigen Values and Eigen Vectors. [5M]
- b) Explain briefly about mass matrices for elements. [5M]
