

CMR ENGINEERING COLLEGE: : HYDERABAD
UGC AUTONOMOUS

III-B.TECH-II-Semester End Examinations (Supply) - June- 2025

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) Write the expression for the shape functions of a quadratic element. [2M]
- b) List out the four advantages of finite element method. [2M]
- c) A cantilever beam is subjected to a point load at the end along with a uniformly distributed load throughout its length. What are its essential and natural boundary conditions? [2M]
- d) Write the transformation matrix of Truss Element. [2M]
- e) What are the advantages of isoperimetric elements? [2M]
- f) Represent the degree of freedom for triangular axisymmetric element. [2M]
- g) State the governing differential equation of a one-dimensional heat transfer case. [2M]
- h) List out the boundary conditions of 1D heat transfer problem. [2M]
- i) What are the properties of Eigenvectors? [2M]
- j) Differentiate Static and Dynamic analysis. [2M]

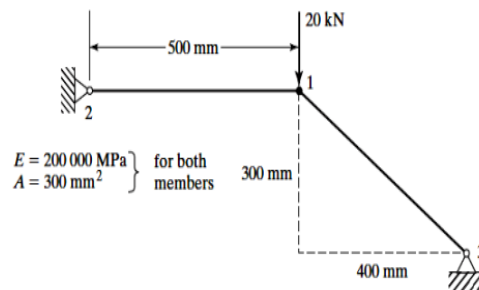
PART-B

(50 Marks)

2. List and explain the steps involved in Finite Element Analysis. [10M]

OR

- 3.a) Explain assembly of stiffness matrix with example. [5M]
- b) Derive the stiffness matrix for one dimensional two noded bar element. [5M]
4. For the two-bar truss shown in figure, determine the displacements of node 1 and the stress in elements 1-3. [10M]



OR

5. Calculate the maximum deflection and slope by using finite element method for the simply supported beam of length L , Young's modulus E and the moment of Inertia I , subjected to a point load of P at the centre. Compare the results with theoretical equations [10M]
 6. Briefly explain Constant Strain Triangle with expressions. [10M]
- OR**
- 7.a) What is Axi-symmetric analysis and give one example? [5M]
 - b) Briefly explain Iso-parametric representation of 4 noded quadrilateral elements. [5M]

8. Consider a pin fin having a diameter of 8 mm and length of 125 mm. At the root, the temperature is 70°C . The ambient temperature is 25°C and $h = 30 \text{ W/sq.mK}$. Take $k = 80 \text{ W/mK}$. Assume that the tip of the fin is insulated. Using a two element model, determine the temperature distribution and heat loss in the fin. [10M]

OR

9. Heat is generated in a large plate ($k = 0.8 \text{ W/m}^{\circ}\text{C}$) at the rate of 4000 W/m^3 . The plate is 25 mm thick. The outside surfaces of the plate are exposed to ambient air at 30°C with a convective heat transfer coefficient of $20 \text{ W/m}^2 \cdot ^{\circ}\text{C}$. Determine the temperature distribution in the wall. [10M]

- 10.a) Differentiate between consistent mass matrix and lumped mass matrix. [5M]
b) Explain Eigen values and Eigen vector. [5M]

OR

11. Write a detailed note on finite element analysis for 3D stress problems. [10M]
