Code No.: ME603PC	R20	H.T.No.			8	R						

CMR ENGINEERING COLLEGE: : HYDERABAD
UGC AUTONOMOUS
III–B.TECH–II–Semester End Examinations (Supply) - December- 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 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 isoparametric 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)	Enumerate the properties of Eigenvectors.	[2M]
	j)	Differentiate between Static and Dynamic analysis.	[2M]

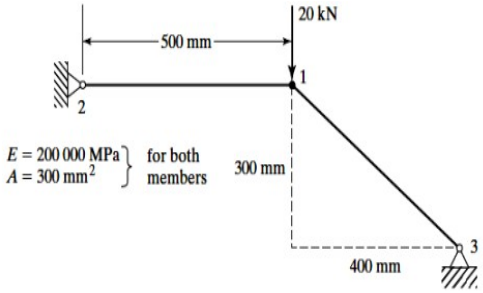
PART-B **(50 Marks)**

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

OR

3. Derive the stiffness matrix for one dimensional two noded bar element. [10M]

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 W/sq.mK. Take k = 80 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 W/m.^{0}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^{0}C with a convective heat transfer coefficient of 20 W/m^2. ^{0}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]

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