CBCS SCHEME

USN | | | | | | | | | | |

18AE/AS63

Sixth Semester B.E. Degree Examination, Dec.2024/Jan.2025
Finite Element Method

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Explain different coordinate systems used in Finite Element Method. **(06 Marks)**

b. Explain compatibility and convergence requirement of shape function. **(06 Marks)**

c. Derive the shape function and stiffness matrix for 1-D linear bar element. **(08 Marks)**

OR

2 a. Explain plane stress and plane strain problems in FEA. **(10 Marks)**

b. Discuss about various elements used in Finite Element Method. **(10 Marks)**

Module-2

3 Consider a bar a shown in Fig Q3, an axial load of 200 kN is applied at point 'P'. Take $A_1 = 2400\ mm^2$, $E_1 = 70\ GPa$, $A_2 = 600\ mm^2$, $E^2 = 200\ GPa$. Calculate :

i) The nodal displacements
ii) Stresses in each material
iii) Reaction forces at supports

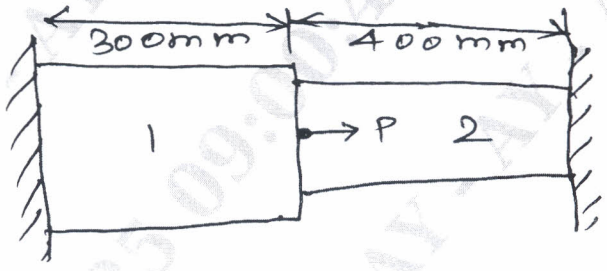
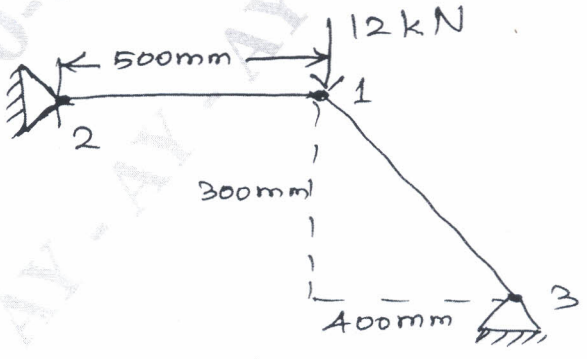


Fig Q3 **(20 Marks)**

OR

4 For the two bar truss shown in Fig Q4. Determine the displacement of node 1 and the stress in element 1-3. **(20 Marks)**



E = 70 GPa
A = 200 mm^2

Fig Q4

Module-3

5 a. Distinguish between Lagrange elements and Serentipity elements. **(08 Marks)**

b. Determine the shape function N_1, N_2 and N_3 at the interior point P for the triangular elements shown in Fig Q5(b).

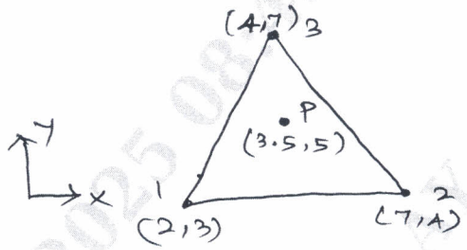


Fig Q5(b) **(12 Marks)**

OR

6 a. Derive shape function for Hexahedral element. **(12 Marks)**

b. Explain different types of higher order elements used in FEA. **(08 Marks)**

Module-4

7 a. Explain ISO parametric, sub parametric and super parametric elements. **(10 Marks)**

b. Explain briefly preprocessing processing and post processing used in FEA. **(10 Marks)**

OR

8 a. Explain Axisymmetric formulation. **(04 Marks)**

b. Derive strain-displacement matrix for an Axisymmetric Triangular element. **(16 Marks)**

Module-5

9 A wall of 0.6m thickness having thermal conductivity of 1.2 W/mK. The wall is to be insulated with a material of thickness 0.06m having an average thermal conductivity of 0.3 W/mK. The inner surface temperature is 1000°C and outside of the insulation is exposed at atmospheric air at 30°C with heat transfer coefficient of 35 W/m^2K. Find the nodal temperature. **(20 Marks)**

OR

10 For the one dimensional bar shown in Fig Q10, determine the natural frequencies of longitudinal vibration using two elements of equal length. Take $E = 2 \times 10^5$ N/mm^2, $\rho = 0.8 \times 10^{-4}$ N/mm^3, L = 400 mm.

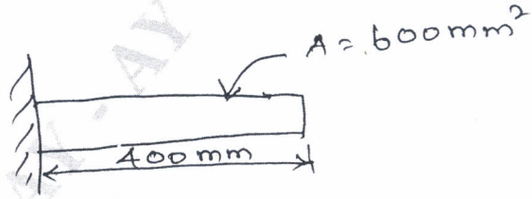


Fig Q10 **(20 Marks)**

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