CBCS SCHEME

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21AU644

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

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain the following:
i) Work potential
ii) Strain energy **(04 Marks)**

b. Explain with neat sketch the simplex, complex and multiplex elements characteristics. **(06 Marks)**

c. Explain the basic steps involved in finite element method formulation. **(10 Marks)**

OR

2 a. Explain the following:
i) Half band width
ii) Potential energy **(04 Marks)**

b. Explain the convergence criteria of a polynomial. **(06 Marks)**

c. Determine the expression for displacement in bar subjected to load P as shown in Fig.Q.2(c) by RR method. **(10 Marks)**

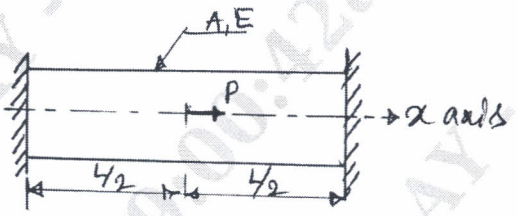

Fig.Q.2(c)

Module-2

3 a. Derive the expression for shape functions of 3 noded triangular element with the help of polynomial approach in natural coordinate system. **(06 Marks)**

b. Define a shape function and list the properties of shape functions. **(04 Marks)**

c. Determine the nodal displacements and stress in each element of the bar shown in Fig.Q.3(c). **(10 Marks)**

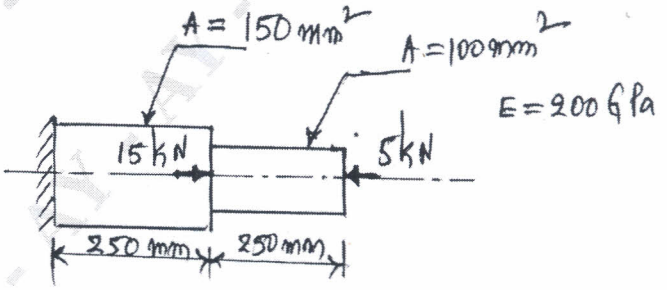

Fig.Q.3(c)

OR

4 a. Derive the shape functions for a 8-noded quadrilateral element using Lagrangian method. **(08 Marks)**

b. Determine the nodal displacements for the trust system as shown in Fig.Q.4(b). **(12 Marks)**

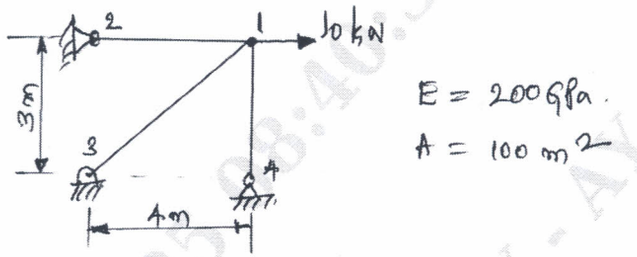

Fig.Q.4(b)

Module-3

5 a. Determine the global load vector for the beam as shown in Fig.Q.5(a). **(06 Marks)**

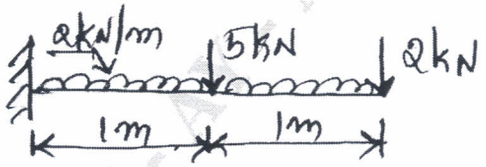

Fig.Q.5(a)

b. Determine the deflection of the beam at its centre as shown in Fig.Q.5(b). **(14 Marks)**

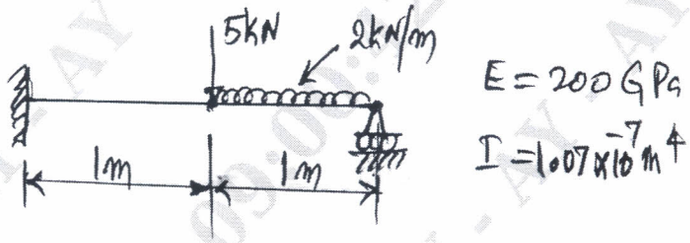

Fig.Q.5(b)

OR

6 a. Derive the stiffness matrix for torsion rod element. **(06 Marks)**

b. Determine the angle of twist at each end of section and shear stress in each section for torsion system shown in Fig.Q.6(b). **(14 Marks)**

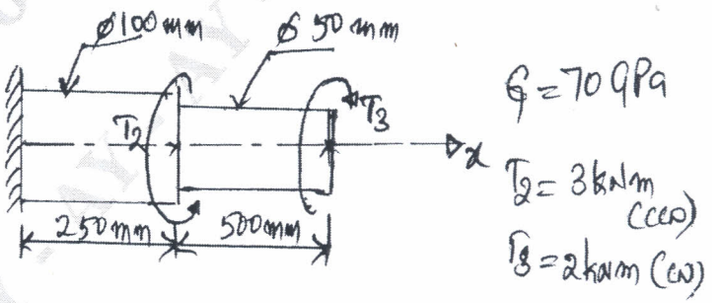

Fig.Q.6(b)

Module-4

7 a. Derive the convection matrix for a round rod lateral surface, with usual notations. **(06 Marks)**

b. Determine the temperature distribution in a composite wall, as shown in Fig.Q.7(b), using 1 D formulation. **(14 Marks)**

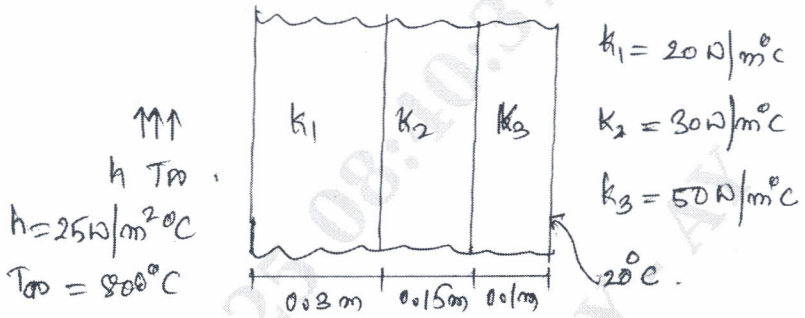

Fig.Q.7(b)

OR

8 a. Derive the conduction matrix [K] for 1D conduction with usual notations. **(06 Marks)**

b. A brick of wall thickness 0.3 m, K = 0.7 W/m°C, the inner surface is at 28°C and outer surface is exposed to cool air of temperature -15°C. Determine the temperature distribution in brick and heat flux using two elements. **(14 Marks)**

Module-5

9 a. Explain 2D axi-symmetric element. **(04 Marks)**

b. Derive the strain-displacement matrix [B] for 2D axi-symmetric triangular element. **(16 Marks)**

OR

10 a. Write a note:

i) Lumped mass matrix

ii) Consistent mass matrix. **(04 Marks)**

b. Determine the natural frequencies of stepped bar as shown in Fig.Q.10(b).

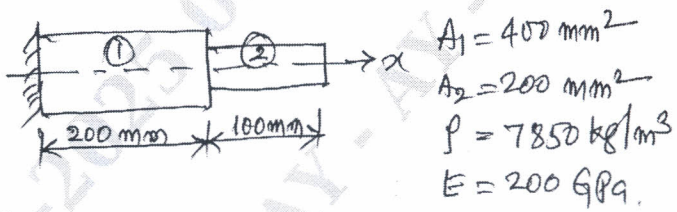

Fig.Q.10(b)

(16 Marks)

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