CBCS SCHEME

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

15AU73

Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024
Finite Element Modeling and Analysis

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Explain with neat sketch plane stress and plane strain. **(08 Marks)**

b. For the spring system shown in Fig.Q.1(b) using principle of minimum potential energy determine the nodal displacement. Take $F_1 = 75N$ and $F_2 = 100N$. **(08 Marks)**

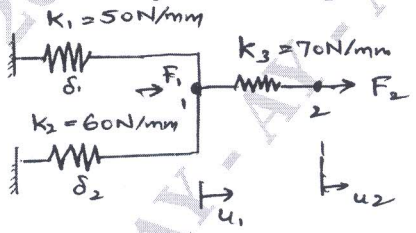

Fig.Q.1(b)

OR

2 a. Derive the equilibrium equation for 3D elastic body. **(08 Marks)**

b. By RR method for a bar of cross section area A, elastic modulus E, subjected to uniaxial loading P. Show that a distance X from fixed end is $u = \left(\frac{P}{AE}\right)X$ **(08 Marks)**

Module-2

3 a. Derive an expression for jacobain matrix for a four noded quadrilateral element. **(05 Marks)**

b. Write the basic steps involved in FEM for stress analysis of elastic solid bodies. **(04 Marks)**

c. Write the shape function for 1-D linear bar element using natural co-ordinates. **(07 Marks)**

OR

4 a. Explain convergence requirements and compatibility conditions. **(05 Marks)**

b. Write the stiffness matrix for 1-D bar element. **(06 Marks)**

c. Explain the Pascal triangle with neat sketch. **(05 Marks)**

Module-3

5 a. Determine the nodal displacement stress in each element and support reaction in the bar shown in Fig.Q5(a). **(08 Marks)**

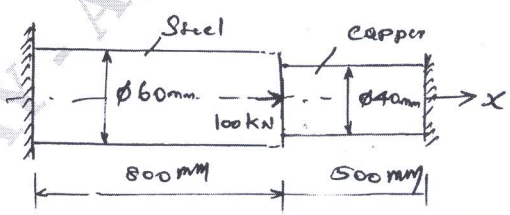

Fig.Q5(a)

b. Solve the following system of simultaneous equation by gauss elimination method:

$4x_1 + 2x_2 + 3x_3 = 4$

$2x_1 + 3x_2 - 5x_3 = 2$

$2x_1 + 7x_2 = 4$ **(08 Marks)**

OR

6 a. For the two bar truss shown in Fig.Q.6(a). Determine the nodal displacements. Take $E = 2 \times 10^5 MPa$, $A = 200mm^2$. **(08 Marks)**

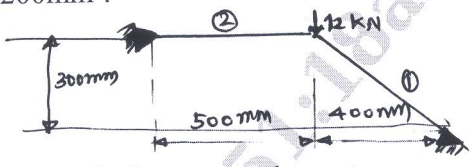

Fig.Q.6(a)

b. Derive the elemental stiffness matrix for a truss element. **(08 Marks)**

Module-4

7 a. Write the shape function of 2D quadrilateral element by using natural coordinates. **(08 Marks)**

b. Write the shape function for 2D triangular element by using natural coordinates. **(08 Marks)**

OR

8 Write the Hermit shape function for Beam element. Write the variation diagram also. **(16 Marks)**

Module-5

9 a. Determine the deflection at the centre of the portion of the beam carrying UDL

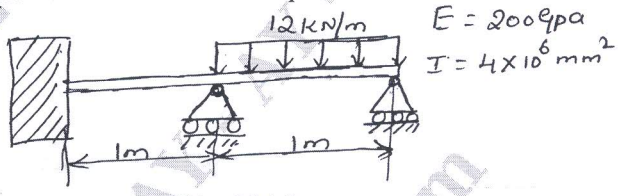

Fig Q9(a) **(08 Marks)**

b. For the beam element shown in figure, determine deflection under the given load

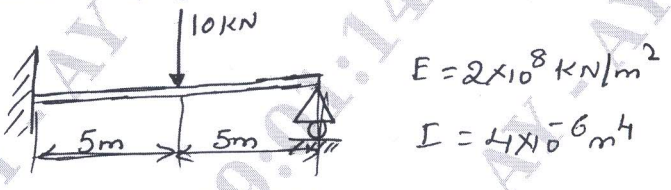

Fig Q9(b) **(08 Marks)**

OR

10 a. Find the temperature distribution in one dimensional fin shown in Fig Q10(a)

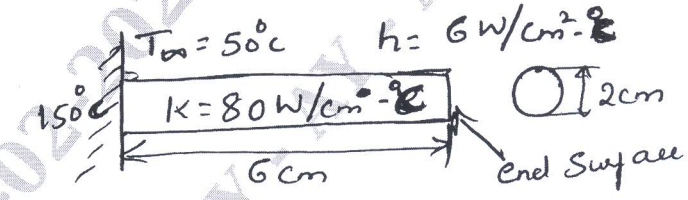

Fig Q10(a) **(10 Marks)**

b. Determine the temperature distribution in a 1D fin shown in the figure. There is a uniform generation of heat inside the wall of $500W/m^3$ & $500W/m^3$

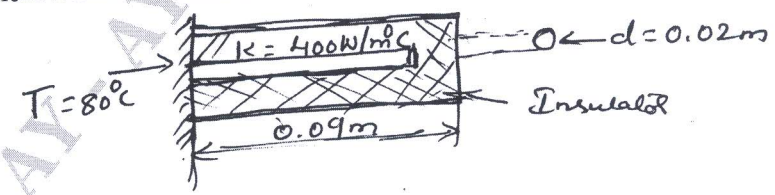

Fig Q10(b) **(06 Marks)**