CBCS SCHEME

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15AU73

Seventh Semester B.E. Degree Examination, July/August 2022
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. Derive the equilibrium equation for 3D elastic body. **(08 Marks)**

b. Explain the with neat sketch plane stress and plane strains. **(08 Marks)**

OR

2 a. State the principles of minimum potential energy. Explain the potential energy with usual notations. **(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. For the spring system shown in Fig.Q3(a) using principle of minimum potential energy. Determine the nodal displacement. Take $F_1 = 75N$ and $F_2 = 100N$.

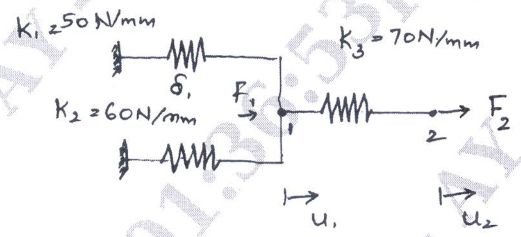

Fig.Q3(a) **(08 Marks)**

b. What is FEM? What are the advantages and limitations? **(08 Marks)**

OR

4 a. What do you understand FEM? Briefly explain the steps involved in FEM. **(08 Marks)**

b. Derive the stiffness matrix for the bar subjected to axial load F using direct method. **(08 Marks)**

Module-3

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

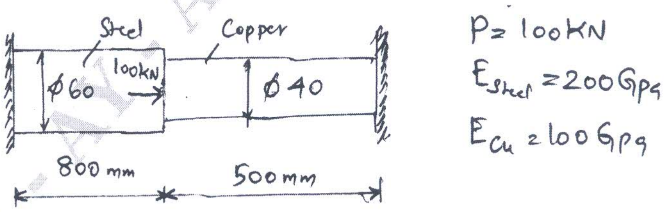

Fig.Q5(a) **(08 Marks)**

b. Solve the following system of simultaneous equation by Gauss Elimination method.

$x + y + z = 9$

$x - 2y + 3z = 8$

$2x + y - z = 3.$ **(08 Marks)**

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.

OR

6 a. For the two bar truss shown in Fig.Q6(a). Determine the nodal displacement. Take $E = 2 \times 10^5$MPa, A = 200mm^2.

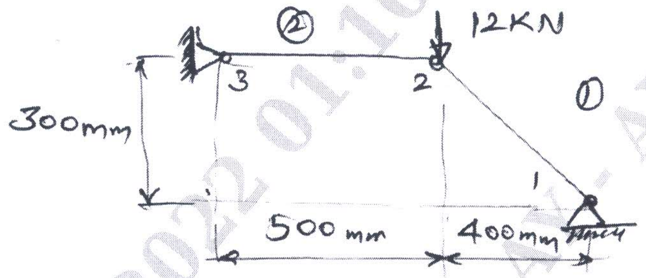

Fig.Q6(a) **(08 Marks)**

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

Module-4

7 a. Derive the shape function using Lagrangian interpolation for liner quadrilateral element. **(08 Marks)**

b. Briefly explain Sub parametric element and Super parametric elements. **(08 Marks)**

OR

8 a. Derive the Hermite shape function for a 2 noded beam element. **(08 Marks)**

b. Briefly explain the finite element formulation of 2D Constant Stream Triangle (CST). **(08 Marks)**

Module-5

9 a. Fig.Q9(a) shown in simply supported beam subjected to a uniformly distributed load. Obtain the maximum deflection. Take young's modulus E = 200GPa and moment of inertia $I = 2 \times 10^6$mm^4.

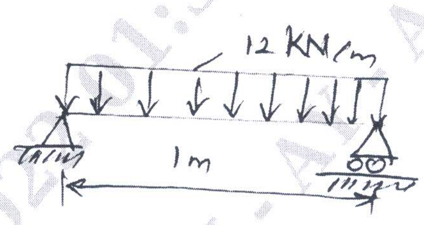

Fig.Q9(a) **(08 Marks)**

b. Derive differential equation for an 1D heat conduction. **(08 Marks)**

OR

10 a. Derive the expression for stiffness matrix for 1D heat conduction. **(08 Marks)**

b. Determine the temperature distribution in the rectangular fin shown in Fig.Q10(b). Neglect the convection heat transfer and assume heat generated inside the fin as 500 W/m^3.

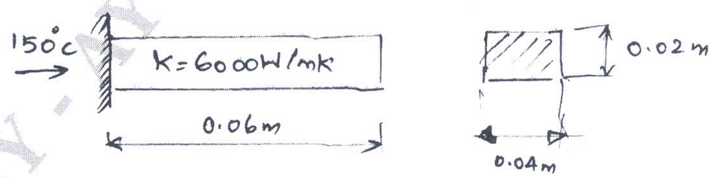

Fig.Q10(b) **(08 Marks)**

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