CBCS SCHEME

USN

15AU73

Seventh Semester B.E. Degree Examination, June/July 2019
Finite Element Modelling 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 equitation in elasticity of 3D elastic body subjected to body force and traction force. **(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)**

OR

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

b. For the spring system shown in Fig Q2(b) using principle of minimum potential energy, determine the nodal displacements Take $F_1 = 75N$ and $F_2 = 100N$?

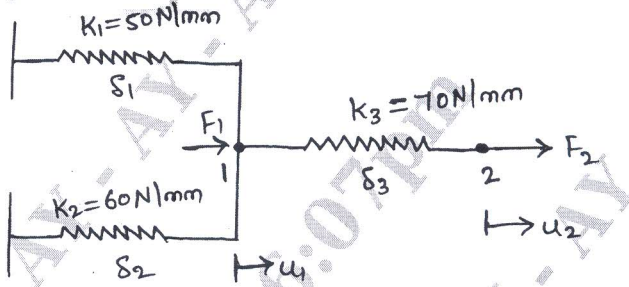

Fig Q2(b) **(08 Marks)**

Module-2

3 a. What is FEA? Explain the basic steps involved in FEM? **(08 Marks)**

b. What is shape function? Derive the shape function for bar element in global co-ordination. **(08 Marks)**

OR

4 a. Derive the stiffness matrix for the bar subjected to axial load P using direct method. **(08 Marks)**

b. What are the convergence requirements? Discuss three conditions of convergence requirements? **(08 Marks)**

Module-3

5 a. Determine the nodal displacement, stress in each elements and support reaction in the bar shown in Fig Q5(a) due to applied force P = 100kN. Take $E_{steel} = 200GPA$, $E_{cu} = 100GPa$.

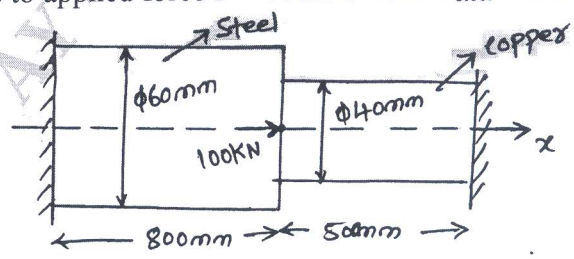

Fig Q5(a) **(08 Marks)**

b. Consider the bar as shown in Fig Q5(b). An axial load $P = 60 \times 10^3$N is applied at its mid point. Using elimination method of handling boundary conditions. Determine nodal displacement and support reaction?

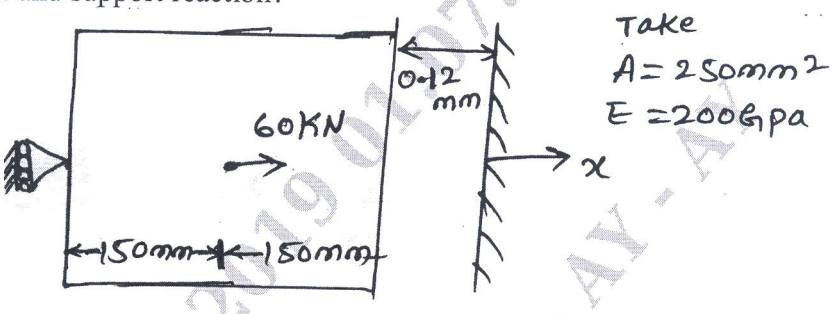

Fig Q5(b) **(08 Marks)**

OR

6 a. Derive the element stiffness matrix for truss elements. **(08 Marks)**

b. For the two bar truss shown in Fig Q6(b), determine the nodal displacement, stress in each element and reaction at the support Take $E = 2 \times 10^5$MPa, $A_e = 200mm^2$.

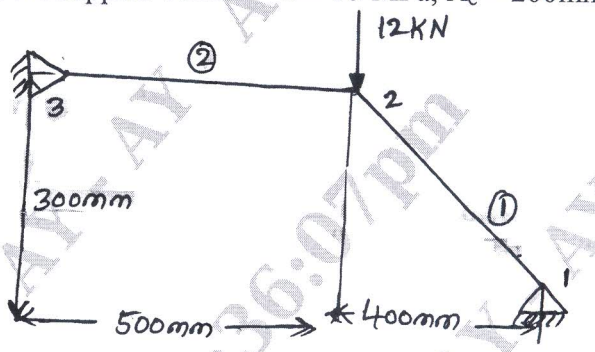

Fig Q6(b) **(08 Marks)**

Module-4

7 Derive the Hermite shape function for beam element. Sketch the variation. **(16 Marks)**

OR

8 a. Derive the shape functions for a three noded quadratic bar element. **(10 Marks)**

b. Explain serendipity elements. **(06 Marks)**

Module-5

9 For the beam shown in Fig Q9, determine the end reaction and deflection at mid span. Take $E = 200$GPa, $I = 4 \times 10^6 mm^4$

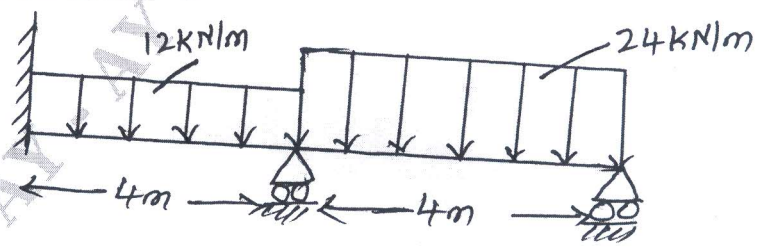

Fig Q9 **(16 Marks)**

OR

10 a. Derive the expression for stiffness matrix for 1D – heat conduction. **(06 Marks)**

b. Solve the temperature distribution in the composite wall as shown in Fig Q10(b). Using 1-D heat elements use penalty approach of handling boundary conditions.

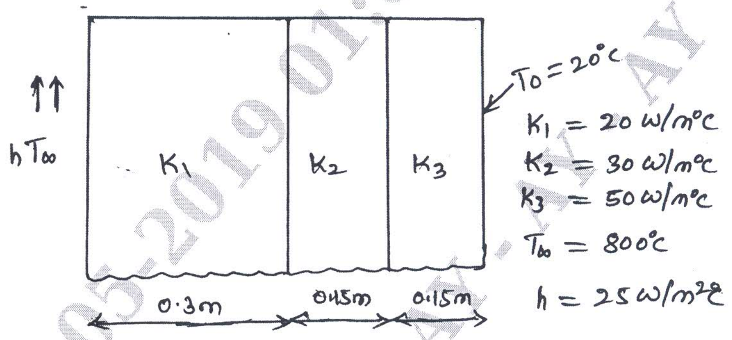

Fig Q10 (b) **(10 Marks)**

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