CBCS SCHEME

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15AE651

Sixth Semester B.E. Degree Examination, June/July 2019
Finite Element Method

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Describe steps involved in the finite element analysis. **(06 Marks)**

b. A simply supported beam is subjected to a point load at the center. Determine maximum deflection using R – R – M. **(10 Marks)**

OR

2 a. Explain plane stress and plane strain problem with suitable examples. **(06 Marks)**

b. Using principles of minimum PE, determine the nodel displacement for spring system shown in Fig.2(b). **(10 Marks)**

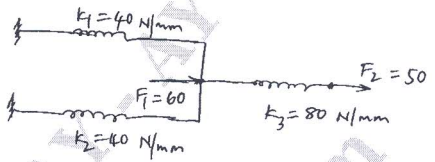

Fig.Q2(b)

Module-2

3 a. Define shape function, evaluate shape function of 1D bar element. **(08 Marks)**

b. A compound bar is loaded as shown in Fig.3(b) Determine the following i) nodal displacement ii) stresses in each element. Initial temperature of bar is 30°C and final temperature is 130°C, $E_S = 2 \times 10^5 N/mm^2$, $E_C = 100 \times 10^3 N/mm^2$, $\alpha_S = 12 \times 10^{-6}/°C$, $\alpha_C = 18 \times 10^{-6}/°C$. **(08 Marks)**

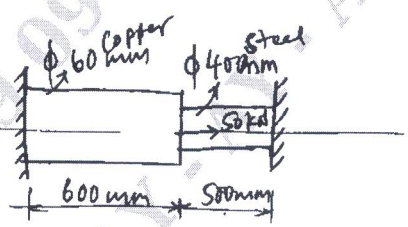

Fig.Q3(b)

OR

4 a. Derive element stiffness matrix of 1D bar element. **(08 Marks)**

b. A bar is loaded as shown in Fig.Q4(b) E = 200GPa by using elimination method of boundary condition find : i) nodal displacement ii) reaction at the support iii) stress in each element. **(08 Marks)**

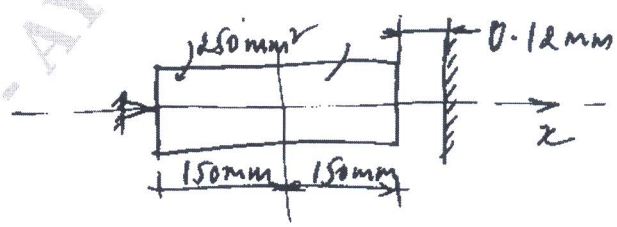

Fig.Q4(b)

Module-3

5 a. Evaluate shape function of N_1, N_2, N_3 for a triangular element shown in Fig.Q5(a) at point P where coordinates are (3.85, 4.8). **(06 Marks)**

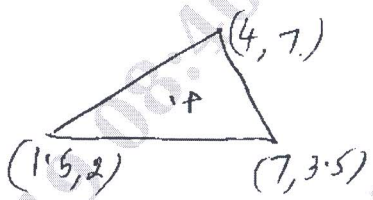

Fig.Q5(a)

b. Determine the shape function of linear stain triangular element, use natural coordinate system. **(10 Marks)**

OR

6 a. Explain with neat sketch serendipity family element. **(06 Marks)**

b. Using 'serendipity concept' derive shape functions for 4 noded rectangular elements. **(10 Marks)**

Module-4

7 a. Explain isoparametric concept in finite element analysis. **(06 Marks)**

b. Derive the expression for shape function of CST element. **(10 Marks)**

OR

8 a. Derive the expression of strain matrix for CST element. **(08 Marks)**

b. Explain with a neat sketch quadrilateral element in Cartesian coordinate. **(08 Marks)**

Module-5

9 a. Derive expression for 8 noded brick element. **(08 Marks)**

b. Explain dynamic analysis concept for a 2 degree system. **(08 Marks)**

OR

10 a. Derive expression for mass matrix. **(06 Marks)**

b. A composite wall consists of three materials as shown in the Fig.Q10(b). Determine the temperature distribution in the wall. **(10 Marks)**

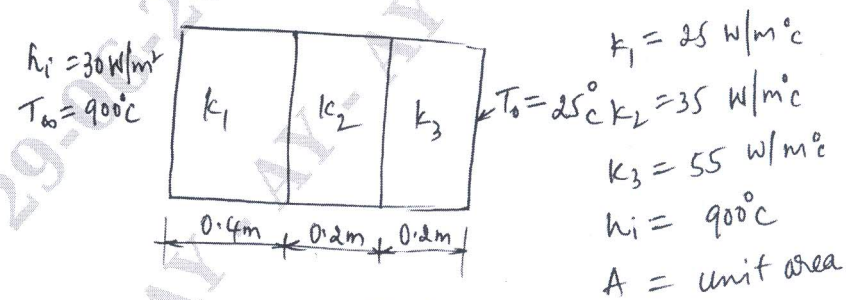

Fig.Q10(b)

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