CBCS SCHEME

USN | | | | | | | | | | 15AE651

Sixth Semester B.E. Degree Examination, Feb./Mar. 2022
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. What is FEM? List any four advantages and limitations in FEM. **(06 Marks)**

b. Use R – R method to find stress and displacement at midpoint of bar as shown in Fig.Q1(b). Take A = 100mm^2, E = 70GPa. Assume displacement method of 2nd order polynomial.

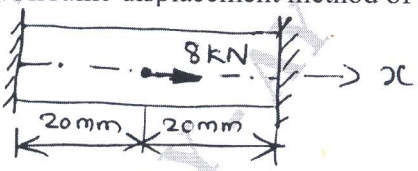

Fig.Q1(b) **(10 Marks)**

OR

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

b. Using principles of minimum PE, determine the nodal displacement for spring system shown in Fig.Q2(b).

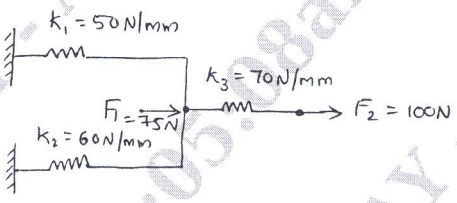

Fig.Q2(b) **(10 Marks)**

Module-2

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

b. Fig.Q3(b) shows a bar subjected to uniformly distributed load P_0. Taking E = 70GPa, A = 10^{4}mm^2, determine : i) nodal displacement ii) stress in the element.

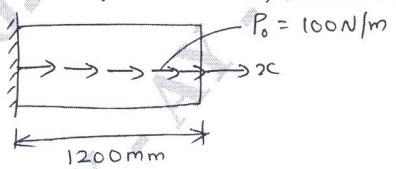

Fig.Q3(b) **(08 Marks)**

OR

4 a. List any four assumptions made in truss analysis. **(04 Marks)**

b. For the plane truss shown in Fig.Q4(b), determine the horizontal and vertical displacements at the nodes and stresses in each element. All the elements have E – 201GPa, A = 4 × 10^{4}m^2.

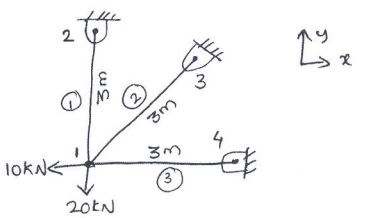

Fig.Q4(b) **(12 Marks)**

Module-3

5 a. Derive the shape function of constant strain triangular element using natural coordinate system. **(10 Marks)**

b. The natural coordinates of a triangular element are shown in Fig. Q5(b). The x – coordinate of interior point P is 3.3 and shape function $N_1 = 0.3$. Find N_2, N_3 and y co-ordinate of point P.

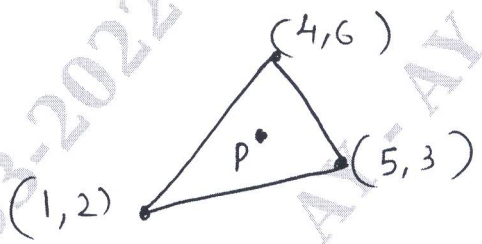

Fig.Q5(b) **(06 Marks)**

OR

6 a. Derive shape function of 4 noded rectangular element. **(10 Marks)**

b. With neat sketch, explain serendipity family element. **(06 Marks)**

Module-4

7 a. Explain ISO. Sub and supersonic parametric element. **(06 Marks)**

b. Explain the structure of computer program for FEM analysis. **(10 Marks)**

OR

8 a. Explain with a neat sketch triangular element in Cartesian co-ordinate. **(08 Marks)**

b. Explain the characteristics of isoparametric quadrilateral elements. **(08 Marks)**

Module-5

9 a. Using Penalty approach of handling boundary condition, solve for temperature distribution in composite wall as shown in Fig.Q9(a).

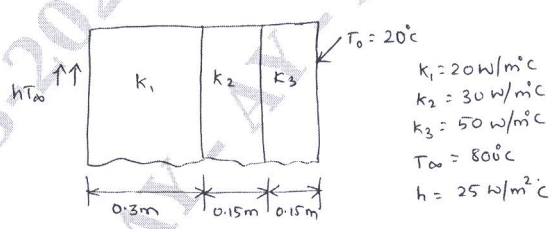

Fig.Q9(a) **(12 Marks)**

b. What is conduction and convection in heat transfer problems? **(04 Marks)**

OR

10 a. Explain dynamic analysis concept for a 2 degree system. **(10 Marks)**

b. Derive expression for mass matrix. **(06 Marks)**

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