CBCS SCHEME

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15AE651

Sixth Semester B.E. Degree Examination, Aug./Sept. 2020
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. Explain plane stress and plane strain problems in FEM. **(08 Marks)**

b. For the spring system shown in Fig.Q1(b). Determine the nodal displacements. Take $F_1 = 75N$, $F_2 = 100N$.

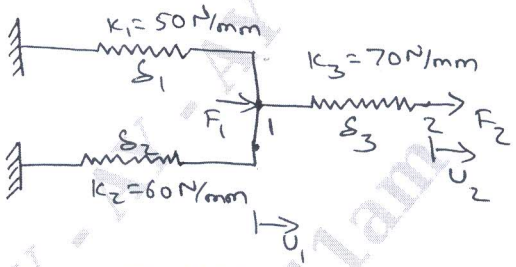

Fig.Q1(b) **(08 Marks)**

OR

2 Using Rayleigh – Ritz, find the displacement at midpoint of a beam as shown in Fig.Q2 carries a central point load 'P' having Young's modulus 'E' and cross sectional area 'A'.

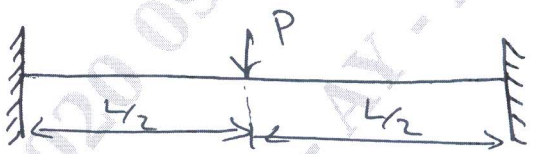

Fig.Q2 **(16 Marks)**

Module-2

3 a. Determine the nodal displacement, stress in each element and support reaction in the bar shown in Fig.Q3(a) due to applied load P = 100kN take E_{steel} = 200 GPa; E_{cu} = 100 GPa.

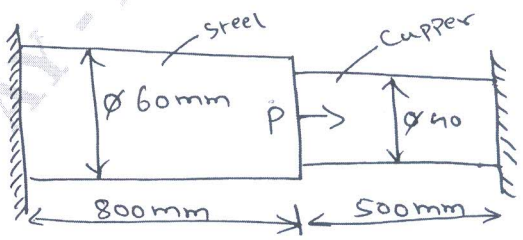

Fig.Q3(a) **(08 Marks)**

b. Write Hermite function for beam element with usual notations. **(08 Marks)**

OR

4 For 2 bar truss shown in Fig.Q4 determine the nodal displacements and the stress in each member. Take E = 200 GPa.

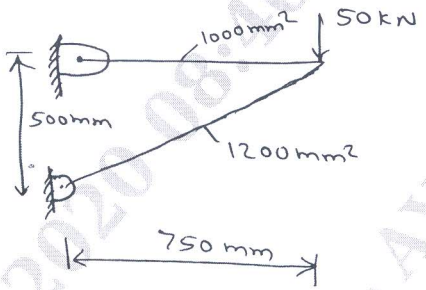

Fig.Q4 **(16 Marks)**

Module-3

5 a. Derive shape function for quadrilateral element in natural co-ordinate system considering nine nodes. **(08 Marks)**

b. The nodal co-ordinates of a triangular element are shown in Fig.Q5(b). The X-coordinate of point P is 3.3 and shape function $N_1 = 0.3$. Determine N_2, N_3 and Y – coordinate of point P.

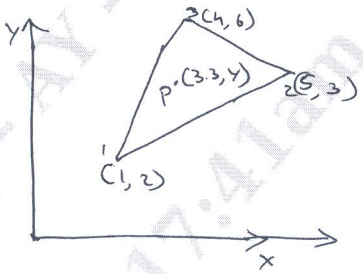

Fig.Q5(b) **(08 Marks)**

OR

6 a. Derive shape function of simple tetrahedral element in natural co-ordinate system. **(08 Marks)**

b. Determine the Jacobian of the transformations J for triangular element shown in Fig.Q6(b). Also find the area of triangle.

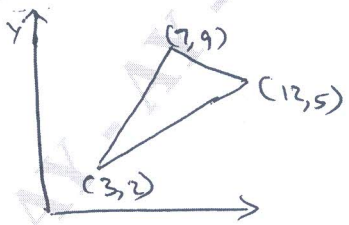

Fig.Q6(b) **(08 Marks)**

Module-4

7 a. Explain isoparemteric, subparametric and superparametric elements. **(08 Marks)**

b. Using Gaussian 2 point formula evaluate following :

i) $I = \int_{-1}^{1} (1 + r + 2r^2 + 3r^3) dr$

ii) $I = \int_{-1}^{1} (3e^{\xi} + \xi^2 + \frac{1}{\xi+2}) d\xi$. **(08 Marks)**

OR

8 a. Explain computer program for structure for FEM analysis. **(08 Marks)**

b. Explain formulation of global co-ordinate system of axisymmetric triangular element to local co-ordinate system. **(08 Marks)**

Module-5

9 Solve for temperature distribution in the composite wall as shown in Fig.Q9, using 1 – D elements.

$K_1 = 20$ w/m°C

$K_2 = 30$ w/m°C

$K_3 = 50$ w/m°C

$T_\infty = 800$°C

$h = 25$ w/m^2°C

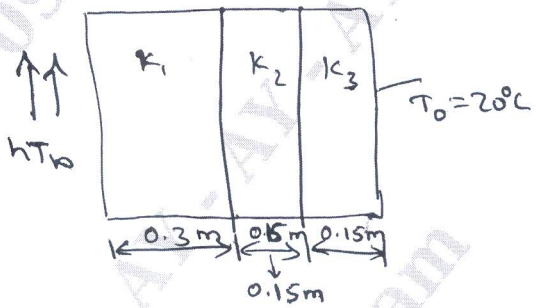

Fig.Q9 **(16 Marks)**

OR

10 Find the natural frequencies of longitudinal vibration of constrained stepped bar shown in Fig.Q10.

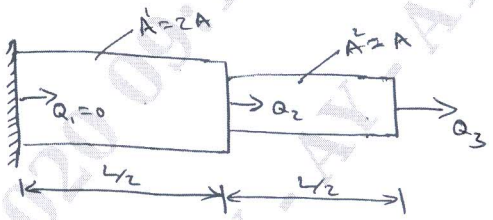

Fig.Q10 **(16 Marks)**

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