CBCS Scheme

USN | | | | | | | | | | 16/17MDE12

First Semester M.Tech. Degree Examination, Dec.2017/Jan.2018
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 are the requirements to be satisfied for a finite element method solution for convergence? **(04 Marks)**

b. Using the Galerkin approach determine the displacement of the bar shown in Fig.Q1(b). Assume $u = c_0 + c_1x + c_2 x^2$. **(12 Marks)**

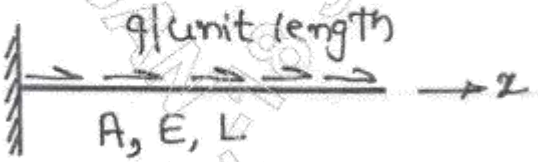

Fig.Q1(b)

OR

2 a. Explain the elimination approach to handle the boundary condition in finite element solution procedure. **(04 Marks)**

b. Using the variational approach obtain the governing Euler–Lagrange equation and the natural (force) boundary conditions of bar shown in Fig.Q2(b) **(12 Marks)**

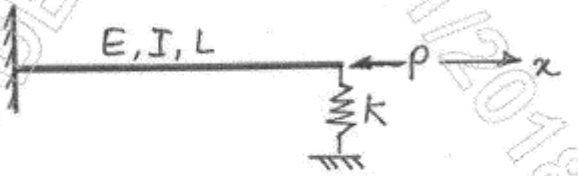

Fig.Q2(b)

Module-2

3 A vertical bar is subjected to self weight and load P = 300 kN as shown in Fig.Q3. The temperature of the bar is raised from 20° to 60°C. Find the nodal displacements, stress induced and the reaction at the support. **(16 Marks)**

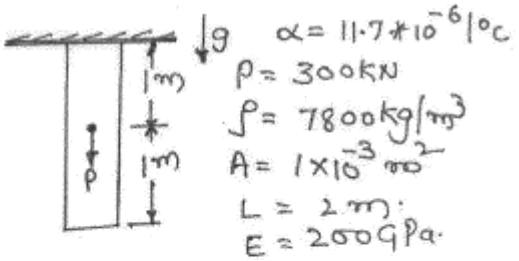

Fig.Q3

OR

4 a. For a two noded axial element show that strain displacement matrix is $B = \frac{1}{Le}[-1\ 1]$ where, Le–element length. **(04 Marks)**

b. For the beam shown in Fig.Q4(b) assemble the global stiffness matrix and load vector. **(12 Marks)**

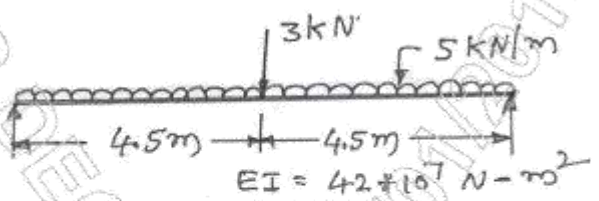

Fig.Q4(b)

Module-3

5 a. Obtain shape functions for the mid side nodes of 8 – noded quadrilateral element. **(08 Marks)**

b. Obtain the shape functions of 8 – noded hexahedral element. **(08 Marks)**

OR

6 a. For the element shown in Fig.Q6(a). Find P(x, y) at ξ - 0.5 η = 0.5. **(08 Marks)**

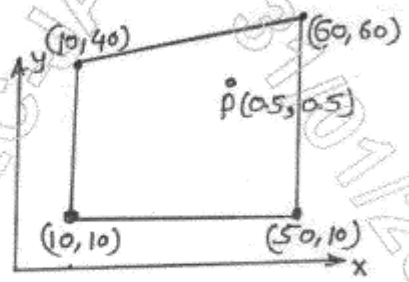

Fig.Q6(a)

b. An axisymmetric body with linearly distributed load on a conical surface is shown in Fig.Q6(b). determine the elemental equivalent point loads at nodes 2, 4 and 6. **(08 Marks)**

Coordinates : P(2) = (r_2) = (20, 70)

P(4) = (r_2) = (40, 55)

P(6) = (r_2) = (60, 40)

All dimensions in mm.

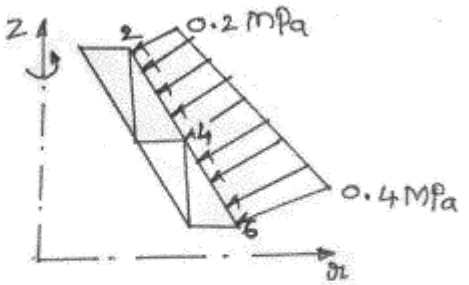

Fig.Q6(b)

Module-4

7 For triangular membrane element derive the strain displacement matrix. **(16 Marks)**

OR

8 a. What assumptions are made in the analysis of thin plate? **(04 Marks)**

b. Assuming the shell element to be straight obtain the stiffness matrix of 2 – noded element. **(12 Marks)**

Module-5

9 a. Write down the lumped mass matrix of :
i) bar element ii) truss element iii) CST element iv) beam element. **(08 Marks)**

b. For bar shown in Fig.Q9(b) determine the first two natural frequencies. Use 2 element models. **(08 Marks)**

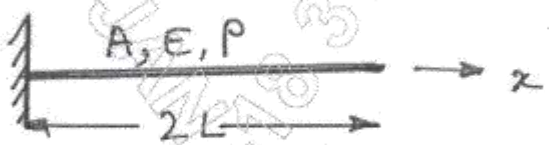

Fig.Q9(b)

OR

10 A slender cantilever beam is modelled as a single element. Find the mode shapes. **(16 Marks)**

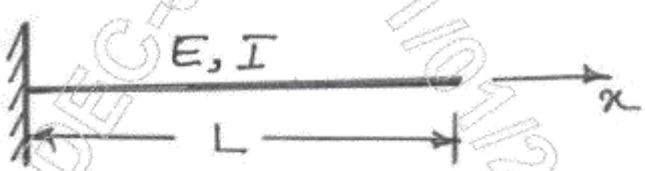

Fig.Q10

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