CBCS SCHEME

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16/17MDE12

First Semester M.Tech. 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. Briefly describe the steps in finite element method to solve mechanical engineering problems. **(08 Marks)**

b. Explain briefly (one two) :
i) Convergence requirements
ii) Compatibility requirements
iii) C_0, C_1 and C_n continuity. **(08 Marks)**

OR

2 A simply supported beam is subjected to uniformly distributed load. Determine maximum deflection using Galerpin's method for beam shown in Fig.Q2. **(16 Marks)**

Fig.Q2

Module-2

3 a. An axial load P = 300kN is applied at 20°C to the rod shown in Fig.Q3. The temperature is then raised to 60°C.
i) Assemble the 'K' and 'F' matrices
ii) Det nodal displacement and element stresses. **(10 Marks)**

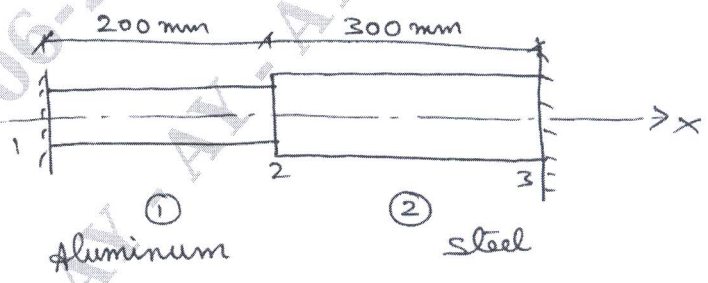

Fig.Q3(a)

$E_1 = 70 \times 10^9$ N/m^2 $E_2 = 200 \times 10^9$ N/m^2
$A_1 = 900$ mm^2 $A_2 = 1200$ mm^2
$\alpha_1 = 23 \times 10^{-6}$ per °C $\alpha_2 = 11.7 \times 10^{-6}$ per °C.

b. Derive the shape function of a quadratic 1D bar element. **(06 Marks)**

OR

4 a. Derive Hermite shape function for a beam element. **(06 Marks)**

b. A simply supported beam of span 6m and of uniform flexural rigidity EI = 40000 kN m^2 subjected to a clockwise couple of 300 kN m at a distance of 4m from left end (Fig.Q4(b)). Find the deflection at point of application of load and internal loads. **(10 Marks)**

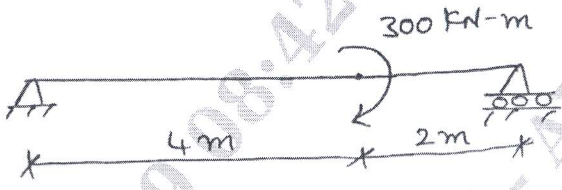

Fig.Q(b)

Module-3

5 Derive the shape function for :

a. Quadratic triangular element (Tria 6)

b. Quadratic quadrilateral element (9 noded). **(16 Marks)**

OR

6 a. Derive the strain – displacement relation for a triangular axisymmetric element. **(08 Marks)**

b. Derive the shape function of a serendipity element. **(08 Marks)**

Module-4

7 a. List the assumptions made in classical theory of thin plates in bending. **(04 Marks)**

b. Derive the strain – displacement matrix for a triangular membrane element. **(12 Marks)**

OR

8 For the truss shown in Fig.Q8, find nodal displacement reactions, stresses, strains. Take E = 210 GPa. **(16 Marks)**

$A_1 = 2 \times 10^{-4} m^2$
$A_2 = 1 \times 10^{-4} m^2$
$A_3 = 1.5 \times 10^{-4} m^2$

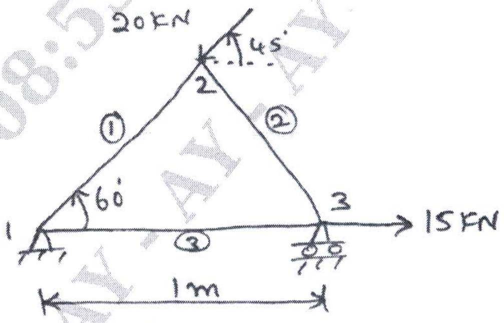

Fig.Q8

Module-5

9 Derive the consistent mass matrix of :

a. Bar element

b. Beam element. **(16 Marks)**

OR

10 Derive the mass matrix of :

a. CST element

b. Axisymmetric triangular element. **(16 Marks)**

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