CBCS SCHEME

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18ME61

Sixth Semester B.E. Degree Examination, June/July 2024
Finite Element Methods

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. List and explain general steps of Finite Element Methods. **(10 Marks)**

b. A bar of length L, cross section area A and modulus of elasticity E, is subjected to distributed load q = CX, where C is constant as in Fig Q1(b). Determine the displacement of bar at end using R-R method.

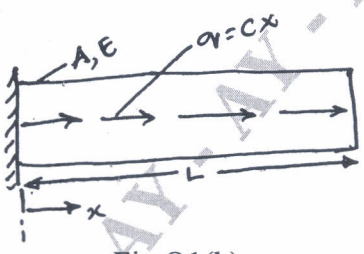

Fig Q1(b) **(10 Marks)**

OR

2 a. Explain different types of elements in Finite Element Method. **(05 Marks)**

b. Explain simplex, complex and multiplex elements. **(05 Marks)**

c. Using Galeskin's method find the expression for displacement of cantilever beam as shown in Fig Q2(c)

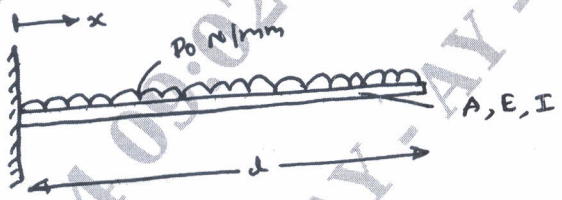

Fig Q2(c) **(10 Marks)**

Module-2

3 a. Derive shape functions for C.S.T element. **(10 Marks)**

b. Derive shape function for TET – 4 elements. **(10 Marks)**

OR

4 Determine the stresses in members of structure given in Fig Q4. Using penalty approach method.

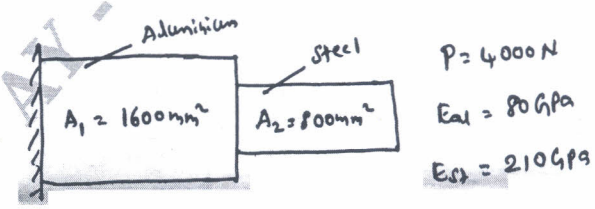

Fig Q4 **(20 Marks)**

Module-3

5 a. Derive Hermite shape functions for beam element. **(10 Marks)**

b. Fig Q5(b) shows a simply supported beam subjected to U.D.L to obtain max, deflection. Take $E = 200GPa$, $I = 2 \times 10^6 mm^4$.

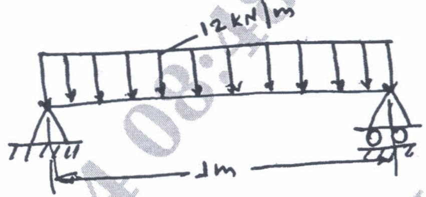

Fig Q5(b) **(10 Marks)**

OR

6 a. Derive an equation for stiffness matrix for Torsion bar. **(10 Marks)**

b. A solid stepped bar of circular C/S as in figure is subjected to torque as shown in Fig Q6(b). Determine angle of twist and shear stresses in bar $E = 2 \times 10^5 N/mm^2$, $G = 7 \times 10^4 N/mm^2$.

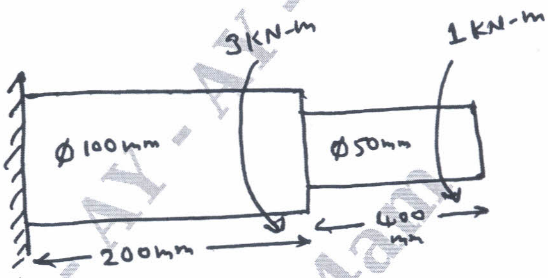

Fig Q6(b) **(10 Marks)**

Module-4

7 a. Derive an differential equation for 1D heat conduction. **(10 Marks)**

b. Find the temperature distribution in 1D fin as shown in Fig Q7(b)

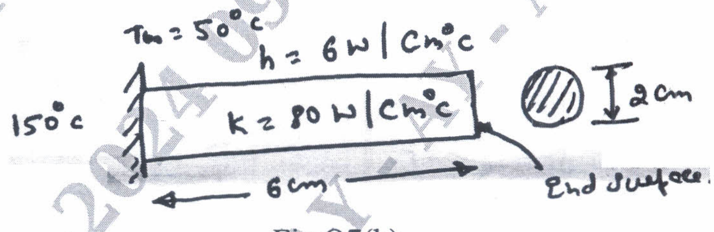

Fig Q7(b) **(10 Marks)**

OR

8 a. Derive 2D fluid flow for porous medium differential equation. **(10 Marks)**

b. For the smooth pipe shown in Fig Q8(b) with uniform C/S of $1m^2$ determine the flow velocities at the centre and right end, knowing velocity at left $V_x = 2m/sec$.

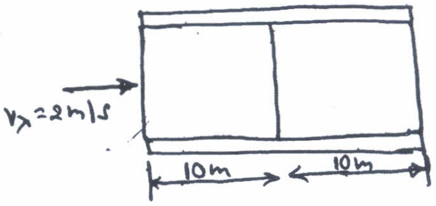

Fig Q8(b) **(10 Marks)**

Module-5

9 a. Derive strain displacement matrix for axi-symeric element. **(10 Marks)**

b. Evaluate nodes forces used to replace the linearly varying surface traction as in Fig. Q9(b)

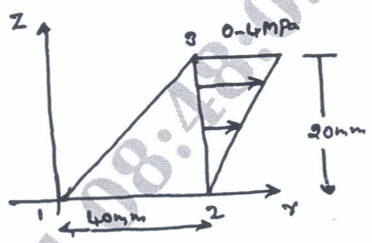

Fig Q9(b) **(10 Marks)**

OR

10 Evaluate eigen vectors and eigen values for the stepped bar shown in Fig Q10. Take E = 200GPa and specific weight 7850 kg/m^3. Draw mode shapes, A_1 = 400mm^2, A_2 = 200mm^2.

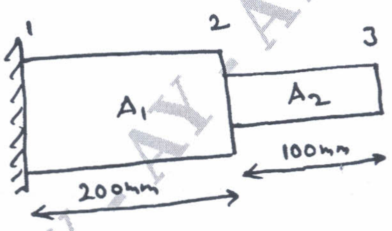

Fig Q10 **(20 Marks)**

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