CBCS SCHEME

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17AU73

Seventh Semester B.E. Degree Examination, July/August 2022
Finite Element Modelling and Analysis

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Derive the equilibrium equation in elasticity of 3D elastic body subjected to body force and traction force. **(10 Marks)**

b. Solve the following system of simultaneous equation by Gauss elimination method:

$x + y + z = 9$
$x - 2y + 3z = 8$
$2x + y - z = 3$ **(10 Marks)**

OR

2 a. Explain principle of minimum potential energy. Write the limitations of Rayleigh-Ritz method. **(08 Marks)**

b. By RR method, for a bar of cross sectional area (A) elastic modulus E, subjected to uniaxial loading (P), show that at a distance (x) from fixed end is $u = (P/AE)x$ and hence determination of end deflection i.e $u = P/AE$. **(12 Marks)**

Module-2

3 a. Derive the stiffness matrix for the bar which is under axial loading (F) using direct method.

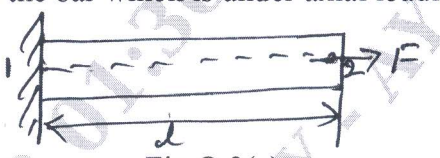


Fig.Q.3(a)

(10 Marks)

b. Use the Galerkin's method, to obtain the approximate solution of the differential equation.

$\frac{d^2y}{dx^2} - 10x^2 = 5 \quad 0 \le x \le 1$, with boundary condition $y(0) = y(1) = 0$. Take the trial functions as $N_1(x) = x(x - 1)$. **(10 Marks)**

OR

4 a. Explain basic steps involved in FEM. **(10 Marks)**

b. Explain convergence requirement and compatibility conditions. **(05 Marks)**

c. Explain the Pascal triangle with neat sketch. **(05 Marks)**

Module-3

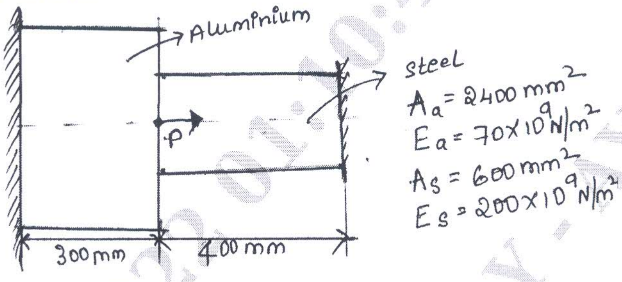
5 Consider the bar shown in Fig.Q.5. Using penalty approach method for handling boundary conditions, when an axial load (P) = 200×10^3N do the followings:

a. Determine the stress in each material.

b. Determine the nodal displacement.

c. Determine the reaction forces.

Fig.Q.5

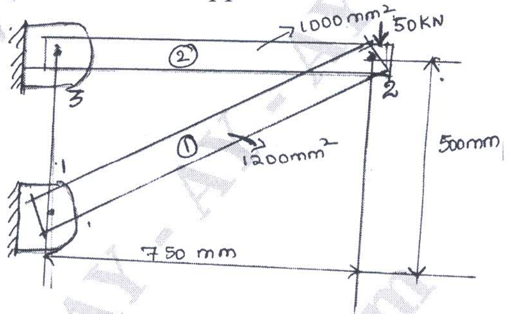


(20 Marks)

OR

6 For the two bar truss as shown in Fig.Q.6, determine the nodal displacements and the stress in each element (member). Also find the support and reaction. Take E = 200GPa.

Fig.Q.6



(20 Marks)

Module-4

7 a. Write the shape function of 2D quadrilateral by using natural coordinates. (10 Marks)

b. Write the shape function of 2D triangular by using natural coordinates. (10 Marks)

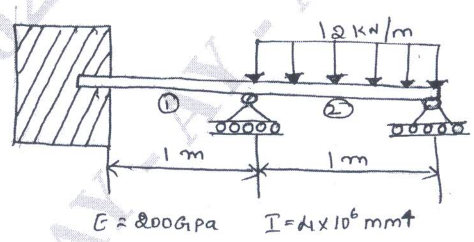
OR

8 Derive the Hermite shape function for beam element. Sketch the variation. (20 Marks)

Module-5

9 Solve for vertical deflection and slopes, at point (2) and (3) using beam elements for the structure shown in Fig.Q.9. Also determine the deflection at the centre of the portion of the beam carrying UDL. (20 Marks)

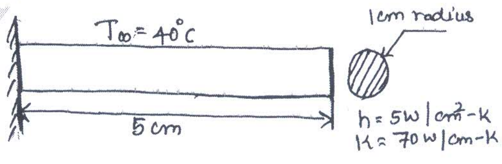
Fig.Q.9



OR

10 Find the distribution in the 1D fin shown in Fig.Q.10. Take two elements for FE idealization. (20 Marks)

Fig.Q.10



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