Hall Ticket Number :										

R-13

Code: 1G573

IV B.Tech. I Semester Supplementary Examinations July 2021

Finite Element Methods

(Mechanical Engineering)

Max. Marks: 70 **Time: 03 Hours**

Answer *any five* questions

All Questions carry equal marks (14 Marks each)

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1. a) Discuss in detail about the concepts of FEM formulation. How is that FEM emerged as powerful tool 7M
   b) List out the advantages and disadvantages of the FEM? 7M
2. a) Derive element strain displacement matrix (B) ? 6M
   b) Derive the shape functions for Quadratic element 8M
3. The plane truss shown in Figure 2 is composed of members having a square 15 mm × 15 mm cross section and modulus of elasticity *E* = 69 GPa. Find
   a. Assemble the global stiffness matrix.
   b. Compute the nodal displacements in the global coordinate system for the loads shown.
   c. Compute the axial stress in each element.

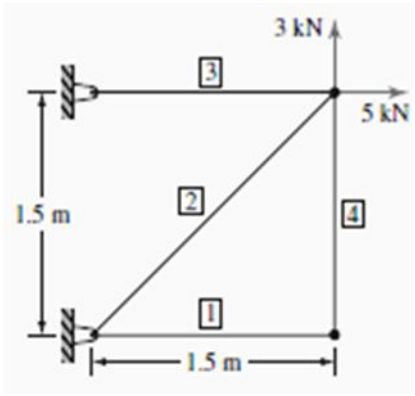
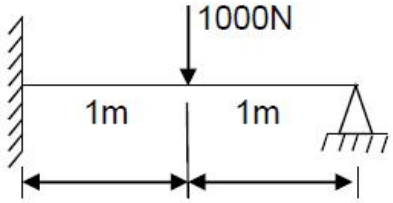


Fig. 2 14M

4. Solve the following problem using finite element method. Take E= 200GPa, I= 10^{-4} m^4



14M

5. a) Discuss the finite element modeling of 2 -D stress analysis with CST elements and treatment of boundary conditions. 7M
   b) Why the three noded triangular element is called CST? Write the stress strain relations for plane stress and plane strain conditions. 7M
6. Derive the strain displacement matrix for 4 noded isoparametric element. 14M
7. A long cylinder of inside diameter 80mm and outside diameter 120mm fits in a hole over its full length. The cylinder is then subjected to an internal pressure of 2 MPa. Using two elements on the 10mm length, Find the displacements at the inner radius. E = 200 GPa and μ = 0.3 14M
8. Derive the consistent mass matrix for bar and beam element? 14M

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Hall Ticket Number :										

Code : 1G573

R-11

Last Chance Special Supplementary Examinations

IV B.Tech. I Semester Supplementary Examinations July 2021

Finite Element Methods

(Mechanical Engineering)

Max. Marks: 70 **Time: 03 Hours**

Answer *any five* questions

All Questions carry equal marks (14 Marks each)

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1. a) Explain Stress- strain relations and develop the Strain Displacement (D) matrix for plane stress and plane strain conditions. 7M
   b) List out the advantages and disadvantages of the FEM? 7M

2. a) Derive element strain displacement matrix (B)? 7M
   b) Derive the shape functions for Quadratic element 7M

3. The coordinates of the plane truss element is given as 1(0,0) and 2(20,35) mm has the displacement values $\{-0.03\ 0.02\ -0.01\ -0.03\}^T$ mm with the material properties 200 GPa Youngs Modulus. Calculate the stiffness matrix, load vector and strain energy if the cross sectional area of the truss is 100 mm^2. 14M

4. What is a beam? Explain briefly the types of beams with suitable examples? 14M

5. For a triangular plate shown in the figure 4, determine the deflection at the point of load using one triangular element. Thickness is 10mm, E = $70x10^3$ MPa, $\mu = 0.3$

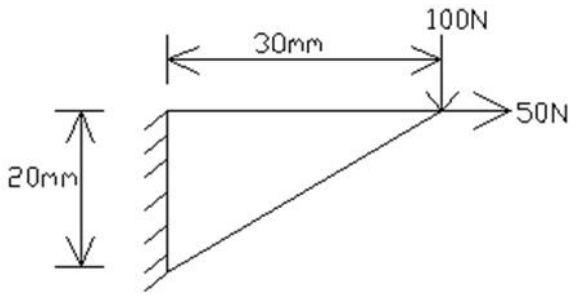

Fig. 4 14M

6. Derive the strain displacement matrix for 4 noded isoparametric element. 14M

7. a) Define axi-symmetric element and write the constitutive matrix? 7M
   b) Derive the strain displacement matrix for an axi-symmetric element? 7M

8. Determine the lowest Eigen value and corresponding mode for the beam shown in the Fig.7. Take E = 200GPa, ρ=7840kg/m^3, I=2000mm^4, A=240mm^2.

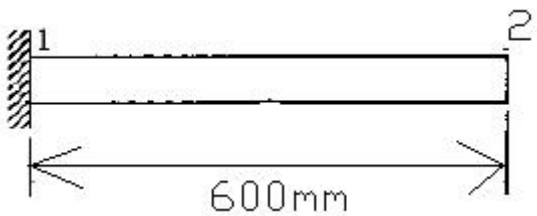

Fig. 7 14M

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