C 30129 (Pages : 3) Name.....

Reg. No.....

SEVENTH SEMESTER B.TECH. (ENGINEERING) DEGREE [2014 SCHEME] EXAMINATION, NOVEMBER 2017

Mechanical Engineering

ME 14 704 G—FINITE ELEMENT METHODS

Time : Three Hours Maximum : 100 Marks

Part A

Answer **eight** *questions.*

Each question carries 5 *marks.*

1. Compare variational and weighted residual methods in detail.
2. Discuss the importance of idealization and mathematical modeling in finite element analysis.
3. Explain the steps involved in finite element analysis - displacement approach.
4. Explain the types of boundary conditions with examples.
5. Explain the Degrees of freedom for a car.
6. Discuss about truss element applications with examples.
7. Describe weighed residual methods with examples.
8. Differentiate between global and local axes with examples.
9. Explain the shape function with an example.
10. Discuss about the numerical integration.

(8 × 5 = 40 marks)

Part B

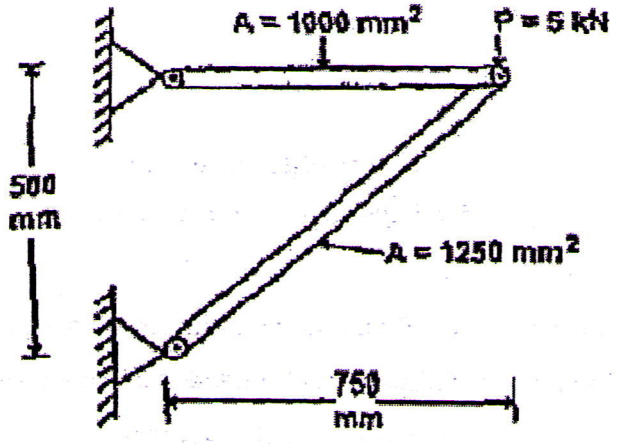
Answer **all** *questions.*

Each question carries 15 *marks.*

11. (a) Develop the Shape function, Stiffness matrix and force vector for one dimensional linear element.

Or

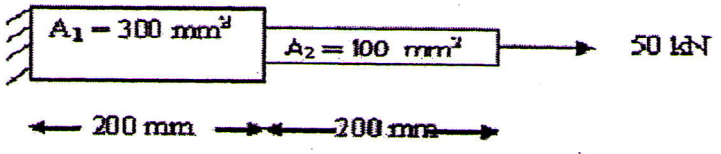
(b) The loading and other parameters for a two bar truss element is shown in figure. Calculate (i) The element stiffness matrix for each element ; (ii) Global stiffness matrix ; (iii) Nodal displacements ; (iv) Reaction force ; and (v) The stresses induced in the elements. Assume E = 200 GPa.



12. (a) Describe the method to calculate the load vector for the 1-D axi-symmetric element for the specified body force and variable surface force over the surface.

Or

(b) Calculate natural frequency, displacements and mode shapes of the stepped bar shown in figure Take E = 2 E^5 N/mm² and density = 7200 kg/m³.

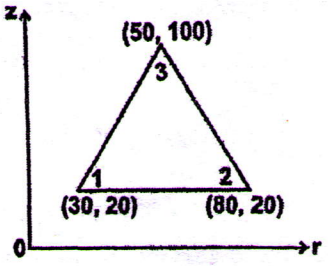


13. (a) Derive the shape functions for four noded bar element using Lagrangian interpolation function. Nodes are equally spaced.

Or

(b) The (x, y) Co-ordinate of nodes i, j, and k of triangular elements are given by (0, 0), (3, 0) and (1.5, 4) mm. respectively. Evaluate the shape functions N1, N2 and N3 at an interior point P (2, 2.5) mm for the element. For the same triangular element, obtain the strain-displacement relation matrix.

14. (a) For an axisymmetric triangular elements as shown in fig. Evaluate the stiffness matrix. Take modulus of elasticity E = 210 GPa. Poisson's ratio = 0.25. the co-ordinates are given in millimetres.



Or

(b) Derive the element stiffness matrix for a four noded iso-parametric plane stress element.

(4 × 15 = 60 marks)