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Question Paper Code: 47702

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2022

Seventh Semester

Mechanical Engineering

14UME702 - FINITE ELEMENT ANALYSIS

(Regulation 2014)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Which one is Numerical method?

(a) Functional Approximation (b) Finite Difference Method (FDM

(c) Finite Element Method (FEM) (d) All the above

2. . …… method is most commonly used for solving simultaneous linear equations. This method is easily adapted to the computer for solving such equations.

(a) Weighted residuals method (b) Rayleigh-Ritz method

(c) Gaussian Elimination method (d) All the above.

3. When the aspect ratio increases, the accuracy of the solution

(a) Increases (b) Decreases

(c) Neither increases nor decreases (d) None

4. The derivative of sum of the shape functions within the element is equal to __

(a) 0 (b) -1 (c) 1 (d) more than one

5. When there are less geometric nodes than shape function nodes then the element is called

(a) Sub parametric (b) Super parametric (c) Iso parametric (d) None

6. When thin plate is subjected to loading in its own plane only, the condition is called

(a) Plane stress (b) Plane strain (c) Axi-symmetric (d) General

7. All the calculations are made at limited number of points known as

(a) Elements (b) Nodes (c) Discretization (d) Mesh

8. Sum of shape functions is

(a) +1 (b) -1 (c) 0 (d) Infinity

9. ANSYS uses

(a) frontal solution (b) banded matrix solution

(c) Cramer's rule (d) Cholesky decomposition

10. The normal stress is the same in all directions at a point in a fluid, when the fluid is

(a) non-viscous

(b) incompressible

(c) both (a) and (b)

(d) having no motion of one fluid layer relative to the other.

PART - B (5 x 2 = 10 Marks)

11. Name the types of weighted residual methods.

12. Mention the basic steps of Rayleigh Ritz method.

13. State the properties of stiffness matrix.

14. Explain the term Eigen value Problem

15. Mention two natural boundary conditions as applied to thermal problems.

PART - C (5 x 16 = 80 Marks)

16. (a) Explain the various steps involved in finite element method. (16)

Or

(b) A bar of length L and uniform cross section of A is clamped at one end and left the other end and it is subjected to a uniform axial load of P at the free end. Calculate the displacement and stress in the bar using two terms of polynominal. (16)

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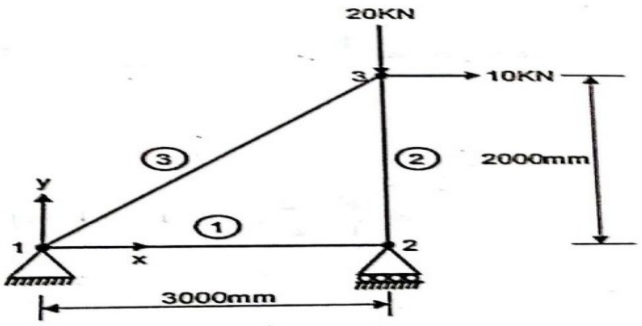
17. (a) Find out nodal displacement for a truss show in figure, Consider the Area and young modulus of truss elements are 1500 mm^2 and $2*10^5$ N/mm^2 respectively.



(16)

Or

(b) A concentrated load P=50KN is applied at the center of a fixed beam of length 3m,depth 200mm and width 120mm. Calculate the deflection and slope at the midpoint. Assume E=200GPa. (16)

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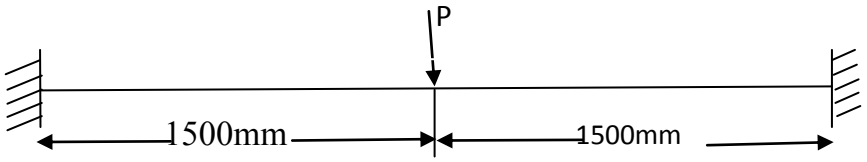
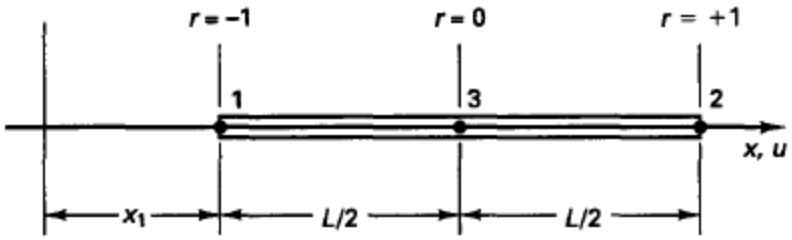


18. (a) Derive the displacement interpolation matrix H, strain-displacement interpolation matrix B, and Jacobian operator J for the three node truss element shown in figure (16)



Figure

Or

(b) (i) Explain the step by step procedure involved in the FEM of structural analysis (8)

(ii) Evaluate the integral e^{-x} dx by applying 3 point Gaussian approach with limit of -1 to +1. (8)

19. (a) Consider the Eigen problem

$$\mathbf{K}\phi = \lambda\phi \qquad \text{with } \mathbf{K} = \begin{bmatrix} 2 & & \\ & 2 & \\ & & 3 \end{bmatrix}$$

and show that the Eigen vectors corresponding to the multiple Eigen value are not unique. (16)

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Or

(b) A simply supported beam of both end hinged supported has length of 1m and cross sectional area of $30cm^2$.Determine the natural frequency by taking two elements with lumped mass condition. Take $E=2X10^{11}N/mm^2$ and density as $7800kg/m^3$ (16)

20. (a) A composite wall through which heat inside layer with $K_1=0.02$ W/cm^{0}C. The middle layer $K_2=0.005$ W/cm^{0}C and outer layer $K_3=0.0035$ W/cm^{0}C. The thickness of each layer 1.3cm,8cm and 2.5 cm respectively . Inside temperature of wall is 20^0C and outside temperature of the wall is -15^0C. Determine nodal temperature (16)

Or

(b) The motion of fluid particles in aduct are given by

$$^{t}x1 = -5 + \sqrt{(25 + 10\,^{0}x_{1} + (0x_{1})^{2} + 4t)}$$

Calculate the velocities and accelerations of the particles. Express your results in the Legrangians form $^{t}\ddot{u}_1 = f_1\ (^{0}x_1, t), {}^{t}\ddot{u}_1 = f_2\,(^{0}x^1, t).$ (16)