Reg. No. : | | | | | | | | | | |

Question Paper Code: 47702

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2018

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. Primary variable in FEM structural analysis is

(a) Displacement (b) Force (c) Stress (d) Strain

2. The accuracy of FEM results can be improved by_____ the order of the polynomial

(a) Decreasing (b) Increasing (c) keeping constant (d) None

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

(a) Increases (b) Decreases
(c) Neither increases nor decreases (d) None

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

(a)1 (b)2 (c)3 (d) 0

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. The global stiffness matrix is a singular matrix because its determinant is equal to --

(a) 1 (b) Zero (c) 2 (d) More than one

8. The solution by FEM is

(a) Always exact (b) mostly approximate

(c) Sometimes exact (d) never exact

9. The boundary condition which in terms of the field variables is known as

(a) Primary (b) Secondary (c) Natural (d) Essential

10. Thermal conductivity Kx=Ky=Kz in case of

(a) Isotropic material (b) Orthotropic material

(c) Anisotropic material (d) Homogenous material

PART - B (5 x 2 = 10 Marks)

11. State the properties of stiffness matrix.

12. Mention the basic steps of Rayleigh Ritz method.

13. State the properties of stiffness matrix.

14. State the two methods for solving transient vibration problems.

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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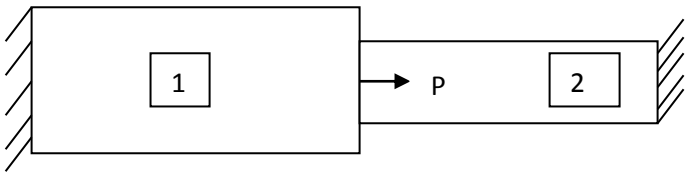
17. (a) An axial of P= 200kN is acting at the junction. Find the nodal displacement at the junction point and stresses in each element for the bar system as shown in figure. Take E_1=70GPa, A_1=2400mm^2, L_1=300mm, E_2=200GPa, A_2=600mm^2 and L_2=400mm.



(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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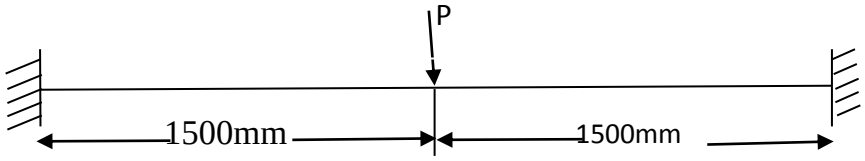

18. (a) A four noded rectangular element of length 2mm and height 1mm determine
(i) Jacobian matrix
(ii) Strain-displacement matrix
(iii) Element stresses. Taking E=200GPa, Poisson's ratio=0.25, Nodal displacements as (0, 0, 0.003, 0.004, 0.006, 0.004, 0, 0) with local coordinates of (0, 0). (16)

Or

(b) (i) Evaluate the integral Cos(πx/2) dx by applying 3 point Gaussian approach with limit of -1 to +1. (8)

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

19. (a) A cantilever bar of length 400mm and cross sectional area of 600mm^2. Determine the natural frequencies of longitudinal vibration using two elements of equal length. Take E=2X10^{5}N/mm^2,ρ=0.8X10^{-4}N/mm^3. (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 steel rod of diameter 2cm, length of 5cm and thermal conductivity of 50W/m°C is exposed at one end to a constant temperature of 320°C.The other end is in ambient air of temperature 20°C with a convective coefficient of $100W/m^2°C$.Determine the temperature at the midpoint of the rod. (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 ${}^{t}\dot{u}_1 = f_1\ ({}^{0}x_1, t), {}^{t}\ddot{u}_1 = f_2({}^{0}x^1, t)$..