SATHYABAMA UNIVERSITY

(Established under section 3 of UGC Act,1956)

Course & Branch :B.E - AERO
Title of the Paper :Finite Element Methods — Max. Marks :80
Sub. Code :526E01/AEE01 — Time : 3 Hours
Date :05/05/2010 — Session :FN

PART - A (10 x 2 = 20)

Answer ALL the Questions

1. What are the properties of stiffness matrices?

2. What is the basic difference between bar and beam elements?

3. State the use of shape function.

4. How is a quadratic triangular element different from linear triangular element?

5. What are isoparametric elements?

6. Define the term “Static condensation”.

7. What is lumped mass matrix?

8. Give the advantage and limitation of Ritz vectors.

9. State any two non-linear problems in Finite Element Analysis.

10. Explain the analogies between structural, heat transfer and fluid mechanics.

PART – B (5 x 12 = 60)

Answer All the Questions

11. Briefly explain the step by step procedure for finite element analysis with an illustration.

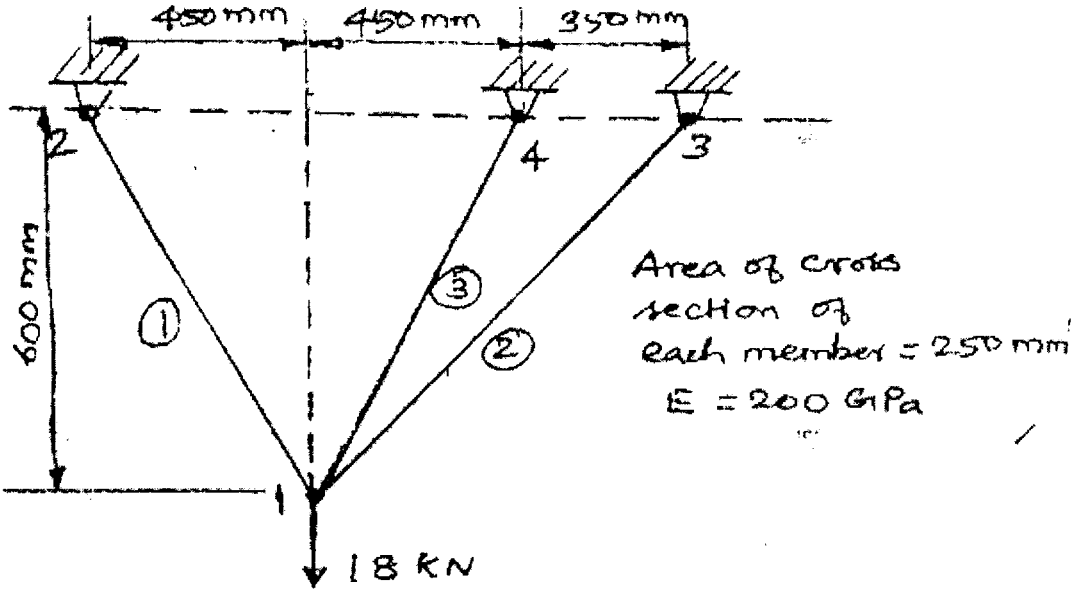
(or)

12. (b) List and briefly describe the general steps of the finite element method.
    (c) Explain Variational approach, weighted residual methods.

13. Using two finite elements find the stress distribution in a uniformly tapering bar of circular cross sectional area $3cm^2$ and $2cm^2$ at their ends, length 100mm, subjected to an axial tensile load of 50N at smaller end fixed at the larger end. Take the value of Young's modulus $2 \times 10^5 N/mm^2$.

(or)

14. For the three-bar truss shown in Fig.1, determine the displacements in node 1 and the stress in element 3.



15. The Cartesian co-ordinates of the corner nodes of a quadrilateral elements are given by (-1,-1), (-3,3), (1,4) and (4,3). Find the co-ordinate transformation between the global and local co-ordinates. Determine the Cartesian co-ordinates of the point defined (r,s) = (0.25,0.25) in the global co-ordinate system.

(or)

16. Derive element mass matrix for CST element.

17 The stiffness and consistent mass matrices for an unsupported, uniform, three node quadratic bar element are $\frac{AE}{L}\begin{bmatrix} 7 & -8 & 1 \\ -8 & 16 & -8 \\ 1 & -8 & 7 \end{bmatrix}$, and $\frac{\rho AL}{30}\begin{bmatrix} 4 & 2 & -1 \\ 2 & 16 & 2 \\ -1 & 2 & 4 \end{bmatrix}$. For axial vibration, determine the three natural frequencies and mode shapes.

(or)

18. Consider the isoparametric quadrilateral with nodes 1 – 4 at (15,0), (17,12), (7,10), and (6,2) respectively. Compute the Jacobian matrix and its determinant at the element centroid. Also calculate the area of the element and compare the ration of the two to the calculated | J |. Sketch each element and its parent to scale.

19. A metallic fin with thermal conductivity K = 360 W/m°C, 1mm thick and 100mm long extends from a plane wall whose temperature is 235°C. Determine the temperature distribution. Take film coefficient h = 9 W/m^2°C, air temperature = 20° C and the width of fin = 1m.

(or)

20. Explain step by step procedure for solving structural problems in analysis software.