A

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SECOND SEMESTER M.Tech DEGREE EXAMINATION MAY/JUNE 2016
(2015 Admissions)
MACHINE DESIGN
04 ME 6502: FINITE ELEMENT ANALYSIS

Time: 3 hrs Max. Marks: 60

PART A
(Answer all questions. Each question carry 3 marks).

1. What are the advantages of FEM (3)
2. Define the term node (3)
3. State Castgliano's first theorem (3)
4. What are the types of boundary conditions? (3)
5. What is elementary beam theory? (3)
6. Discuss the convergence criteria for isoparametric elements? (3)
7. Define super parametric element? (3)
8. Differentiate local and global coordinate system (3)

PART B
(Each full question carries 6 marks).

9. What is the general procedure for finite element analysis? (6)

OR

10. Define the term stiffness matrix and its properties (6)
11. For spring assemblage shown in figure1. Obtain (a) global stiffness matrix (b) The displacements of nodes 2 to 4 (c) The global nodal forces (d) The local elemental forces Node 1 is fixed while node 5 is given as fixed known displacement $\delta = 20\,mm$. the spring constant are all equal to $k = 200\,kN/m$. (6)

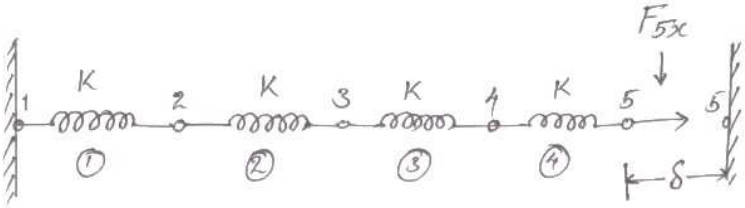

Figure 1:

OR

12. For the three bar assemblage shown in figure 2.Determine (a) global stiffness matrix (b) Displacements at node 1 & 4 (c) The reactions of nodes 1& 4 A force of 3000 lb is applied in the X- Direction at node 2. The length of each element is 30 $inch$. $E = 30 \times 10^6 psi$ and $A = 1\, inch^2$ for element 1 & 2 and $E = 15 \times 10^6 psi$ and $A = 2\, inch^2$ for element 3. Nodes 1 & 4 are fixed. (6)

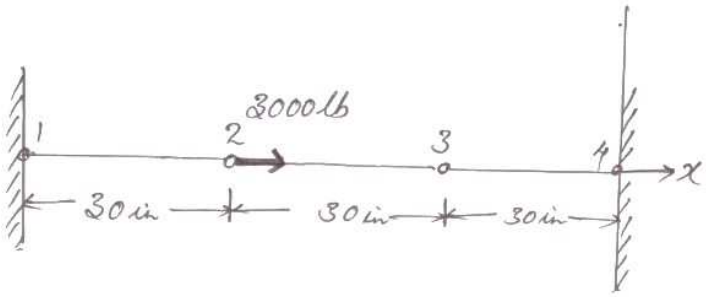

Figure 2:

13. Describe the direct stiffness method with neat sketch (6)

OR

14. For the two bar truss shown in figure 3, determine the displacements of node1 & stress element in 1-3 (6)

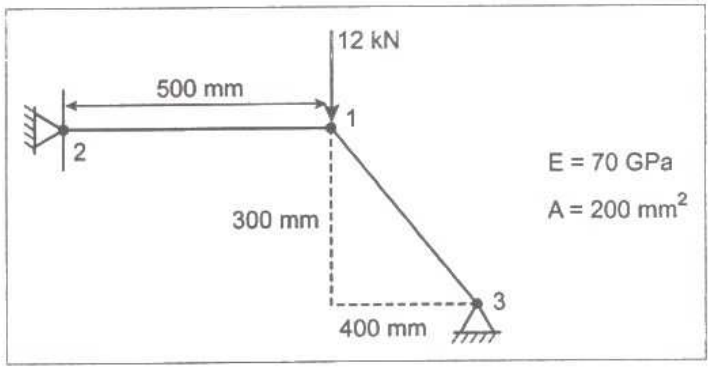

Figure 3:

15. Describe elementary beam theory with neat sketches. Explain the properties of Flexure Element stiffness matrix (6)

OR

16. A four nodal rectangular element is shown in figure. Determine (a) Jacobean matrix (b) Strain displacement matrix (c) Element stresses Take $E = 2 \times 10^5\ N/mm^2$, $\gamma = 0.25$, $U = [0, 0, 0.003, 0.004, 0.006, 0, 0]^T$, $\eta = \xi = 0$ (6)

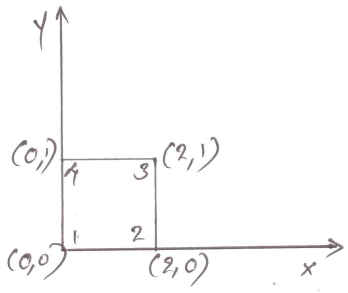

Figure 4:

17. Find the shape function for 4 noded rectangular parent element using natural coordinate system and coordinate transformation (6)

OR

18. Define the methods (a) Weighted residual (b) Plane strain and plain stress conditions (6)

19. What are the various methods involved in pre-processing and post-processing in FEM (6)

OR

20. Describe consistent and lumped mass matrices (6)