

GUJARAT TECHNOLOGICAL UNIVERSITY
M. E. - SEMESTER – I • EXAMINATION – WINTER • 2013

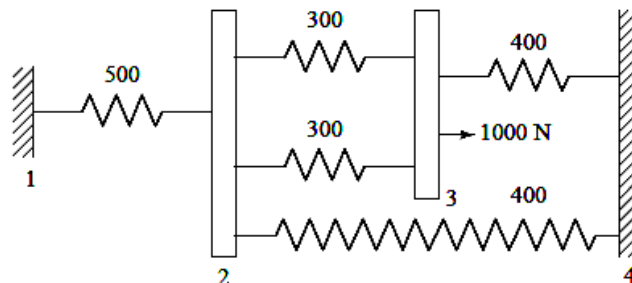
Subject code: 714705N**Date: 01-01-2014****Subject Name: Finite Element Procedures in Engineering****Time: 10.30 am – 01.00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

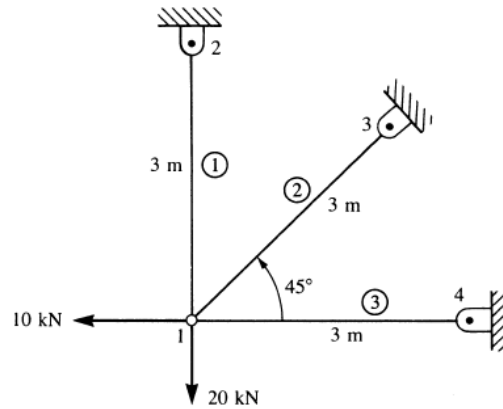
- Q.1** (a) Explain the following terms **07**
1. Beam Element
 2. Discretization
 3. Degree of freedom
 4. Spring Element
- (b) Describe the methods used for deriving the element stiffness matrix and element equations. **07**
- Q.2** (a) Describe the assumptions and applications of Finite Element Method. **07**
- (b) What is post processing? Why are boundary conditions necessary in a Finite Element Problem? During discretization mention the place where it is necessary to place a node. **07**

OR

- (b) Using direct stiffness approach find the nodal displacements, forces in each element and the reactions for the spring assemblage shown in below figure. Units are in N/mm. **07**

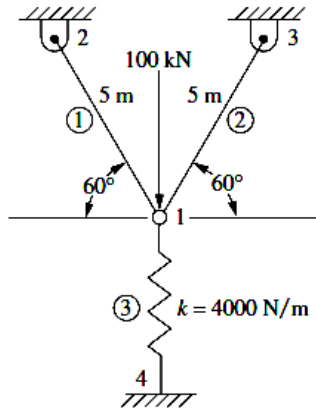


- Q.3** (a) Define Shape function and its characteristics. Differentiate the minimum potential energy approach and the direct stiffness approach for deriving the stiffness matrices. **07**
- (b) For the plane truss, shown in below figure find the horizontal and vertical displacements of node 1 and stresses in each element. Let $E = 210 \text{ GPa}$ and $A = 4.0 \times 10^{-4} \text{ m}^2$ for both truss elements. **07**

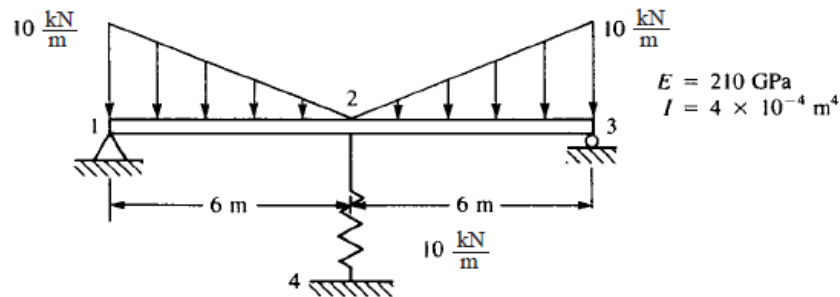


OR

- Q.3** (a) What is the necessity of determining Von misses stresses in finite element static analysis? 07
- (b) For the truss shown in the below figure compute the horizontal and vertical displacements of node 1 and stresses in each element. Let $E = 210 \text{ GPa}$ and $A = 5.0 \times 10^{-4} \text{ m}^2$ for all truss elements. 07

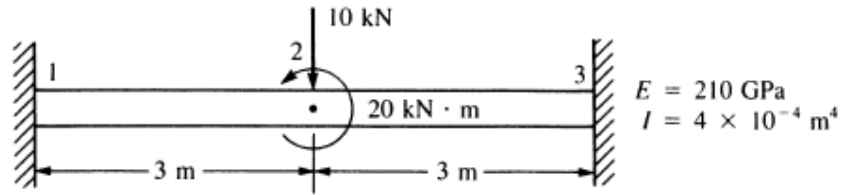


- Q.4** (a) Differentiate between spring and beam elements from general and application point of view. 07
- (b) For the below shown beam find the displacements and slopes at the nodes, forces in each element and reactions. Also sketch the shear force and bending moment diagrams. 07

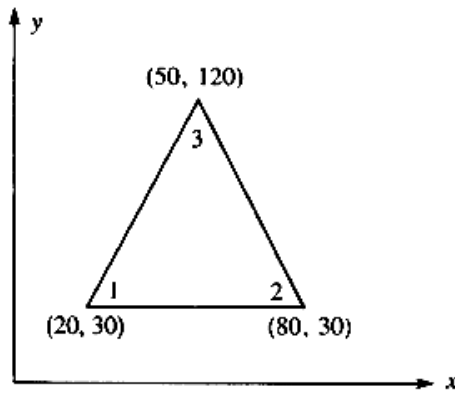


OR

- Q.4** (a) Consider the following displacement function for the two noded bar element : $u = a + b x^2$. Is this a valid displacement function? Discuss why or why not. 07
- (b) For the below shown beam find the displacements and slopes at the nodes, forces in each element and reactions. 07



- Q.5** (a) Explain the stress strain relationship for a Plane stress and Plane strain conditions giving suitable examples. **07**
- (b) Evaluate the stiffness matrix for the element shown below. The coordinates are given in units of millimeters. Use $E = 210 \text{ GPa}$, $\nu = 0.25$ and $t = 10 \text{ mm}$. Assume plane stress condition. **07**



OR

- Q.5** (a) Derive an expression for shape function of Constant Strain Triangle. **07**
- (b) For the one dimensional bar shown in below figure discretized into three elements, find the lumped and consistent mass matrices. Let the bar properties be E, ρ and A throughout the bar. **07**

