

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VII (NEW) EXAMINATION – SUMMER 2024****Subject Code: 3172008****Date: 22-05-2024****Subject Name: Finite Element Analysis****Time: 02:30 PM TO 05:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

- Q.1**
- | | | |
|-----|---|-----------|
| (a) | Define Finite element analysis. | 03 |
| (b) | Explain the types of boundary conditions identified in Finite element analysis. | 04 |
| (c) | Explain the advantage and disadvantages of finite element method. | 07 |
- Q.2**
- | | | |
|-----|--|-----------|
| (a) | Explain Discretization in FEM. | 03 |
| (b) | Explain the principle of minimum potential energy with a suitable example. | 04 |
| (c) | Explain the different types of Elements used 1D, 2D and 3D in Finite Element Analysis. | 07 |

OR

- (c) Using minimum potential energy method or Direct stiffness method, Find the nodal displacements and deflection of the spring assemblage shown in fig 1. **07**

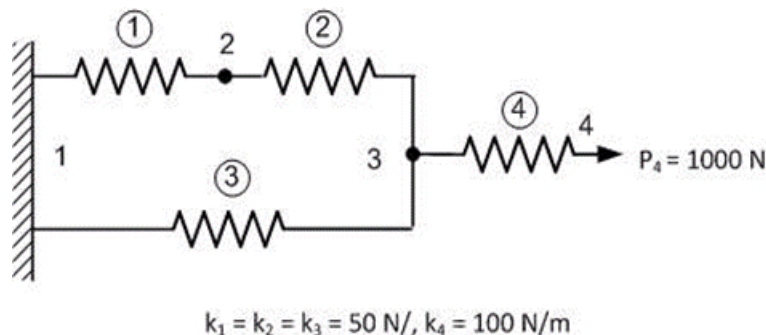


Figure 1 (All Dimensions of spring are N/m)

- Q.3**
- | | | |
|-----|---|-----------|
| (a) | Types of software used in FEA. | 03 |
| (b) | Derive element stiffness matrix for 1D bar element. | 04 |
| (c) | Explain the elimination approach in 1D Problem with suitable example. | 07 |
- OR**
- Q.3**
- | | | |
|-----|---|-----------|
| (a) | How the material properties assign in FEA software. | 03 |
| (b) | Differentiate between CST and LST. | 04 |
| (c) | Explain the penalty approach in 1D Problem with suitable example. | 07 |
- Q.4**
- | | | |
|-----|---|-----------|
| (a) | FEA leads to obtaining an approximate solution. Explain. | 03 |
| (b) | Differentiate between dynamics and statics in FEA. | 04 |
| (c) | Explain the steps involved in performing a finite element analysis. | 07 |
- OR**
- Q.4**
- | | | |
|-----|--|-----------|
| (a) | Define local and global coordinate system in trusses. | 03 |
| (b) | Differentiate between plane stress and plane strain. | 04 |
| (c) | Fig. 2 shows a truss consisting of three elements whose AE/L value is 1000 N/mm. Calculate the deflection at node 2. | 07 |

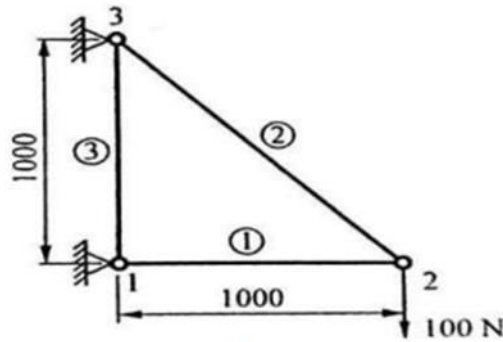


Figure 2

- Q.5 (a) Define the Shape function in FEM. 03
 (b) Explain the different types of nonlinearities with appropriate examples. 04
 (c) An axial load $P = 385 \text{ KN}$ is applied to the composite block shown in fig.3. 07
 Determine the stress in each material.

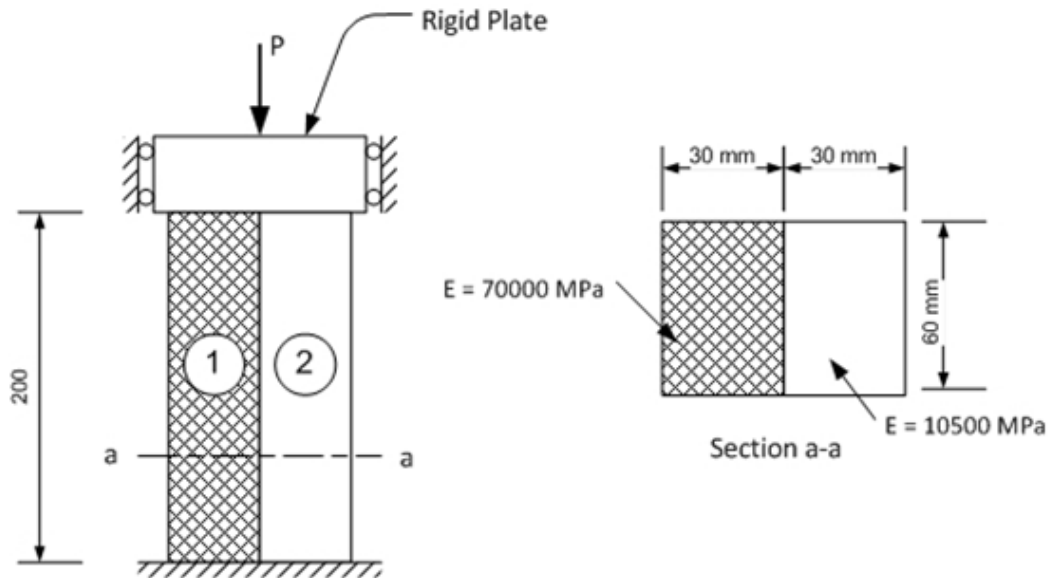


Figure 3

OR

- Q.5 (a) Give four examples of practical application of axisymmetric element. 03
 (b) Discuss the Isoparametric formulation for a bar element. 04
 (c) Using the minimum potential energy approach OR Direct stiffness method, obtain the stiffness matrix for the spring system shown in figure 4 below. The vertical members at nodes 2 and 3 are to be considered rigid. Solve for the nodal displacements and the reaction force (at node 1) if $k_1 = 4 \text{ N/mm}$, $k_2 = 6 \text{ N/mm}$, $k_3 = 3 \text{ N/mm}$, $F_2 = 30 \text{ N}$, $F_4 = 50 \text{ N}$ 07

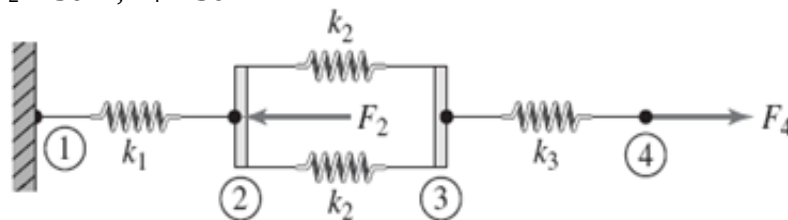


Figure 4
