Seat No./Enrollment No.: _____

GUJARAT TECHNOLOGICAL UNIVERSITY
MASTER OF ENGINEERING – SEMESTER 1 – EXAMINATION – SUMMER 2026

Subject Code: 3712011 **Date: 09/06/2026**

Subject Name: Advanced Structural 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.**

Q.1 **(a)** State the advantages and disadvantages of FEM and its applications. **07**

(b) Explain "Axisymmetric solids" with respect to finite element. **07**

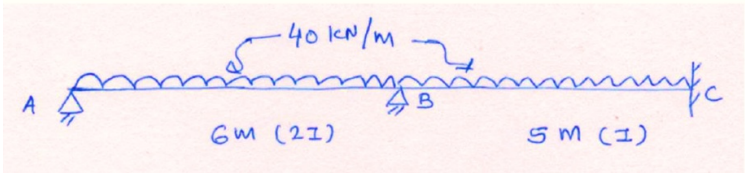
Q.2 **(a)** Explain the principles of discretization. **07**

(b) Determine element stiffness matrix for an axially loaded bar element whose area of cross-section varies linearly. **07**

OR

Q.2 **(b)** A two noded bar element has length "l". Using generalized coordinates, find shape functions, strain displacement matrix only. **07**

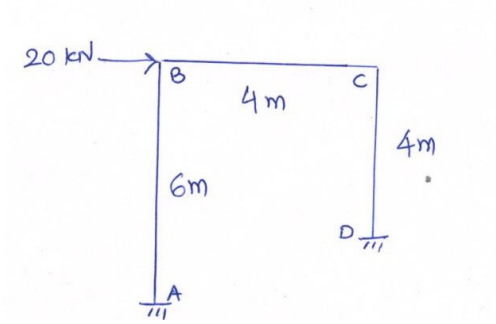
Q.3 **(a)** Analyze the continuous beam as shown in figure using stiffness member approach and write final stiffness equations. **07**



(b) Formulate stiffness matrix for a prismatic beam element. **07**

OR

Q.3 **(a)** Analyze the plane frame as shown in figure by stiffness member approach and write member end stiffness matrices. **07**



(b) Determine the shape functions for a CST element in terms of natural coordinate system. **07**

Q.4 **(a)** Explain Nonlinear and linear response of a structure stating reasons of Nonlinearity. **07**

(b) Enlist useful software of FE Analysis. Also Discuss the role of computer in FE Analysis. Discuss on convergence of solution. **07**

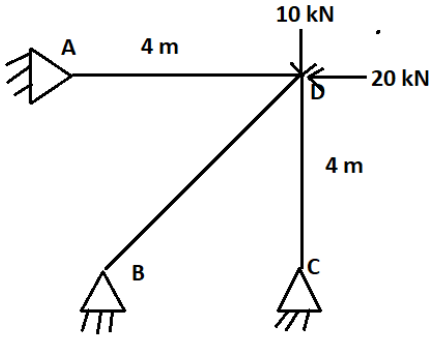
OR

Q.4 **(a)** Explain global and local coordinate system with neat diagrams. **07**

(b) Find the member stiffness matrix and load vector for a cantilever beam of length 1.5 m subjected to 5 kN/m throughout the length. EI is constant throughout the length. **07**

Q.5 **(a)** Using polynomial functions determine shape functions of a three noded line element. Draw the shapes. **07**

(b) Determine the support reactions for the truss as shown in figure by stiffness matrix method. Here joint B settles down by 10 mm downward. AE = 8000 kN. Member BD is at an angle of 45^0 with DB member. **07**



OR

Q.5 **(a)** Derive the transformation matrix for a grid structure. **07**

(b) Derive the member stiffness matrix for a plane frame. **07**

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