Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER– IV EXAMINATION – SUMMER 2026

Subject Code:3140603 Date:21-05-2026

Subject Name: Structural Analysis-I

Time:10:30 AM TO 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.**
4. **Simple and non-programmable scientific calculators are allowed.**

			Marks
Q.1	**(a)**	Define statically determinate and indeterminate structures. Also give examples with neat sketch.	**03**
	(b)	State and prove Maxwell's reciprocal theorem.	**04**
	(c)	Analyze the truss given in Fig:(1) by Method of Joint.	**07**
Q.2	**(a)**	Distinguish between Truss and Frame.	**03**
	(b)	Derive the expressions for Hoop and longitudinal stresses in a thin cylinder.	**04**
	(c)	Calculate horizontal thrust at support of three hinged parabolic arch with 'L' span, certral rise 'R' and two hinges at same level. It is subjected to UDL of w/L kN/m over entire span. Also calculate bending moment at L/3 meter from the support.	**07**
		OR	
	(c)	A cylindrical shell 1 meter long, 180 mm internal diameter, thickness of metal 8 mm is filled with a fluid at atmospheric pressure. If an additional 20000 mm^3 of the fluid is pumped into the cylinder, find the pressure exerted by the fluid on the wall of the cylinder. Find also the hoop stress induced. Take E= 2 x 10^5 N/mm^2 and Poisson's ratio as 0.3.	**07**
Q.3	**(a)**	Define: 1)Resilience, 2) Proof Resilience and 3) Modulus of Resilience.	**03**
	(b)	Derive the Relationship between slope, deflection and radius of curvature.	**04**
	(c)	A uniform metal bar has a cross sectional area of 700 mm^2 and a length of 1.5 meter with an elastic limit of 160 N/mm^2. Find its proof resilience. Find also the maximum value of an applied load which may be suddenly applied without exceeding the elastic limit. Calculate the value of the gradually applied load which will produce the same extension as that produced by the above suddenly applied load. E = 200 GPa.	**07**
		OR	
Q.3	**(a)**	Differentiate between real beam and conjugate beam. Justify the support conditions in conjugate beam.	**03**
	(b)	Define slenderness ratio. With the help of sketches, explain effective length of column for different end conditions.	**04**
	(c)	A steel beam is simply supported as shown in **Fig:(2)** at the ends on a span of 8 meters. Determine the location and magnitude of the maximum deflection by Macaulay's Method. I_{xx} = 4.79 x 10^8 mm^4, E = 200 GPa.	**07**
Q.4	**(a)**	Define (a) Axial load (b) Eccentricity (c) Core of a section	**03**
	(b)	Explain Moment -area theorem I and theorem II.	**04**
	(c)	A masonry pier shown in **Fig:(3)** supports a vertical load of 600 kN at a point shown in figure. Find the stresses at the corners of the pier.	**07**
		OR	
Q.4	**(a)**	Differentiate between column and strut.	**03**
	(b)	Write the assumptions and limitations of Euler's formula	**04**

(c) A hollow cylindrical cast iron column is 4 meter long, both ends being fixed. Design the column to carry an axial load of 250 kN. Use Rankine's formula and adopt a factor of safety 5. The internal diameter is 0.8 times the external diameter. Crushing stress for the column material is 550 N/mm^2, and $\alpha = 1/1600$. **07**

Q.5 **(a)** Discuss various types of Arches. **03**

(b) Draw a neat sketche of Kernel of following cross-sections: **04**

a) Rectangular 200mm x 300mm

b) Hollow circular cylinder with external dia. =300 mm, thickness= 50 mm

c) Square with 600 cm^2 area

(c) Determine the support reactions for the fixed beam shown in **Fig:(4)** Draw shear force and bending moment diagrams. **07**

OR

Q.5 **(a)** Distinguish between direct and bending stress. **03**

(b) Derive the equation of fixed end moment in a fixed beam of span 'L' having one of the support sink by δ. **04**

(c) Analyze the continuous beam shown in **Fig:(5)** by moment distribution method. **07**

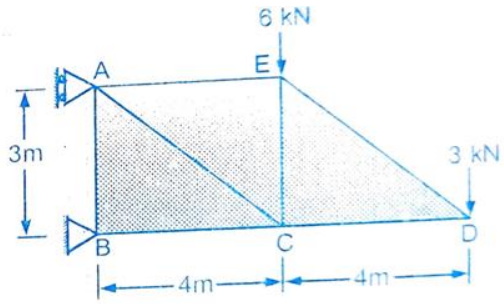

Fig:(1)

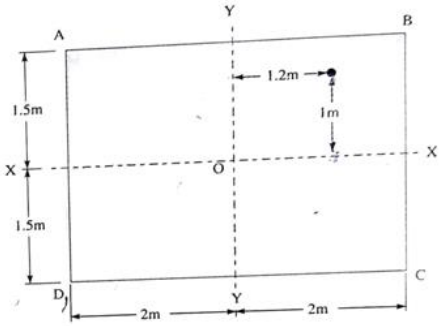

Fig:(3)

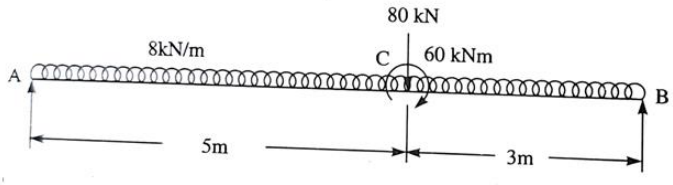

Fig:(2)

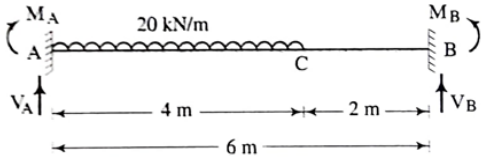

Fig:(4)

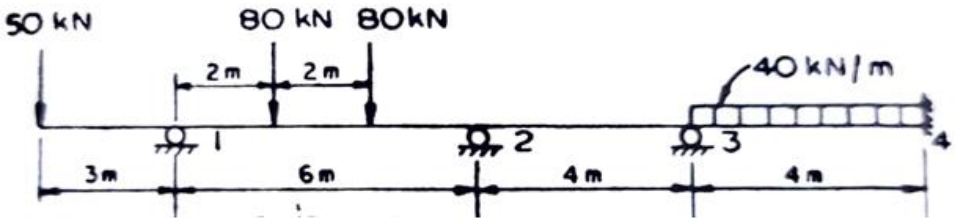

Fig:(5)

****