Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV (NEW) EXAMINATION – WINTER 2023

Subject Code:3140603 **Date:17-01-2024**

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)**	Explain the Maxwell reciprocal deflection theorem with neat sketch.	**03**
	(b)	Calculate the static and kinematic indeterminacies of the structure in Fig 1 and 2	**04**

Fig. 1

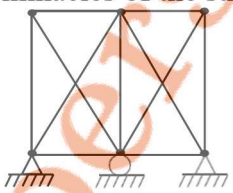

Fig. 2

	(c)	A three hinged parabolic arch of 20 m span and 4 m central rise carries a point load of 160 kN at 4 m from left side support. Calculate Normal thrust and shear force at sectionunder load. Draw BMD.	**07**
Q.2	**(a)**	A thin cylindrical shell of internal diameter d, wall thickness t and length l, is subjected to internal pressure p. Derive the expression for circumferential stress produced if the efficiencyof the longitudinal joint is η.	**03**
	(b)	A thin cylindrical shell has 100 mm internal diameter and wall thickness is 12 mm. It carries a steam pressure of 11 N/mm^2, Find hoop stress and longitudinal stress in the shell material.	**04**
	(c)	A thin cylindrical shell is 3000 mm long 1000 mm in diameter and thickness of metal 10 mm after being filled with water at atmosphere pressure, more water is pumped in until the pressure is 2.4 N/mm^2 on relieving the pressure, what should be amount of additional water let out if the water is assumed to incompressible. Take E for steel = 200 kN/m^2, Poisson's ratio = 0.3	**07**
		OR	
	(c)	Find a slope at A and deflection at C for the beam shown in Figure 3 using a Macaulay method. Take EI 3000 $kN.m^2$.	**07**

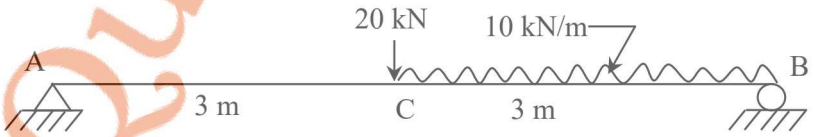

Fig. 3

Q.3	**(a)**	Explain following Terms, i) Resilience; ii) Proof Resilience; iii) Modulus of Resilience.	**03**
	(b)	Derive the formula for strain due to sudden loading.	**04**

(c) A 1500 mm long wire of 30 mm^2 cross sectional area is hanged vertically. It receives a sliding collarof 100 N weight and stopper at bottom end. The collar is allowed to full on stopper through 200 mmheight. Determine the instantaneous stress included in the wire and corresponding elongation. Alsodetermine the strain energy stored in the wire. Take modulus of elasticity of wire as 200GPa **07**

OR

Q.3 **(a)** What are the fundamental principles to consider when analyzing a fixed beam in structural engineering?" **03**

(b) Determine slope and deflection at free end of cantilever as shown in Figure 4. Take E= 200GPa, and I = 150 x 10^6mm. **04**

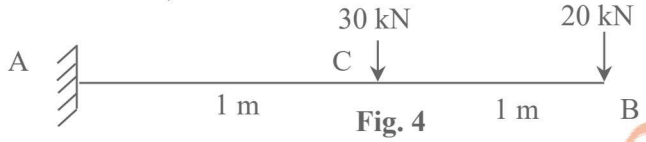

Fig. 4

(c) Using a moment area method, determine the slope at B and c and deflection at B of the cantilever beam as shown in Figure 5. **07**

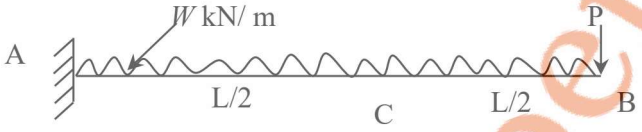

Fig. 5

Q.4 **(a)** Define conjugate beam. What are the different kinds of a support condition in conjugate beam? **03**

(b) A propped cantilever beam of span 'l' is subjected to a point load 'w' at the center of the span.Determine all and draw shear force and bending moment diagram. **04**

(c) A 20 m height masonry chimney is 2 m square at base and trapper to 1 m square at top the tapped central flue is circular in cross- section and 1 m diameter at the base. If the total weight of the brick work, about the base is 1300 kN. Find for what uniform intensity of wind pressure and one face of chimney the stress distribution the base just ceases to be wholly compressive. **07**

OR

Q.4 **(a)** Define "core" or "Kernel" of section. Obtained the "core" or "Kernel" of solid square section. **03**

(b) A cast iron column having a 150 mm diameter carries an eccentricity load of 50 kN. If maximum tensile stress is not exceed 7.5 N/mm^2, find permissible eccentricity of load column. **04**

(c) A rectangular retaining wall section is 2 m wide. It retains water up to full height. Fin the maximum height required for following: (a) when it is just at the point of overturning; (b) when it is just on the point of sliding; (c) there is a no tensile stress is produced at the base of section. The density of wall material and water is 22 kN/m^3 respectively and take efficiently of friction as 0.5. **07**

Q.5 **(a)** Discuss Euler's formula for column buckling. What are its key assumptions, and how is it used in column design? **03**

(b) Describe the behavior of columns with initial curvature. How does this initial curvature affect their stability, and what considerations are needed in their design? **04**

(c) A hollow cast iron column 6 m. long is fixed at both ends, and has an external diameter of 400 mm. find the internal diameter of column if it supports an axial load of 1000 kN. Factor of safety = 5; $\alpha = 1/1600$, fc= 550 N/mm^2. **07**

OR

Q.5	**(a)**	Differentiate between long and short column.	**03**
	(b)	Distinguish between direct stresses and bending stresses.	**04**
	(c)	A rectangular column section ABCD having AB = CD = 400 mm and BC = AD = 300 mm carries a compressive load 300 kN at corner B. Find the stress at each corner A, B, C and D and draw stress –distribution diagram for each side.	**07**

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