Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV (NEW) EXAMINATION – SUMMER 2024

Subject Code:3140603 Date:18-07-2024

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)**	Define statically determinate and indeterminate structures.	**03**
	(b)	Calculate Static and Kinematic Indeterminacy for the structures shown in the figure 1	**04**
	(c)	A three hinged parabolic arch of 16 m span and 3 m central rise carries a point load of 150 kN at 4 m from left side support. Calculate Bending moment, Normal thrust and shear force at section under load.	**07**
Q.2	**(a)**	Define (a) Resilience (b) proof resilience (c) Modulus of resilience	**03**
	(b)	A thin cylindrical shell with internal diameter of 130 mm and 10 mm thickness is subjected to a pressure of 15 $N/mm^{2.}$ Find circumferential and longitudinal stress in shell material.	**04**
	(c)	A 2000 mm long wire of 30 $mm^{2.}$ Cross sectional area is hinged vertically. It receives a sliding collar weight of 150 N weight and stopper at bottom end. The collar is allowed to fall on stopper through 250 mm height. Determine the instantaneous stress induced in the wire and corresponding elongation. Also determine the strain energy stored in the wire. Take modulus of rigidity of wire as 200 Gpa.	**07**
		OR	
	(c)	A concrete dam, trapezoidal in cross section with 3 m width at base and 1.1 mt width at top, is 8 m high. It has to retain water up to full height. If unit weight of concrete is 25 kN/m^3 and that of water 10 kN/m^3, calculate maximum and minimum stress intensity induced at the base.	**07**
Q.3	**(a)**	Write moment area theorem -1 and moment area theorem 2	**03**
	(b)	Derive the expression to find slope and deflection at free end of cantilever beam having span L subjected to point load W at free end using double integration method.	**04**
	(c)	A simply supported beam of span 8 m is subjected to UDL of 25 kN/m over entire span. Calculate the slope at left support and deflection at center of beam. Take EI= $6X10^4$ $kN\text{-}m^2$	**07**
		OR	
Q.3	**(a)**	Define core or Kernel of a section and draw core for rectangular and circular section.	**03**
	(b)	Discuss stability checks for a dam.	**04**
	(c)	A simply supported beam of span 6 m carries a point load of 80 KN at 4-meter from left end support. Calculate defection under point load and slope at left support using Macaulay's method. Take EI=20000 $kN\text{-}m^2$	**07**
Q.4	**(a)**	Differentiate between column and strut.	**03**
	(b)	Discuss different column end conditions and effective length of columns.	**04**
	(c)	A short column of rectangular size 250 mm X 200 mm is subjected to a load of 500 kN at a point of 50 mm from longer side and 100 mm from shorter side. Find maximum and minimum stresses in the column.	**07**
		OR	

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

(b) Differentiate between long and short column **04**

(c) A hollow cast iron column of 300 mm diameter and 25 mm thickness is used as 5 m long column with both ends fixed. Find the safe cripling load by (a) Euler's formula (b) Rankine's formula Take factor of safety as 3.5 and maximum compressive stress as 500 N/mm^2 take value of α as 1/1600 and E= 0.14 X 10^5 N/mm^2 **07**

Q.5 **(a)** State assumptions of Euler's formula. **03**

(b) Find fixed end moments for the fixed beam of span L m subjected to UDL of W kN/m on entire span. **04**

(c) Analyze the fixed beam shown in the figure 2. **07**

OR

Q.5 **(a)** Define (a) Carry over moment (b) Stiffness (c) Distribution factor **03**

(b) What are the advantages and disadvantages of fixed beam **04**

(c) Analyze the beam shown in the figure 3 using moment distribution method and draw bending moment diagram. **07**

****

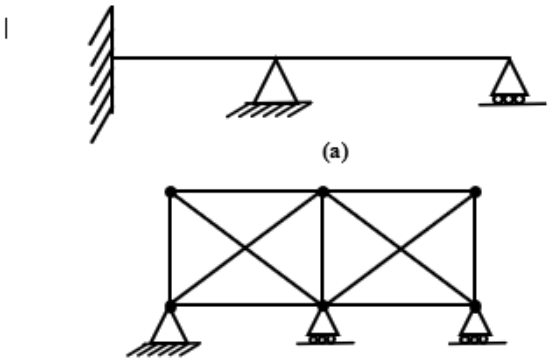

Figure 1

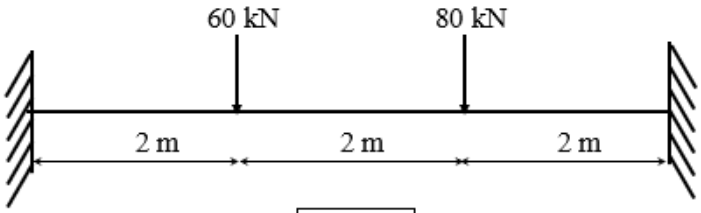

Figure 2

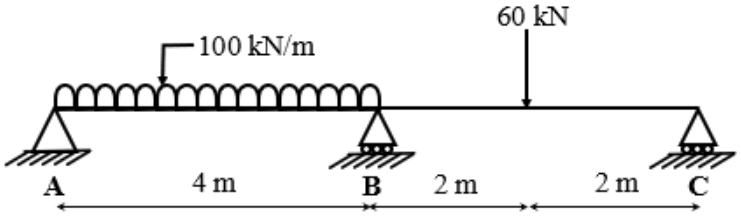

Figure 3