Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

Subject code: X20603 **Subject Name: Structural Analysis I**

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 and explain Maxwell's Reciprocal Theorem. Give two examples of zero SI & KI each. **07**

(b) Find S.I. and K.I. for structures shown in the fig 1 Stating whether structure is stable or unstable. **07**

Q.2 **(a)** Draw ILD for R_B & SF_X by first principle & draw ILD for R_A, M_B & BM_X by static law. Fig 2 **07**

(b) Draw ILD for the members of trusses shown in fig. U_1L_1, U_2L_2, L_2U_3, L_2L_3. Ref Fig 3 **07**

OR

(b) A three-hinged parabolic arch of span 20 m & rise 4 m carries a UDL of 50 kN/m on left half of the span. Find the reaction at the supports & the position & amount of maximum bending moment. Also draw BM diagram also. **07**

Q.3 **(a)** Differentiate **07**

- Statically Determinate Structure & Statically Indeterminate Structure
- Static Indeterminacy & Kinematic Indeterminacy

Explain following

- Effective length
- Radius of gyration

(b) Calculate stresses at A, C & B & draw stress diagrams. Give your comment about the result. Take P = 200 kN Ref Fig 4 **07**

OR

Q.3 **(a)** Derive equation of strain energy due to impact loading. What is the relation between strain energy due gradual loading & impact loading? **07**

(b) A trapezoidal masonry dam is 12.0 m high and 3.0 m wide at top and 9.0 m at bottom. It retains water up to 10.0 m height on its vertical face. Find maximum and minimum resultant stress induced at the base of the section. Draw stress distribution diagram. **07**

Q.4 **(a)** Derive Euler's formula for crippling load if both ends of columns are fixed. Also state limitation of Euler's formula. **07**

	(b)	A steel strut is made up of 4 m long T section having flange – 500mm x 100mm & web – 100mm x 500mm which is fixed at both ends. Calculate the safe axial load by Rankine formula, using factor of safety of 2. Take fc = 330 MPa & α = 1/1600	**07**

OR

Q.4	**(a)**	Derive relation between slope, deflection and radius of curvature	**07**
Q.4	**(b)**	Calculate equivalent UDL acting on cantilever such that strain energy stored in the cantilever beam is equal to strain energy stored due to point load of 40 kN acting at centre of the beam.	**07**
Q.5	**(a)**	Find the slope & deflection at point B and deflection at Point C for the beam shown in the fig 5 using Moment area or conjugate beam method.	**07**
	(b)	Calculate slope at A, deflection at D, deflection at C & maximum deflection for the beam shown in fig. 6 Take E = 2×10^5 N/mm^2, I = 2×10^8 mm^4.	**07**

OR

Q.5	**(a)**	Derive the basic equation of Torsion with usual notation. Give two practical application of structure subjected to torsion.	**07**
	(b)	A hollow circular shaft having external diameter 150 mm & internal diameter 100 mm. It is 4 m long & transmitting 200 kW power at 200 rpm. Calculate the shear stress on the external & internal surface of the shaft. Also calculate the angle of twist for the shaft if G = 100 GPa	**07**

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