Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III • EXAMINATION – WINTER 2013

Subject Code: 130604 **Date: 28-11-2013**

Subject Name: Structural Analysis-I

Time: 02.30 pm - 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)**	A column one meter long has cross sectional area of 9 cm^2. Find the slenderness ratio if the section is (a) circular, (b) square and (c) hollow circular with inner radius half the outer radius.	**07**
	(b)	Differentiate static and kinematic indeterminacy. Also explain these terms with respect to fixed beam.	**07**
Q.2	**(a)**	Find the deflection and slope for a cantilever beam shown in Fig. 1, using moment area method.	**07**
	(b)	Find the deflection and slope under load 100 kN using conjugate beam method. Refer Fig. 2. E = 200 GPa and I = 150 x 10^6 mm^4.	**07**
		OR	
	(b)	Find the deflection at the center of beam by conjugate beam method for Fig. 3. E = 200 GPa and I = 2 x 10^8 mm^4.	**07**
Q.3	**(a)**	The five moving loads 20 kN, 60 kN, 60 kN, 50 kN and 40 kN (Distances between those loads are 1.5 m, 1.5 m, 2 m, and 1 m) passing on a simply supported beam is shown in Fig. 4. Determine Maximum bending moment at a section 4 m from left support.	**07**
	(b)	A simply supported beam has a span of 15 m, subjected to UDL of 40kN/m and 5 m long crosses the girder from left to right (Refer Fig. 5). Calculate maximum shear force at 6 m from left support.	**07**
		OR	
Q.3	**(a)**	The five moving loads 20 kN, 60 kN, 60 kN, 50 kN and 40 kN (Distances between those loads are 1.5 m, 1.5 m, 2 m, and 1 m) passing on a simply supported beam having a length of 15 m is shown in Fig. 4. Determine Maximum shear force at a section 4 m from left support.	**07**
	(b)	A simply supported beam has a span of 15 m, subjected to UDL of 40kN/m and 5 m long crosses the girder from left to right (Refer Fig. 5). Calculate maximum bending moment at 6 m from left support.	**07**
Q.4	**(a)**	A hollow shaft having an inside diameter 60% of its external diameter, is replace a solid shaft transmitting the same power at same speed. Calculate the percentage saving in material, if the material used is also the same.	**07**
	(b)	A rectangular column of width 200 mm and thickness 150 mm carries a point load of 240 kN at an eccentricity of 10 mm as shown in Fig. 6. Determine the maximum and minimum stresses on the section.	**07**
		OR	
Q.4	**(a)**	A solid steel shaft has to transmit 75 kW at 200 rpm. Taking allowable shear stress as 70 MPa, find suitable diameter for the shaft, if the maximum torque transmitted at each revolution exceeds the mean by 30%.	**07**
	(b)	A hollow rectangular column of external depth 1 m and external width 0.8 m is 10 cm thick. Calculate maximum and minimum stress in the section of the column if a vertical load of 200 kN is acting with eccentricity of 15 cm as	**07**

shown in Fig.7.

Q.5	**(a)**	Derive the expression for longitudinal stress for a thin cylindrical vessel subjected to internal fluid pressure *p*.	**07**
	(b)	A three hinged symmetrical parabolic arch of span 60 m and rise 12 m is subjected to a concentrated load of 40 kN acting 10 m from its left support and UDL of 10 kN/m acting over its entire right half portion. Draw bending moment diagram.	**07**

OR

Q.5	**(a)**	Explain and prove Maxwell's reciprocal theorem	**07**
	(b)	Prove that bending moment at any section will be equal to zero for a parabolic three hinged arch subjected to UDL over its entire span.	**07**

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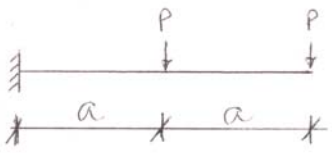

Fig. 1
(Q. 2 (a))

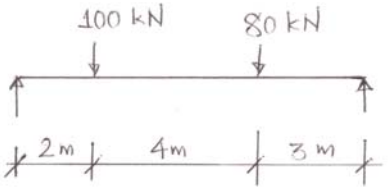

Fig. 2
(Q. 2 (b))

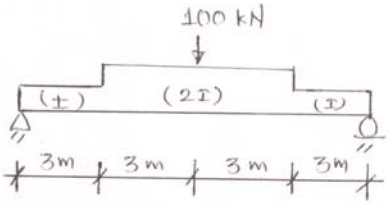

Fig. 3
(OR (Q. 2 (b)))

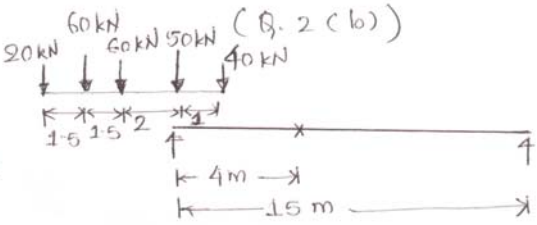

Fig. 4
(Q. 3 (a)) and
(OR Q. 3 (a))

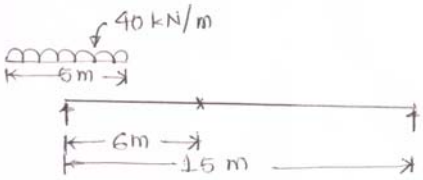

Fig. 5
(Q. 3 (b)) and
(OR Q. 3 (b))

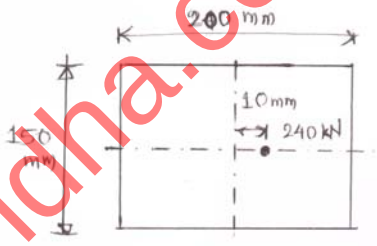

Fig. 6
(Q. 4 (b))

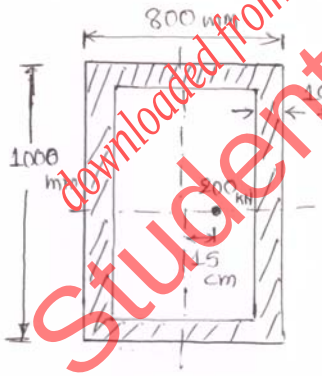

Fig. 7
(OR. Q. 4 (b))