Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– IV (New) EXAMINATION – WINTER 2019

Subject Code: 2140603 Date: 14/12/2019

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.**

Q.1	**(a)**	Define Core of the Section. Derive and locate the same for a Circular cross section.	**03**
	(b)	Find the Static and Kinematic Indeterminacy for the structures shown in **Figure – 1(a) and 1(b).**	**04**
	(c)	A weight of 500 N falls through a height of 20 mm on to a collar rigidly attached to the lower end of the vertical bar 2m long and circular cross section of 40 mm diameter. The upper end of the vertical bar is fixed. Find: (i) maximum instantaneous stress induced in the vertical bar (ii) instantaneous elongation and (iii) the strain energy stored in the bar. Take $E = 2 \times 10^5$ N/mm^2.	**07**
Q.2	**(a)**	Enlist the types of framed structures with neat sketch.	**03**
	(b)	A cylindrical shell 3m long and 600 mm in diameter with 6 mm thick plates is subjected to an internal pressure of 4 MPa. Calculate (i) circumferential stress (ii) longitudinal stress and (iii) change in capacity of the shell. Take E = 200 GPa and Poisson's ratio = 0.3 for the shell material.	**04**
	(c)	Using Macaulay's method, find the Slope at point A and deflection at points C for the beam shown in **Figure – 2**. Take EI = 4000 kN-m^2.	**07**
		OR	
	(c)	Using Moment Area method, find the Slope at point A and deflection at points C for the beam shown in **Figure –3.** Take EI = 4000 kN-m^2.	**07**
Q.3	**(a)**	Differentiate between direct stress and bending stress with example.	**03**
	(b)	Discuss Stability checks for a dam.	**04**
	(c)	Find load carrying capacity of the column having circular cross section with 400 mm diameter by (i) Euler's formula (ii)) Rankine's formula. The column is 6m long, fixed at one end and hinged at other end. Take fc = 320 N/mm^2, $E = 2 \times 10^5$ N/mm^2, $\alpha = 1/6400$.	**07**
		OR	
Q.3	**(a)**	Differentiate between long and short column.	**03**
	(b)	Define: slenderness ratio and find the same for a column of 5m length with both ends fixed and having circular cross section with 400 mm diameter.	**04**

	(c)	A masonry dam 9m high, 2 m wide at the top and 6 m wide at the base retains water to the full height. The water face of the dam is vertical. Find maximum and minimum stresses developed at the base. The Unit weight of water and masonry are 10 kN/m^3 and 22 kN/m^3, respectively.	**07**
Q.4	**(a)**	State Moment Area theorems I and II.	**03**
	(b)	Using Conjugate beam method, find the Slope and deflection at points B and C for the cantilever beam shown in **Figure – 4**.	**04**
	(c)	A three-hinged parabolic arch having span of 20m and central rise 5m carries a Uniformly Distributed Load of 60 kN/m over right half span. Calculate the reactions developed at Supports. Also find the (i) Bending Moment, (ii) Normal Thrust and (iii) Radial Shear at point 5m from left support.	**07**
		OR	
Q.4	**(a)**	A suspension cable having supports at the same level has a span of 60m and a maximum dip of 6m. The cable is loaded with a uniformly distributed load of 20 kN/m throughout its length. Find the maximum and minimum tensions in the cable. Also find length of the cable.	**03**
	(b)	Explain with neat sketch the types of arrangements of anchor cables over the towers in a suspension bridge.	**04**
	(c)	Using Conjugate beam method, find the Slope and deflection at points B and C for the cantilever beam shown in **Figure – 5**.	**07**
Q.5	**(a)**	Define: (i) Resilience (ii) Proof Resilience and (iii) Modulus of resilience.	**03**
	(b)	A steel bar 3m long and rectangular in section 50 mm x 20 mm is subjected to an axial load of 5 kN. Find the maximum stress if the load is applied (i) gradually and (ii) suddenly, Also find the strain energies in each of the above cases? Take E = 200 GPa.	**04**
	(c)	Determine the fixed end moments for the beam shown in **Figure – 6** .	**07**
		OR	
Q.5	**(a)**	Find out fixed end moment for a fixed beam subjected to a point load (W) at the center of the span (L). Also draw shear force and bending moment diagrams.	**03**
	(b)	Using method of consistent deformation, analyze the propped cantilever beam shown in **Figure – 7**, and draw shear force and bending moment diagrams.	**04**
	(c)	Determine the ratio of strain energy stored for a simply supported beam of 4m span in following two cases (i) if a point load of 40 kN is applied at centre and (ii) if it carries a uniformly distributed load of 10 kN/m over its entire span. Assume EI = Constant.	**07**

****

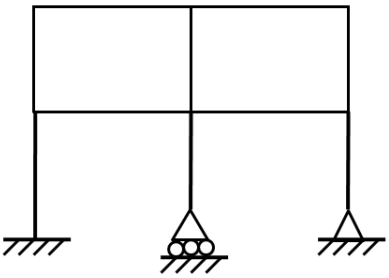

Figure – 1 (a)

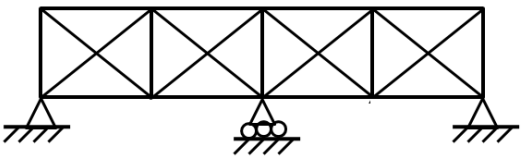

Figure – 1 (b)

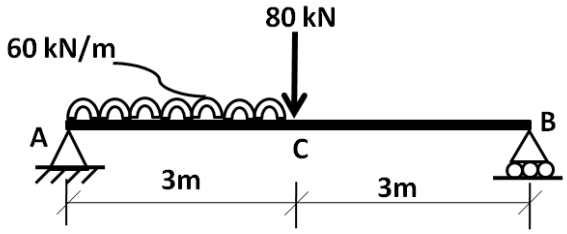

Figure – 2

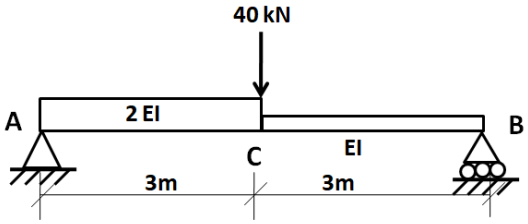

Figure – 3

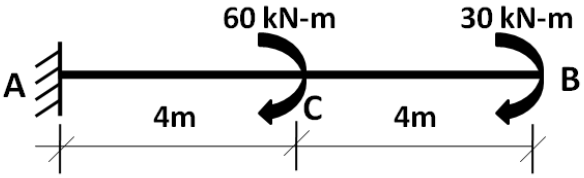

Figure – 4

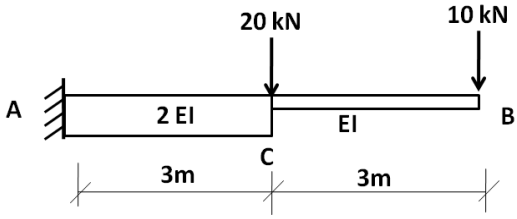

Figure – 5

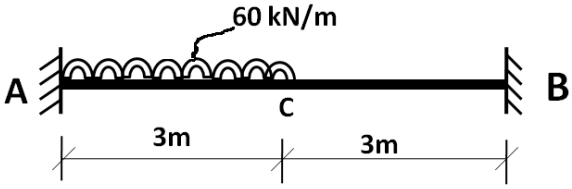

Figure – 6

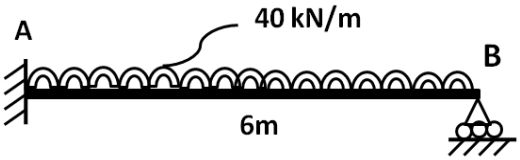

Figure – 7