Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code: 2140603 Date: 27-11-2024

Subject Name: Structural Analysis-I

Time: 02:30 PM TO 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.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Draw neat sketch of kernel for the following cross-sections: (i). Rectangular block 200 mm x 300 mm (ii) Circular section of 300 mm diameter	**03**
	(b)	Derive Euler's formula of critical load for column having both ends hinged.	**04**
	(c)	A steel bar 100 cm long and rectangular in section 40 mm x 80 mm is subjected to an axial load of 1 kN. Find the maximum stress if (i) The load is applied gradually, (ii) The load is applied suddenly, and (iii) The load is applied after falling through a height of 8 cm. What are the strain energies in each of the above cases? Take E = 200 GPa.	**07**
Q.2	**(a)**	Differentiate between direct stress and bending stress.	**03**
	(b)	Explain various types of framed structures with distinguishing features of each.	**04**
	(c)	A hollow cast iron column, 4.5 m long, is fixed at both ends and has an external diameter of 250 mm and thickness 25 mm. Adopting a factor of safety of 3.5, find safe crippling load by Rankine's formula. Take f_c=500 N/mm^2 and ά=1/1600. E = 140 GPa.	**07**
		OR	
	(c)	A rectangular column section ABCD, as shown in fig. 1, carries a compressive load of 300 kN at corner B. Find stress at each corner A, B, C, and D. Also draw stress distribution diagram for each side.	**07**

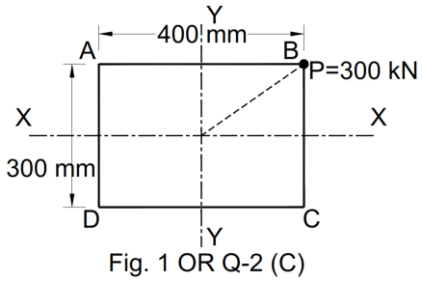

Fig. 1 OR Q-2 (C)

Q.3	**(a)**	Explain in brief about stability of structures.	**03**
	(b)	Derive formula for slope and deflection at free end of a cantilever beam of span L and loaded with udl of w over entire span.	**04**
	(c)	For the simply supported beam shown in fig. 2, calculate slope at A and deflection at C using Conjugate beam method. Take E = 200 GPa and I = 24 x 10^6 mm^4.	**07**

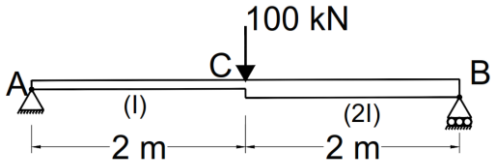

Fig. 2 Q-3 (c)

OR

Q.3 **(a)** Differentiate between linear arch and actual arch. **03**

(b) State moment area theorems and discuss its usefulness in analysis of beam. **04**

(c) Using Macaulay's method, find slope at A and deflection at C for the beam shown in fig. 3. Take EI = 3000 kN.m^2. **07**

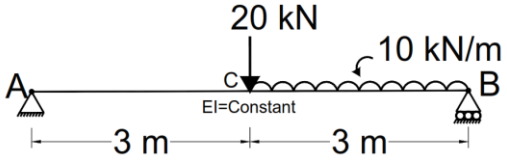

Fig. 3 OR Q-3 (C)

Q.4 **(a)** Derive the formula for no tension condition at base for a dam. **03**

(b) State basic difference between Continuous and simply supported beams. State advantages of Continuous beam over simply supported beam. **04**

(c) A fixed beam of span 7.2 m carries a UDL of 30 kN/m over entire span and a point load of 50 kN at a distance 4.2 m from left support. Calculate fixed end moments and draw BMD. Take EI = Constant. **07**

OR

Q.4 **(a)** A thin cylindrical shell with internal diameter 125 mm and wall thickness 12 mm is subjected to a steam pressure 10 N/mm^2. Find circumferential and longitudinal stress in the shell material. **03**

(b) Write advantages and disadvantages of fixed beams. **04**

(c) A three hinged parabolic arch, having span 20 m, central rise 4 m is loaded by UDL of 2 kN/m over left 8 m span. Calculate (a) magnitude and direction of reactions at end hinges and (b) B.M., normal thrust and radial shear at 4 m from left end. **07**

Q.5 **(a)** State Maxwell's Reciprocal theorem. **03**

(b) A masonry wall 5 m high is of rectangular section 3 m wide and 1 m thick. A horizontal wind pressure of 1.2 kN/m^2 acts on 3m side. Find the maximum and minimum stresses induced on the base, if unit weight of masonry 22.4 kN/m^3. **04**

(c) Draw shear force, bending moment and axial force diagram for the rigid jointed portal frame shown in fig. 4. **07**

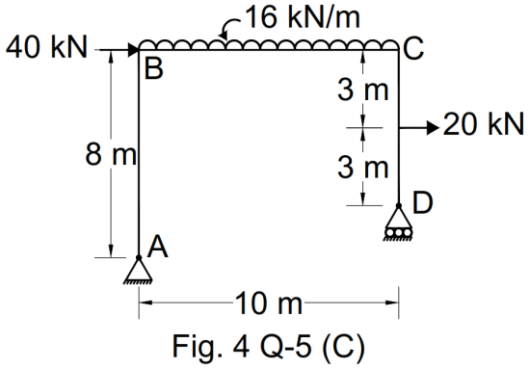

Fig. 4 Q-5 (C)

OR

Q.5 **(a)** A fixed beam AB of span 6 m is 60 mm wide and 100 mm deep. If support B sinks down by 6 mm, Find the fixed end moments. Take E = 200 GPa. **03**

(b)	A propped cantilever beam of span 6 m is acted upon by a point load of 20 kN at 3m from fixed end. Calculate support reactions.	**04**
(c)	A 1.5 m long rod of 25 mm^2 cross sectional area is hanged vertically. It receives a sliding collar of 100 N weight and stopper at bottom end. The collar is allowed to fall on stopper through 200 mm height. Determine the instantaneous stress induced in the rod and corresponding elongation. Also determine the strain energy stored in the rod. Take E = $2x10^5$ N/mm^2.	**07**