Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code:3140603 Date:21-11-2024

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)**	Explain the External Stability and internal stability of structure.	**03**
	(b)	Explain Maxwell Reciprocal deformation.	**04**
	(c)	Draw shear force, bending moment and Axial Force diagram for the rigid frame as sown in Fig. 1.	**07**
Q.2	**(a)**	Derive the expression for strain energy due to impact loading. Explain the key factors influencing the energy absorption and discuss its relevance in engineering applications.	**03**
	(b)	An unknown weight falls through 20 mm on caller rigidly attached to the lower end of vertical bar. 3 m long and 25 mm in diameter. If the maximum instantaneous extension is known to be 4 mm. what is the corresponding stress and the value of unknown weight? Take E = 210 kN/mm^2.	**04**
	(c)	Determine the ratio of strain energy stored in the simply supported beam AB of span 5 m carries 25 KN load at a central point and the same load distribution over its entire span.	**07**
		OR	
	(c)	A copper rod 30 mm diameter, 2 m long is enclosed in a steel tube, 35 mm internal diameter 5 mm thickness co-axially. The composite member is held vertically. The top end is fixed and rigid collar is provided at the bottom. A body of mass 50 kg is to be dropped centrally on the collar through a height h. the maximum instantaneous stress in copper is not to exceed 60MPa. Compute the maximum value of 'h' take E_s = 200GPa and E_c= 120GPa.	**07**
Q.3	**(a)**	State advantages of fixed beam over simply supported beam.	**03**
	(b)	A cantilever 3 m long carries a uniformly distributed load the entire length. If the slope at free end is 1^0 find the deflection at the free end.	**04**
	(c)	Calculate the slope and deflection at pint A for a beam loaded as shown Fig. 2 as shown below take E = 200 GPa. I = 3 x 10^7 mm^4.	**07**
		OR	
Q.3	**(a)**	Evaluate the stability conditions for retaining walls. Describe the key factors that affect their stability and analyze how these factors contribute to overall wall performance.	**03**
	(b)	A cast iron having 160 mm diameter carries an eccentric load of 50 kN. If maximum tensile stress is not to exceed 7.5 N/mm^2, find possible eccentricity of load on column.	**04**
	(c)	A tabular C/S of column as shown in the Fig. 3 is subjected to a P kN vertical load on the centroid of the hole. Determine the maximum value of P, if maximum compressive stress allowed is 50 kN/mm^2.	**07**
Q.4	**(a)**	Define the following terms and explain their significance in structural engineering: (i) Crippling load; (ii) Statically indeterminate structure; (iii) Strut.	**03**
	(b)	Explain the Euler's formula assumption and its limitation.	**04**

(c) A solid cast iron circular column of 4 m height is to be erected such that its one end remains fixed and other end remain hinged. Find the size if the section. If column has to carry a safe axial load of 300kN. Take factor of safety of 5, F_c = 500 N/mm^2. Renkine's Constant α =1/1500. **07**

OR

Q.4 **(a)** Define & explain the following terms Relative stiffness, Carry-over factor, Distribution factor. **03**

(b) What is conjugate beam? Differentiate between real beam and conjugate beam. Justify the support condition in conjugate beam. **04**

(c) Finds reaction of support for the beam shown in Fig. 4 with using consistant deformation method. **07**

Q.5 **(a)** Explain advantages of three hinged arch over beam. **03**

(b) A thin cylindrical shell 900 mm diameter, 4 m long and 10 mm thick is subjected to an internal pressure of 2MPa. Find the circumferential stress if the eccentricity of longitudinal joints is 75%. **04**

(c) Determine the support movement for a continuous beam as shown in Fig. 5 by moment distribution method. Also draw bending moment diagram. **07**

OR

Q.5 **(a)** What are the advantages and disadvantages of fixed beam? **03**

(b) Derive the expression for horizontal reaction, tension at the ends for a uniformly loaded cable. **04**

(c) A beam AB span 5 m fixed at both ends carries a uniformly distributed load of 20 kN/m over the whole span. The left end 'A' rotates clockwise by 0.8" and right end 'B' sinks by 10 mm. determine the fixed end moments and reactions at the supports. Draw also shear force and bending moment diagram. Take E 200 kN/mm^2 and I = 10 x 10^3 mm^2. **07**

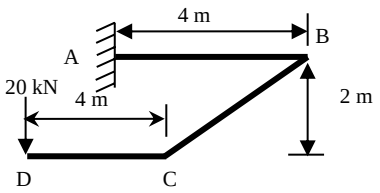

Fig .1

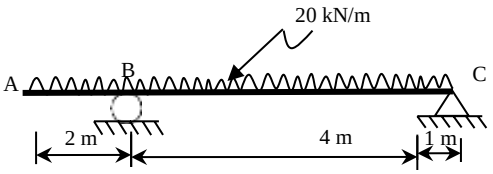

Fig .2

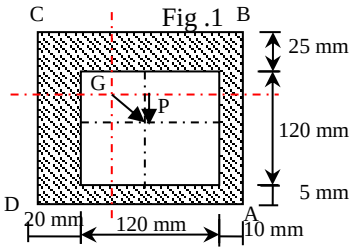

Fig .3

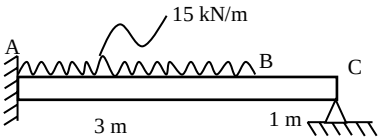

Fig. 4

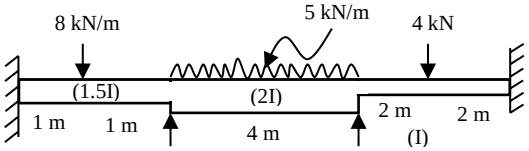

Fig. 5

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