Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–IV (NEW) EXAMINATION – SUMMER 2024

Subject Code:2140603   **Date:03-07-2024**

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.**
4. **Simple and non-programmable scientific calculators are allowed.**

			Marks
Q.1	**(a)**	State assumptions and limitations of Euler's formula.	**03**
	(b)	Write Euler's formula and explain the effective length of the column for different end conditions with a neat sketch.	**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)**	State and explain the principle of superposition.	**03**
	(b)	Explain various types of framed structures with distinguishing features of each.	**04**
	(c)	Determine the slope and deflection at the free end of a cantilever beam AB of span 2 m subjected to a load of 30 KN at free end B. Take $I_{xx}=6 \times 10^7$ mm^4 and E= 2×10^5 N/mm^2 by using moment area method.	**07**

OR

	(c)	A hollow cast iron section having external diameter 250 mm and thickness 25 mm is used as 4.5 m long column with both ends fixed. Find the safe load by (a) Euler's formula & (b) by Rankine's formula. Take factor of safety=3.5 ,Compressive stress= 500 N/mm2, α= 1/1600,E= 0.14×10^5 N/mm^2	**07**
Q.3	**(a)**	Define the followings: (a) Radius of Gyration, (b) Slenderness Ratio and (c) Critical Load.	**03**
	(b)	Explain Maxwell's theorem of reciprocal deflections.	**04**
	(c)	A cylindrical shell 3 m long & 1m diameter is subjected to an internal pressure of 1 N/mm^2. If the thickness of the shell is 12 mm. Find the circumferential stress, longitudinal stress & change in the dimensions of the shell. Take E= 2 x10^5 N/mm^2 , Poisson's ratio (1/m)=0.27	**07**

OR

Q.3	**(a)**	Derive the relation between slope, deflection and radius of curvature of the beam.	**03**
	(b)	Explain any two stability conditions for retaining wall.	**04**
	(c)	A propped cantilever beam AB of span 5 m carries a point load of 30 KN at 2 m from the left support A. Analyse the beam using consistent deformation method and draw S.F.D. and B.M.D.	**07**

Q.4	**(a)**	Define: (i) Resilience (ii) Proof Resilience and (iii) Modulus of resilience.	**03**
	(b)	State advantages and disadvantages of fixed beam over simply supported beam.	**04**
	(c)	A masonry dam 6 m high, 3 m wide at base and 1.2 m wide at top, retains water on vertical face for full height. Considering density of masonry as 17 KN/m^3 and density of water as 10 KN/m^3, find out maximum and minimum pressure intensities at the base.	**07**

<div align="center">OR</div>

Q.4	**(a)**	Derive the equation for Strain Energy stored in a bar due to Sudden Loading.	**03**
	(b)	State Moment Area theorems I and II.	**04**
	(c)	A three-hinged parabolic arch having span of 20 m and central rise 3m carries a point load of 10 KN at 7.5 m from the left hand hinge. Calculate the reactions developed at Supports. Also find the (i) Bending Moment, (ii) Normal Thrust and (iii) Radial Shear at point 7.5 m from right end hinge.	**07**
Q.5	**(a)**	Differentiate between real beam and conjugate beam. Justify the support condition in the conjugate beam.	**03**
	(b)	Discuss various types of Arches.	**04**
	(c)	A fixed beam of 5 m span carries a central point load of 40 KN. Find out the fixed end moments and draw SFD & BMD of the beam.	**07**

<div align="center">OR</div>

Q.5	**(a)**	Explain direct stress and bending stress.	**03**
	(b)	Define and explain : Kernel of rectangular section.	**04**
	(c)	A bar 54 mm in diameter is 4 m long. An axial load of 180 KN is suddenly applied to it. Find (i) maximum instantaneous stress (ii) maximum elongation & (iii) Strain energy. Take E= 2 x 10^5 N/mm^2	**07**

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