

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-III (OLD) EXAMINATION – SUMMER 2021****Subject Code: 130604****Date: 14/09/2021****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.

- Q.1** (a) Define the following Term. Polar moment of Inertia, Determinate Structure, Indeterminate Structure, Resilience, Proof resilience, Direct Stress, Slenderness ratio. **07**
- (b) Define the term Torsion. Write assumptions in the theory of pure torsion. **07**
- Q.2** (a) A hollow cast iron section having external diameter 300 mm and internal diameter 250 mm is used as 4 m long column with both ends hinged. Find safe axial load by using Euler's formula. Take  $E = 0.15 \times 10^5 \text{ N/mm}^2$  and factor of safety is 3. **07**
- (b) Derive the Euler's formula for column having both ends hinged. **07**
- OR**
- (b) A solid circular shaft of 350 mm diameter has to transmit 800 kW power at 250 rpm. Calculate the maximum shear stress developed in the shaft material and angle of twist if the effective length of the shaft is 3 m. take modulus of rigidity is  $8 \times 10^4 \text{ N/mm}^2$ . **07**
- Q.3** (a) Explain Maxwell Reciprocal Theorem. **07**
- (b) Explain the relation between slope, deflection and radius of curvature. **07**
- OR**
- Q.3** (a) Find slope at support A and deflection at C for the beam shown in figure 1. Take  $EI = 3000 \text{ kN.m}^2$ . Use Macaulay's Method. **07**
- (b) Find slope at support A and deflection at C for the beam shown in figure 1. Take  $EI = 3000 \text{ kN.m}^2$ . Use Conjugate beam method. **07**
- Q.4** (a) Draw Shear force and bending moment diagram for a frame shown in figure 2. **07**
- (b) A axial pull of 80kN is suddenly applied to a steel bar 2.5 m long and  $950 \text{ mm}^2$  area in cross section. If modulus of elasticity of steel is  $2 \times 10^5 \text{ N/mm}^2$ , find maximum instantaneous stress, maximum instantaneous extension, strain energy and modulus of resilience. **07**
- OR**
- Q.4** (a) Enlist the types of Arches. Explain Eddy's Theorem. **07**
- (b) A three hinge parabolic arch has span 20 m and central rise 3 m. it carries a point load of 20 kN at 7 m from the left hinge. Calculate normal thrust, shear and bending moment at section 5 m from right end hinge. **07**
- Q.5** (a) A circular column 500 mm in diameter carries a load of 800 kN at an eccentricity of 90 mm. Calculate maximum and minimum stresses for the column. Also draw stress distribution diagram. **07**
- (b) Define Influence line diagram. Explain importance of Influence line diagram. **07**

**OR**

- Q.5** (a) A masonry dam 6 m high, 3.5 m wide at base and 1.5 m wide at top, retains water on vertical face for full height. Consider density of masonry is  $17 \text{ kN/m}^3$  and density of water is  $10 \text{ kN/m}^3$ , find out maximum and minimum pressure intensities at the base. **07**
- (b) Two wheel load 25 kN and 15 kN with fixed distance 2 m between them and 15 kN load leading, crosses a simply supported beam of span 8 m from left to right. Draw influence line diagram for shear for and bending moment for a point 3 m from left support and find maximum value of shear force and bending moment. **07**

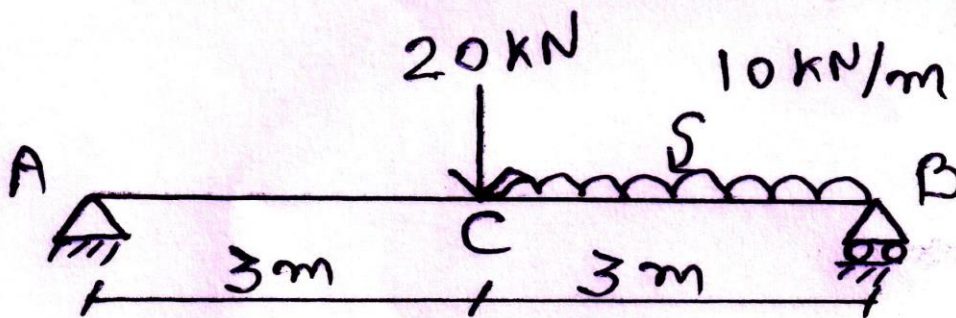


figure: 1 <sup>OR</sup> Q-3 (a) & (b)

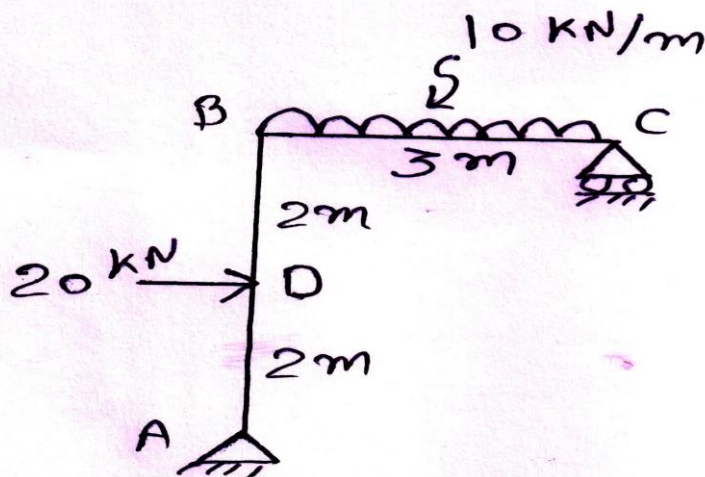


figure: 2 Q-4 (a)