

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-III(OLD) • EXAMINATION – WINTER 2016

Subject Code:130604

Date:07/01/2017

Subject Name:Structural Analysis-1

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) Enlist various framed structures. Differentiate between Grid and Plane frame. **07**
(b) Derive Torsion formula for cantilever circular shaft. **07**

- Q.2** (a) Find Slope at left hand support & Deflection at centre of the beam shown in Fig.1 by Macauli's method. Take $E=2 \times 10^5 \text{ N/mm}^2$ and $I=2 \times 10^8 \text{ mm}^4$. **07**

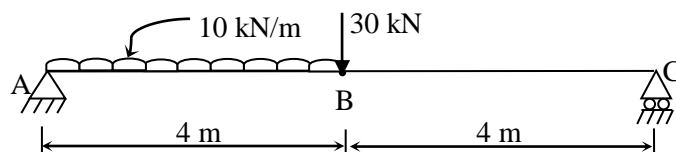


Fig. 1

- (b) Find out all internal forces and draw Shear Force and Bending Moment Diagrams for the plane frame shown in Fig. 2. **07**

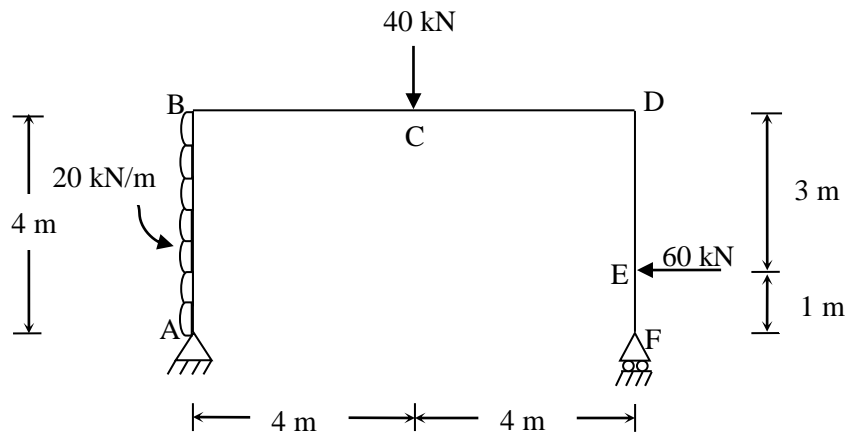


Fig. 2

OR

- (b) Find Deflection at free end of the beam shown in Fig.3 by Conjugate Beam method. Take $E=2 \times 10^5 \text{ N/mm}^2$ and $I=2 \times 10^{10} \text{ mm}^4$. **07**

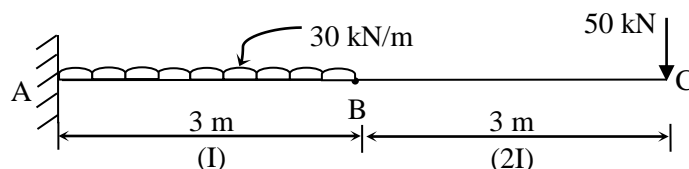


Fig. 3

- Q.3** (a) A three hinged parabolic arch has a span 30 m & central rise 6 m. It carries a point load of 70 kN at 7.5 m from the left hinge. Find out the reactions and draw Bending Moment diagram. Calculate Normal Thrust, Radial Shear & Bending Moment at a section 5 m from right end hinge. Also calculate maximum positive bending moment. **07**

- (b) Derive the equation of strain energy due to bending (Flexure). **07**

OR

- Q.3** (a) A cable of span 120 m and dip 12 m carries a load of 10 kN/m run on horizontal **07**

- span. Find the maximum tension developed in the cable. Find vertical and horizontal forces on top of each pier if the cable passes over smooth rollers on top of the pier. Consider back stay is inclined at 30° to the horizontal. If height of pier is 25 m, find maximum bending moment in the pier.
- (b) A steel rod 60 mm in diameter is 5 m long. An axial load of 120 kN is suddenly applied on it. Find (i) maximum instantaneous stress (ii) maximum instantaneous elongation (iii) work stored in the rod at the instant of maximum elongation considering $E=2 \times 10^5 \text{ N/mm}^2$. **07**
- Q.4** (a) For simply supported beam AB of span 12 m, draw influence line diagrams for (i) Reaction at A (ii) Reaction at B (iii) Shear force at a section 2 m from left, and (iv) Bending moment at a section 4 m from left. Calculate all the influence line ordinates at every 2 m intervals. **07**
- (b) Derive the formula for finding Circumferential and Longitudinal stresses in thin cylindrical shell of thickness 't', diameter 'd' and length 'l' subjected to internal pressure 'p'. **07**
- OR**
- Q.4** (a) A uniformly distributed load of 18 kN/m and length 4 m crosses a simply supported girder of span 12 m from left to right. Draw influence line diagrams for Shear force and Bending moment at 4 m from left support and also find maximum positive Shear force and Bending moment at this section. **07**
- (b) A thin cylindrical shell 24 mm thick, 6 m long and 2.4 m in diameter is subjected to an internal fluid pressure of 3 N/mm^2 . Find the circumferential and longitudinal strains and hence volumetric strain developed in the shell. Consider Poisson's ratio = 0.3 and Modulus of Elasticity = $2 \times 10^5 \text{ N/mm}^2$. **07**
- Q.5** (a) A rectangular column section ABCD having sides $AB = CD = 600 \text{ mm}$ (parallel to X axis) and $BC = AD = 400 \text{ mm}$ (parallel to Y axis) carries a compressive load of 500 kN at corner C. Find stress at each corner and draw stress distribution diagram for each side. **07**
- (b) A hollow circular section having external diameter 300 mm and thickness 30 mm is used as 5 m long column with both ends fixed. Find safe crippling load by Euler's and Rankine's formula. Consider factor of safety = 3, maximum compressive stress = 600 N/mm^2 , modulus of elasticity = $1.5 \times 10^4 \text{ N/mm}^2$ and constant Rankine constant = $1/1600$. **07**
- OR**
- Q.5** (a) A column of T-section with flange dimension 300 mm x 25 mm and web dimension 275 mm x 20 mm is subjected to a load of 150 kN at a point on centroidal axis 30 mm below centroid. Calculate the maximum and minimum stresses induced in the section. **07**
- (b) Derive Euler's formula for column with both ends are hinged. **07**
