

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE SEM-IV Examination-Nov/Dec-2011

Subject code: 140201

Date: 28/11/2011

Subject Name: Mechanics of Deformable Bodies

Time: 02.30 pm -5.00 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) Derive the equation of slope and deflection at any section of the beam of fig. 1. Take $EI = 10^4 \text{ kN-m}^2$. Calculate the slope at section B and the slope and the deflection at section C of the beam. **07**
- (b) A dam 4 m high and 1 m top width has vertical water face. Find the bottom width of the dam if no tension is to develop at the base. Density of masonry is 20 kN/m^3 . **07**

- Q.2** (a) What are the limitations of Euler's formula? **07**
A hollow CI column, hinged at both the ends is 4 m long, its external diameter is 20 cm and internal diameter is 15 cm. Find the safe load it can carry if factor of safety is 4. Take Rankine's constants $a = 1/1600$, $f_c = 550 \text{ N/mm}^2$.
- (b) A hollow shaft 40 cm external diameter and 20 cm internal diameter is subjected to a twisting moment of 4 kN-m. Draw the shear stress distribution across the section. Take $G = 0.8 \times 10^5 \text{ N/mm}^2$. Determine the twist in a length of 4 m. **07**

OR

- (b) A semicircular beam of radius r is fixed at one end and free at the other. It is subjected to a peripheral load (UDL) of w per unit peripheral length. Draw shear force, bending moment and twisting moment diagrams of the beam. **07**

- Q.3** (a) Determine the principle moment of inertia of angle 60X40X6 mm. **07**
- (b) A steel rod of diameter 25 mm is bent in the form of a hook. The ratio of radius of curvature to the radius of rod is 4. The load acts through the centre of curvature. Determine the safe load carried by the hook if the maximum stress is limited to 150MPa. **07**

OR

- Q.3** (a) Find the shear centre for the channel section having web 100X 10 mm and flange 50 X 12 mm. **07**
- (b) A steel ring of 250 mm mean diameter is made up of 50 mm diameter round steel bar. If the maximum stress is limited to 140MPa, and maximum change in diameter is limited to 0.25 mm, find the permissible load that can be applied on the ring. **07**

- Q.4** (a) Determine vertical deflection of Joint C of the truss of fig. 2. Take $AE =$ Constant for all the members. **07**
- (b) A bracket plate of 10 mm thickness is welded to flange of a column as shown in fig. 3. Design the welded joint for the plate. **07**

OR

- Q.4** (a) Using Castigliano's theorem, determine the vertical deflection of joint C of the bent of fig.4 **07**
- (b) Determine the maximum bending moment, maximum twisting moment and maximum shear force in a circular beam of 5.0m diameter supported symmetrically on 4 columns and loaded by UDL of 20.0kN/m. The beam has uniform section throughout. **07**

- Q.5** (a) An angle ISA 65X65X8 mm, is carrying an axial load of 100 kN. Design a bolted or welded connection of angle with 12 mm thick gusset plate **07**
- (b) What is core of section? Derive the core of an I section having flange size 120 X 12 mm and web 226 X 8 mm. **07**

OR

- Q.5** (a) Distinguish between following structures and discuss how they resist the load. (i) Arch, (ii) Cable, (iii) Truss, (iv) frame, (V) Grid **10**
- (b) Derive the torsion formula for shear stress using standard notations. **04**

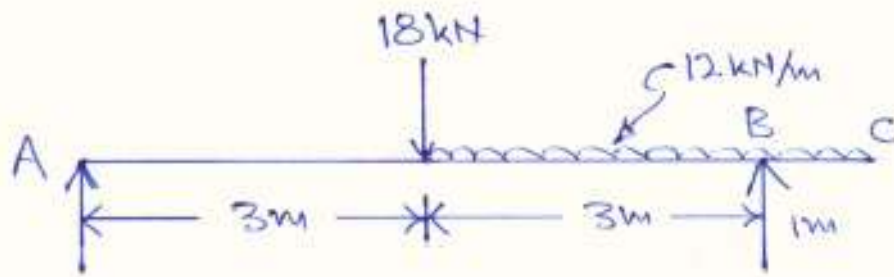


Fig 1. , Q-1 (a)

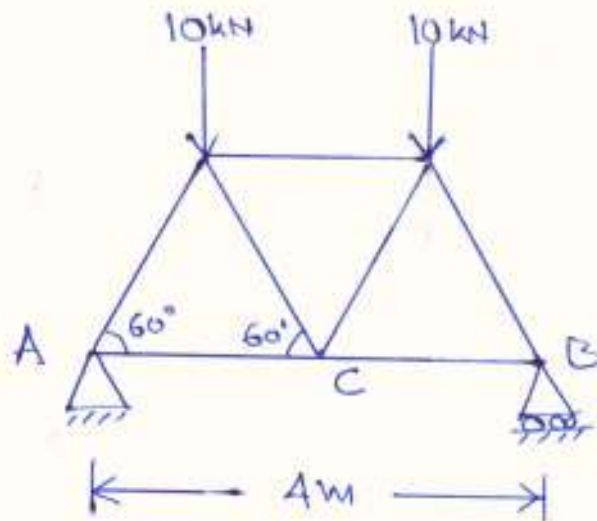


Fig 2. , Q-4 (a)

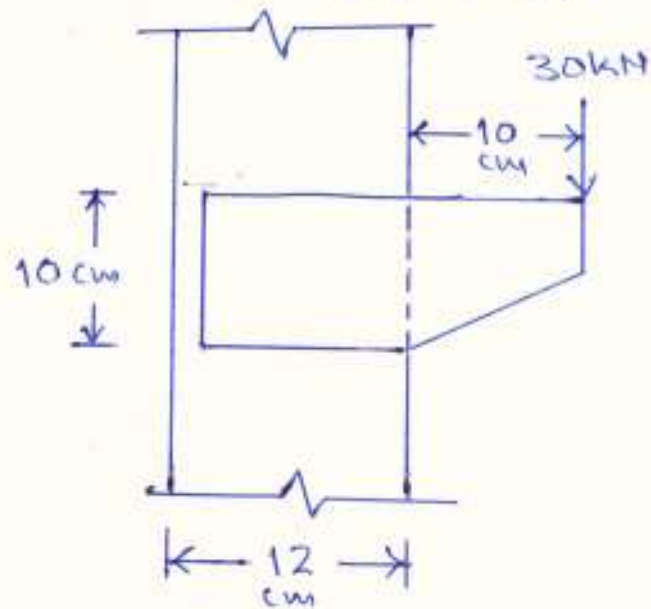


Fig 3. , Q-4 (b)

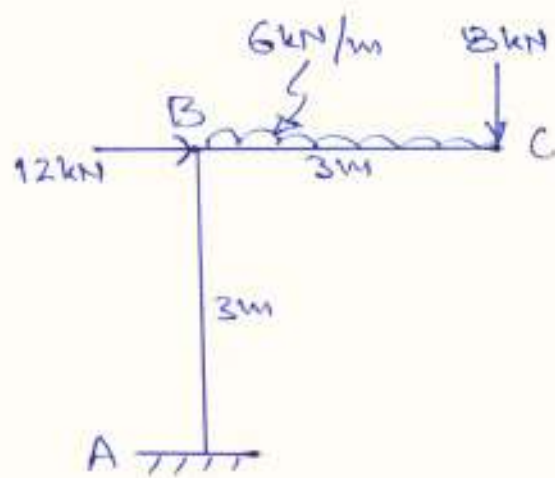


Fig 4., Q-4(a) OR