

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. - SEMESTER – IV • EXAMINATION – WINTER 2012

Subject code: 140201

Date: 28/12/2012

Subject Name: Mechanics of Deformable Bodies

Time: 02.30 pm - 05.00 pm

Total Marks: 70

Instructions:

1. Attempt any five questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

Q:1 (a) Select most appropriate answer (07)

- (i) A hollow shaft of the same cross section area as that of solid shaft can
(a) resist less torque (b) resist more torque (c) resist equal torque
(d) none of these
- (ii) The maximum eccentricity of compressive load acting on a short strut of diameter 'd' without producing tension at the base section is
(a) d/2 (b) d/4 (c) d/6 (d) d/8
- (iii) The equivalent length of a column fixed at both ends is
(a) 0.7 L (b) 0.5L (c) L (d) 2L
- (iv) In a curved beam subjected to pure bending the neutral axis
(a) passes through the centroid of the section (b) is shifted towards the centre of curvature (c) is shifted away from the centre of curvature (d) None of these
- (v) The equivalent bending moment under combined action of moment M And torque T is
(a) $\sqrt{M^2 + T^2}$ (b) $1/2[\sqrt{M^2 + T^2}]$ (c) $M + \sqrt{M^2 + T^2}$ (d) $1/2[M + \sqrt{M^2 + T^2}]$
- (vi) Castigliano's theorem is valid for
(a) truss (b) beam (c) linear structure (d) elastic structure
- (vii) In curve beam ,the stress is zero at
(a) centroidal axis (b) neutral axis (c) bottom face (d) none of these

(b) Write assumption made in theory of pure torsion. (07)

A steel shaft of 100 mm diameter transmits 105 kW at 160 rpm, find the torque on the shaft and maximum shear stress induced. Find also the twist of the shaft in a length of 6 m. Take $C = 8 \times 10^4 \text{ N/mm}^2$.

Q:2 (a) A masonry chimney 20 m high of uniform circular section, 5 m external diameter and 3 m internal diameter has to withstand a horizontal wind pressure of intensity 2 kN/mm^2 on the projected area. Find the maximum and minimum stress intensities at the base. Take unit weight of masonry as 21 kN/mm^3 (07)

(b) (i) Explain terms (a) Torsional rigidity (b) Core of section (03)

(ii) A hollow shaft is subjected to a torque of 40 kNm and a bending moment of 30 kNm, the internal diameter of the shaft is one half the external diameter. If the maximum shear stress is not to exceed 80 MN/m^2 , find the diameter of the shaft . (04)

OR

(b) (i) Enlist various conditions for the stability of a dam. Explain any two in detail. (03)

(ii) A rectangular pier is subjected to a compressive load of 450 kN as shown in fig.1. Find the stress intensities at four corners of the pier. (04)

Q:3 (a) Distinguish between (i) Framed and Grid structure (ii) Arch and Cable (04)

- (b) A horizontal beam carries two concentrated load as shown in fig.2. Calculate the deflections of the beam at C and D using Macaulay's method. $E = 200 \text{ GPa}$
 $I = 160 \times 10^6 \text{ mm}^4$ (10)

OR

- Q:3(a) Define conjugate beam. Give relation between actual beam and conjugate beam (04)
 (b) Determine the horizontal deflection at A, of truss Shown in fig.3 using unit load method. AE is same for all members. (10)

- Q:4(a) Write applicability of Euler theory and limitations of Euler's formula. Derive Euler's formula when both ends of column are hinged. (07)
 (b) A 1.5 m long column has a circular cross-section of 50 mm diameter one end of column is fixed and the other is free. Taking factor of safety 3, calculate the safe load using (i) Rankine-Gordon formula; take yield stress 560 N/mm^2 and $a = 1/1600$ for pinned end. (ii) Euler's formula; $E = 120 \text{ GN/m}^2$. (07)

OR

- Q:4(a) A curve bar of square section $75 \text{ mm} \times 75 \text{ mm}$ and of mean radius of curvature 112.5 mm is initially unstressed. If a bending moment of 7500 Nm is applied to the bar and tends to straighten it, find the stresses at the inner and outer faces. Draw also stress distribution diagram (07)
 (b) What do you mean by beam curved in plan? Explain various internal forces induced in beam curved in plan. Give practical application of this type of beam. (07)

- Q:5(a) Explain various mode of failure of riveted connection (03)
 (b) Write advantages and disadvantages of welded joints (04)
 (c) A masonry retaining wall of trapezoidal section is 10m high and retains earth which is level up to the top. The width at top is 2m and at the bottom 8m. Find maximum and minimum intensities of stresses at the base. Weight of earth $= 16 \text{ kN/m}^3$; weight of masonry $= 24 \text{ kN/m}^3$; Angle of repose of earth $= 30^\circ$. (07)

OR

- Q:5(a) Explain the theory of bending of curved beam with large initial curvature. (07)
 (b) Find the principal moment of inertia if an angle section shown in fig.4 (07)

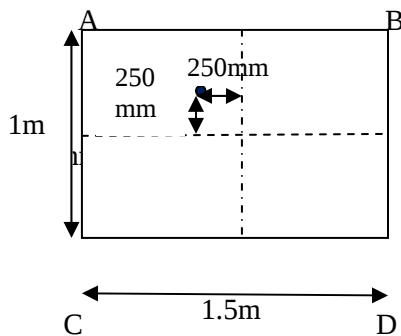


Fig.1 Q:2(b) OR

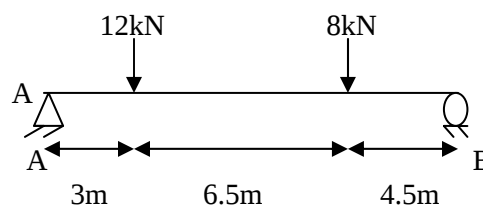


Fig.2 Q: 3(b)

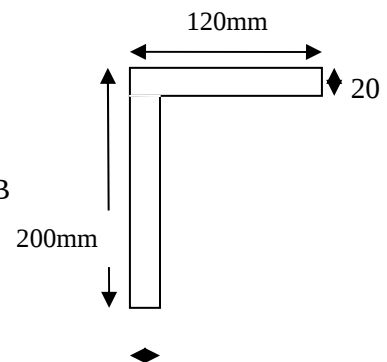


Fig.4 Q:5(b)OR

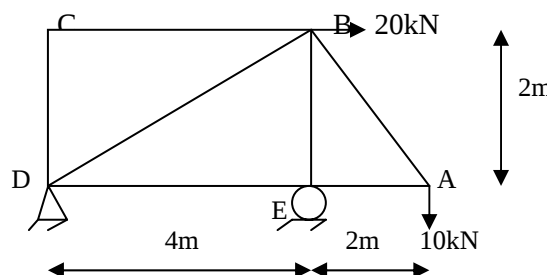


Fig3 Q:3 (b) OR