B Seat No.: _____ Enrollment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER IV EXAMINATION – SUMMER 2015

Subject Code: 140201 **Date: 05/06/2015**

Subject Name: Mechanics of Deformable bodies

Time: 10.30am-01.00pm **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)** Determine the diameter of a solid shaft which will transmit 300 kW at 250 rpm. The maximum shear stress allowed is 30 N/mm^2 and twist should not be more than 1^0 in a shaft length of 2 m. Take modulus of rigidity = 1 x 10^5 N/mm^2. **07**

(b) Explain limit of eccentricity and core of a section. Draw 'core' for Rectangular and Circular section. **07**

Q.2 **(a)** Derive general equation of torsion with usual notations. Write the assumptions made in derivation. **07**

(b) A short column of rectangular cross section 80 mm x 60 mm carries a load of 40 kN at a point 20 mm from the longer side and 35 mm from the shorter side. Find maximum and minimum stresses in the section. **07**

OR

(b) A tie rod of circular cross section is subjected to a tensile force of 20 kN. The force is acting with eccentricity of 4 mm. Calculate the diameter of the rod if maximum tensile stress in the rod is not to exceed 150 MPa. **07**

Q.3 **(a)** Determine slope and deflection at the free end of a cantilever beam, having span of 3 m and loaded with u.d.l. 12 kN/m throughout length, using first principle of double integration. Take EI = 20,000 kN.m^2 **07**

(b) A beam simply supported over a span of 6 m is carrying a point load of 50 kN at 1.2 m from right hand support. Find the position and amount of maximum deflection. Also calculate deflection at mid span. Take EI = 20,000 kN.m^2 **07**

OR

Q.3 **(a)** A masonry wall, 5m high of solid rectangular section, 3 m wide and 1 m thick. A horizontal wind pressure of 1.2 kN/m^2 acts on 3 m side. Find maximum and minimum stress induced on the base, if unit weight of masonry is 22.4 kN/m^3. **07**

(b) Calculate vertical and horizontal displacements of point C for a rigid cantilever frame shown in Fig. 1. **07**

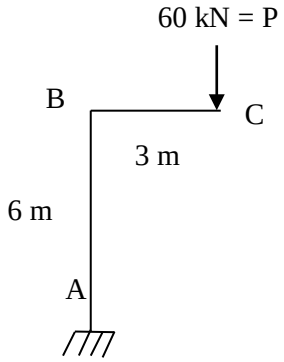

Fig. 1

Q.4 **(a)** Derive an expression for Euler's crippling load for a long column with both ends of column fixed. **07**

(b) A 1.5 m long column has a circular cross section of 5 cm diameter. One of the ends of the column is fixed and other end is free. Taking factor of safety as 3, Calculate safe load using, **07**

(a) Rankine's formula, take yield stress as 560 N/mm^2 and a = 1/5600

(b) Euler's formula, Young's modulus for CI = 1.2×10^5 N/mm^2

OR

Q.4 **(a)** What is shear centre? Show approximate location of shear centre of rectangular and channel section. **04**

(b) A beam circular in plan is loaded with u.d.l. of 140 kN/m inclusive of self weight. The radius of beam is 5 m. The beam is supported by six symmetrically placed columns. Draw S.F., B.M. and T.M. diagram for one of the spans. **10**

Q.5 **(a)** Determine (i) position of neutral axis and (ii) maximum and minimum stresses when a curved beam of circular section of diameter 100 mm is subjected to pure bending moment of +11.5 kN. The radius of curvature is 100 mm. **07**

(b) A hook of circular section 25 mm diameter and radius of curvature of central axis 25 mm carries a load of 5 kN. Calculate the maximum tensile and compressive stress in the hook. **07**

OR

Q.5 **(a)** Give the difference between riveted and welded joints. **04**

(b) Double riveted lap joints are made in following two ways: **10**

(1) Diameter of rivets = 2 cm, pitch of rivets = 6 cm

(2) Diameter of rivets = 3 cm, pitch of rivets = 8 cm

If σ_t = 120 N/mm^2, τ = 90 N/mm^2 and σ_c = 160 N/mm^2, find out which joint has higher efficiency. The thickness of plate is 1.2 cm in each case.

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