Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC- SEMESTER–II - EXAMINATION – SUMMER 2017

Subject Code: X20603 **Date:03/06/2017**

Subject Name: STRUCTURAL ANALYSIS - I

Time: 10:30 AM to 01:00 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)** Compare the crippling loads given by Euler's and Rankine's formula for a tubular steel strut 2.3m long having outer and inner diameters 38mm and 33mm respectively, loaded through pin joints at each end. Take the yield stress as 335 N/mm^2, the Rankine's constant = 1/7500 and E = 0.205 X 10^6 N/mm^2. For what length of strut of this cross section does the Euler's formula cease to apply? **07**

(b) A masonry retaining wall trapezoidal in section with one face vertical is 1m wide at top and 3m at the base and 8m high. The material retained on the vertical face exerts a lateral pressure varying from zero at top to 25 kN/m^2 at the base. If the unit weight of masonry is 21 kN/m^2, calculate the maximum and minimum stress intensities induced in the base. **07**

Q.2 **(a)** Find out S.I. and K.I. for the structures as shown in figure-1 (a) and (b) below. **04**

(b) Write assumptions made by Euler for deriving critical load for long columns. **03**

(c) Analyze the plane frame as shown in Figure-2 below. Draw shear force, bending moment and axial force diagrams. **07**

Q.3 **(a)** For the simply supported beam shown in Figure-3, find (i)slope at each end (ii)deflection at C and D (iii) maximum deflection by Macaulay's method. Take E = 200 kN/mm^2, I = 6.5 x 10^8 mm^4. **07**

(b) Find out θ_B, θ_C , y_B, y_C for the beam shown in Figure -4 by Moment area method. Take E = 2 x 10^5 N/mm^2, I = 5 x 10^8 mm^4. **07**

Q.4 **(a)** A suspension bridge cable hangs between two points A and B separated horizontally by 120m and with A 20 m above B. The lowest point in the cable is 4m below B. the cable supports a stiffening girder which is hinged vertically below A, B and lowest point in the cable. Find the position and magnitude of the largest bending moment which a point load of 10 kN can induce in the girder together with the position of load. **07**

(b) Four wheel loads of 6, 4, 8 and 5 kN cross a girder of 20 m span, from left to right followed by and u.d.l. of 4 kN/m and 4 m long with the 6 kN load leading. The spacing between the loads in the same order are 3m, 2m and 2m. The head of the u.d.l. is at 2m from the last 5 kN load. Using influence lines, calculate the S.F. and B.M. at a section 8m from the left support when the 4 kN is at centre of the span. **07**

Q.5 **(a)** A 450 kW power has to be transmitted at 100 R.P.M. Find (i) the necessary diameter of solid circular shaft, (ii) the necessary diameter of circular section, the inside diameter being ¾ of the external diameter. Allowable shear stress = 75 N/mm^2 and the density of material = 77 kN/m^3. **07**

(b) A load of 200 N falls through a height of 35 mm on to a collar rigidly attached to the lower end of the vertical bar 2 m long having 25 mm radius. The upper end of the bar is fixed. Find (i) maximum instantaneous stress induced in the bar (ii) elongation in the bar (iii) strain energy stored in the bar. Take E = 200 N/mm^2. **07**

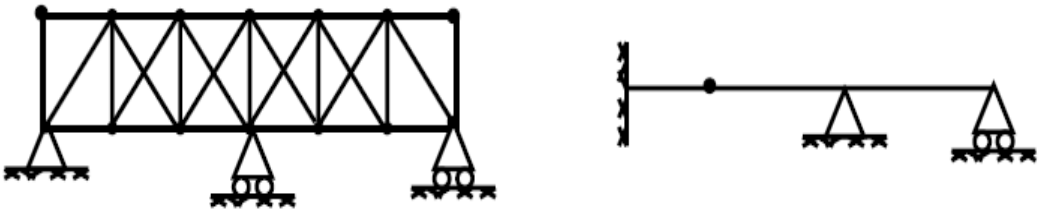
Q.6 **(a)** A closed cylindrical vessel of length 3 m, diameter 600 mm and thickness 10 mm **07**

is subjected to internal pressure of 1.4 N/mm^2. Calculate longitudinal stress, hoop stress, change in length and change in diameter. Take Poisson's Ratio = 0.20 and E = 205 GPa.

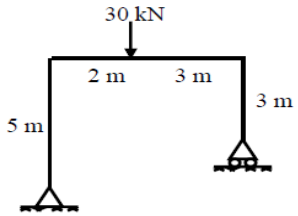
(b) Define : (i) Core of a section (ii) Proof resilience (iii) Thin cylinder (iv) Strut (v) Modulus of resilience (vi) Eccentricity (vii) Strain Energy **07**

Q.7 **(a)** Derive equation for longitudinal and hoop stress for thin cylindrical shell subjected to internal pressure 'p'. **07**

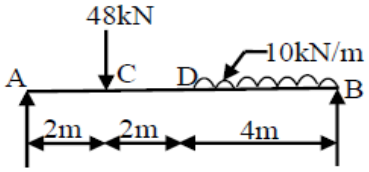
(b) The stiffness of a close collide helical spring is 2 N/mm of compression under a max load of 70 N. The maximum shearing stress produced in wire of spring is 120 N/mm^2. The solid length of spring (when the coils are touching) is 60 mm. Find (i) diameter of wire (ii) mean diameter of coil and (iii) number of coils required. **07**



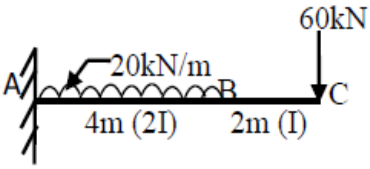
Q.2 (a) Fig.-1 (a) and (b)



Q.2 (c) Fig.-2



Q.3 (a) Fig.-3



Q.3 (b) Fig.-4

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