Seat No.: ________ Enrolment No.___________

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER–II • EXAMINATION – WINTER • 2014

Subject Code: X20603 Date: 01-01-2015

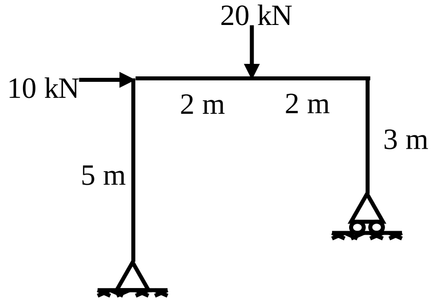
Subject Name: Structure Analysis - I

Time: 02:30 pm - 05:00 pm Total Marks: 70

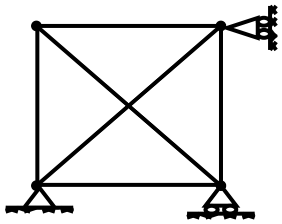
Instructions:

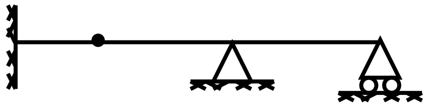
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Analyze the structure as shown in Figure below. Draw shear force, bending moment and axial force diagrams. **07**



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





(c) Define ILD and state significance of ILD in the analysis of structures. **03**

Q.2 **(a)** A cantilever beam having span 5 m is loaded with u.d.l. of 10 kN/m over entire span. Calculate, slope and deflection at free end of beam if E = 200 GPa and I = 10×10^8 mm^4. **07**

(b) A simply supported beam of span 9 m carries two concentrated point loads of 100 kN and 80 kN at a distance of 2 m and 8 m from left hand support respectively. Calculate deflection under the loads using Conjugate Beam Method. Take E = 2×10^5 N/mm^2 and I = 150×10^6 mm^4 **07**

OR

(b) Calculate slope at ends and deflection at mid-span for a simply supported beam of span 5 m and carrying u.d.l. of 10 kN/m over entire span. Take Flexural rigidity = 9×10^3 kN m^2. **07**

Q.3 **(a)** A hollow cast iron column has outside diameter of 200 mm and thickness of 20 mm. It is 4.5 m long and fixed at both ends. Calculate safe load by Rankine's formula using a factor of safety of 4. Calculate the ratio of Euler's and Rankine's loads. Take E = 8×10^4 N/mm^2, f_c = 550 N/mm^2 and Rankine's Constant = 1/1600 **07**

(b) A closed cylindrical vessel of length 3.2 m, diameter 800 mm and thickness 12 mm is subjected to internal pressure of 1.2 Mpa. Calculate longitudinal stress, hoop stress, change in length and change in diameter. Take poisson's Ratio = 0.25 and E = 200 GPa. **07**

OR

Q.3 **(a)** Derive generalized formula for torsion of circular shaft (with usual notations). **07**

$$\frac{T}{J} = \frac{\tau}{R} = \frac{C\theta}{L}$$

(b) A hollow shaft of diameter ratio of 3/8 is to transmit 375 kW power at 100 rpm. The maximum torque being 20% greater than the mean and shear stress is not to exceed 60 N/mm^2 and twist in a length of 4 m is not to exceed 2 degrees. Calculate external and internal diameter. Modulus of rigidity = 8.5 x 10^8 N/mm^2 **07**

Q.4 **(a)** A three hinged parabolic arch carries a u.d.l. of 20 kN/m on the left half of span. The arch has a apan of 16 m and central rise of 3 m. Calculate support reactions and maximum positive bending moment in the arch. **07**

(b) A masonry dam 8 m high, 1.5 m wide at top and 5 m wide at bottom retains water up to a depth of 7.5 m, the water face of the dam being vertical. Find maximum and minimum stress intensities at the base. The unit weight of water is 9810 N/m^3 and unit weight of masonry is 22000 N/m^3. **07**

OR

Q.4 **(a)** Define: (i) Strain Energy (ii) Proof Resilience (iii) kernel of a section **03**

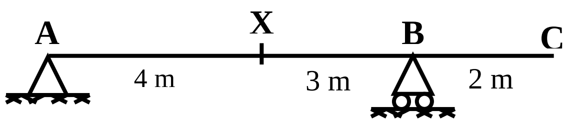
Q.4 **(b)** Draw neat sketch of kernel of the following cross sections. **04**

(i) rectangular section 250 mm x 400 mm
(ii) Circular section of 400 mm diameter

Q.4 **(c)** A load of 100 N falls through a height of 20 mm on to a collar rigidly attached to the lower end of the vertical bar 1.5 m long and of 150 mm^2 cross sectional area. 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.5 **(a)** A u.d.l. of 6 kN/m and 3 m in length passes a simply supported beam of 10 m span from left to right. Draw ILD for shear force and bending moment at a section 4 m from left end support. Also calculate maximum values of shear force and bending moment at section. **07**

(b) Draw ILD for for V_A , V_B , V_X and M_X for an overhanging beam as shown in figure below. **07**



OR

Q.5 **(a)** A concrete column having cross-sectional dimension 300 mm x 400 mm is loaded by a point load 100 kN acting eccentrically at 50mm distance from center along one of the diagonals. Find out the stress at all four corners. **07**

(b) A symmetrical three hinged circular arch has a span of 16 m and a central rise of 4 m. It carries a point load of 20 kN at 4 m from left hand support. Calculate reactions at support and bending moment under the load. **07**

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