Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC– SEMESTER II– • EXAMINATION –WINTER- 2016

Subject Code: X20603 **Date:04/01/2017**

Subject Name: Structural Analysis-I

Time:02:30 PM to 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)** Define Static Indeterminacy and Calculate S.I. and K.I. for structures shown in figure-1. **07**

(b) Define the following terms: **07**

1] Kinematic indeterminacy 2] Slenderness Ratio
3] Proof resilience 4] Strain energy
5] Influence Line Diagram 6] Core/Kernel of a Section
7] Radius of Gyration

Q.2 **(a)** Calculate slope at supports and deflection under '**C**' for beam shown in figure-2 Use Macaulay's method. EI=2000 kNm^2. **07**

(b) 1) State the theorems of moment area method. **07**
2) Draw the S.F and B.M diagram for the frame loaded as shown in the figure-3.

OR

(b) Derive fundamental relation between slope, deflection and radius of curvature. **07**

Q.3 **(a)** Using Macaulay's method, Calculate slope and deflection at free end for cantilever beam subjected to Point load 'W' at free end. **07**

(b) Using Conjugate beam Method, Calculate slope and deflection under 10kN load for a cantilever beam shown in figure-4. Take E= 2 x 10^5 and I = 50 x 10^5 mm^4. **07**

OR

Q.3 **(a)** A cylindrical shell 3.5 m long which is closed at the ends has an internal diameter of 1.2 m and wall thickness of 15 mm. Calculate the circumferential and longitudinal stresses induced if it is subjected to an internal pressure of 2 N/mm^2. Take E=2x10^5MPa & μ=0.3. **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 in direction and position and other end is free. Calculate the safe load using : (a) Rankine's formula, the yield stress, σ_c = 560 N/mm^2 and α = 1/1600 for pinned ends. (b) Euler's formula. $E_{C.I.}$= 1.2 X 10^5 N/mm^2. **07**

Q.4 **(a)** A thin seamless spherical shell of 1.5m dia. and 10mm thick is filled with a liquid, so that the internal pressure is 2 N/mm^2. Determine the increase in diameter & capacity of the shell. Take E=2x10^5 Mpa & 1/m=0.3. **07**

(b) A weight of 250 N falls by 25 mm on a collar rigidly attached to lower end of a vertical bar 3 m long and 300 mm^2 in section. The upper end of the vertical bar is fixed. Find maximum instantaneous stress, maximum instantaneous elongation and strain energy. Take E = 2 × 10^5 N/mm^2. **07**

OR

Q.4 **(a)** Draw Influence Line diagram for forces in member U_2L_2, L_2L_3 & U_2L_3 for the truss shown in the Figure - 5. **07**

(b) Two wheel loads of 15 kN & 20 kN are 2m apart, cross a beam of 10m span. Draw the influence line for B.M & S.F for a point 4m from the left support & find the maximum B.M & S.F at this point. **07**

Q.5 **(a)** A 50 mm diameter steel shaft of length 1200 mm is used to transmit 100 kW between a motor and a pump. Determine the lowest speed of rotation at which shear stress does not exceed 80 MPa and angle of twist does not exceed 2º. **07**

(b) A hollow shaft has to transmit 300kW power at 80 rpm. If the shear stress is not to exceed 60 N/mm2 and internal diameter is 60% of the external diameter, find the external and internal diameters when maximum torque is 1.4 times the average torque. G= 8 x 104 N/mm^2. **07**

OR

Q.5 **(a)** Find the vertical & horizontal deflections of the joint C of the Truss loaded as shown in figure - 6. The c/s areas of members CD & DE are each 2500mm^2 & those of other members are each 1250mm2. Take E=200 GPa. **07**

(b) A symmetrical three hinged circular arch of span 40 m and rise 8m carries uniformly distributed load of 30 kN/m over the left half of the span. The hinges are provided at the support and centre of the arch. Calculate the bending moment, radial shear and normal thrust at a distance of 10m from the left support. Refer figure – 8. **07**

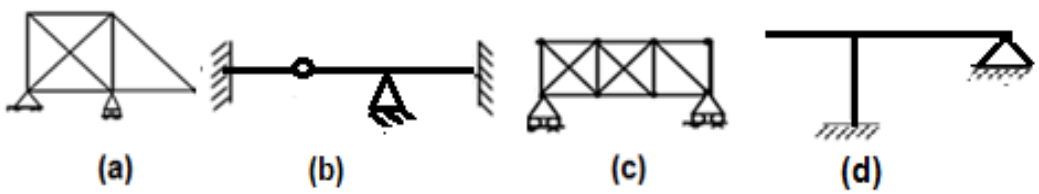

Figure - 1

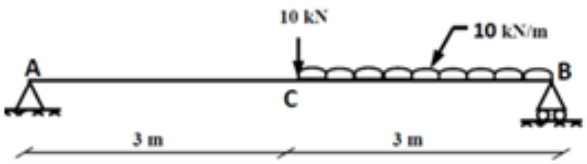

Figure - 2

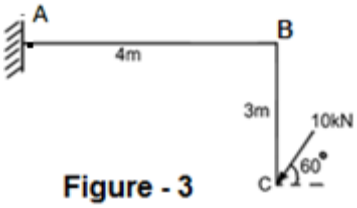

Figure - 3

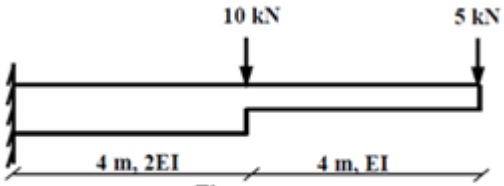

Figure -4

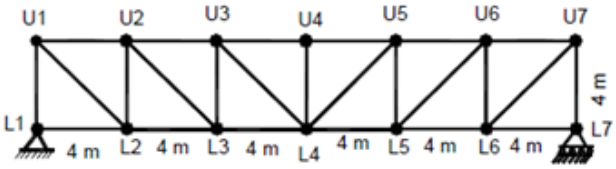

Figure - 5

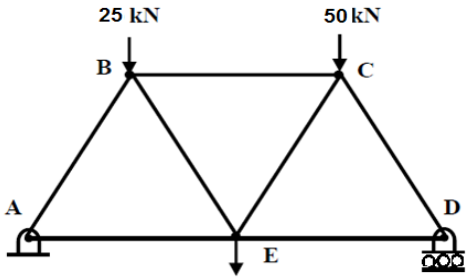

Figure- 7

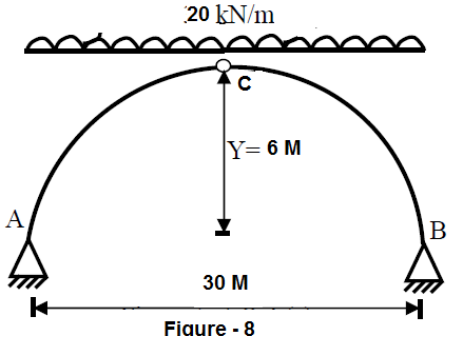

Figure - 8