Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER–II EXAMINATION – SUMMER 2016

Subject Code:X20603 **Date:04/06/2016**

Subject Name:STRUCTURAL ANALYSIS - I

Time:10:30 AM to 01:00 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)** A hollow circular shaft having external diameter 100 mm and internal diameter 75 mm is 2 m long and transmitting 100 kW at 150 RPM. Calculate the shear stress on the external and internal surface of the shaft. Also calculate the angle to twist for the shaft, if G = 80 Gpa. **07**

(b) A shaft shown in Figure -1 is having varying section and is fixed at ends. The value of the torque T applied at the junction B is 15 kN.m. Find the maximum shear stress produced in each part of the shaft. Take modulus of rigidity G = 80 GPa. **07**

Q.2 **(a)** Write assumptions made in the theory of pure torsion and derive torsion equation with figure. **07**

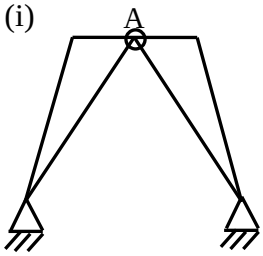
(b) The stiffness of a close collide helical spring is 2 N/mm of compression under a max load of 70 N. The maximum shearing stress produced in wire of spring is 120 N/mm^2. The solid length of spring (when the coils are touching) is 60 mm. Find (i) diameter of wire (ii) mean diameter of coil and (iii)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

OR

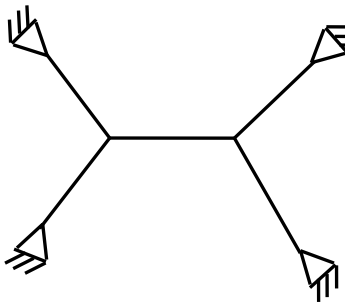
(b) A cylindrical shell 3 m long & 1 m internal diameter is subjected to an internal Pressure of 1 N/mm^2. If the thickness of the shell is 12 mm, find the circumferential & longitudinal stresses. Find also the maximum shear stress & change in dimensions of the shell. **07**

Q.3 **(a)** Find S.I. and K.I of the following. **06**

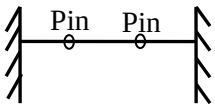
(i)



(ii)



(iii)



(b) Draw S.F.D., B.M.D. and A.F.D. for a frame shown in Figure -2 **08**

OR

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 circular segmental three hinged arch has a span 12 m and central rise of 3.0 m is loaded as shown in Figure-5. Calculate reactions at the hinges and bending moments at the loaded point. **07**

(b) Find the permissible span for a steel cable suspended between supports at the same level, if the central dip $1/10^{th}$ of the span and the permissible stress is 150 N/mm^2. Specific weight of steel = 78 kN/m^3. Assume the cable to hang in a parabolic curve. **07**

OR

Q.4 **(a)** Determine the strain energy of a cantilever beam of span 2 m having size 20 mm width x 60 mm depth. Take E = 200 Gpa. **03**

(i) When 1000 N concentrated load is placed at free end.

(ii) When total 1000 N load is uniformly distributed over the entire span.

(b) What are the Euler's formula for different end conditions of column. **04**

(c) A C.I. column of hollow cylindrical section 5 m long, with ends firmly buit-in, has to carry an axial load of 300 kN. Determine the section using a factor of safety of 8. Internal diameter to be 8/10 of the external diameter. Rankine constants for C.I. are, f_c = 550 N/mm^2 and $\alpha = 1/1600$. **07**

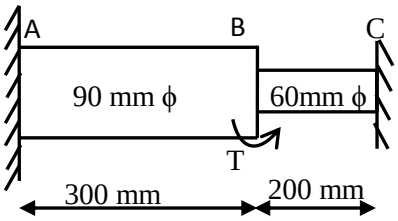
Q.5 **(a)** A simply supported girder has a span 30 m. Six wheel loads 50 kN each, spaced 2m apart cross the girder from left to right. Find maximum B.M. at section 8 m from the left hand support. **07**

(b) Four equal loads of 80 kN each, equally spaced at 2 m apart followed by a uniformly distributed load of 60 kN/m run at a distance 2 m from the last 80 kN load cross a girder of 20 m span from right to left. Using influence lines, calculate maximum S.F. and B.M. at a section 8 m from the left hand support when the leading 80 kN load is 5 m from this support. **07**

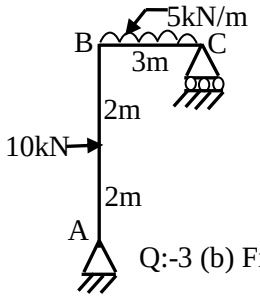
OR

Q.5 **(a)** A masonry dam 6 m high, 3 m wide at base and 1.2 m wide at top, retains water on vertical face for full height. Considering density of masonry as 17 kN/m^3 and density of water as 10 kN/m^3, find out maximum and minimum pressure intensities at the base. **07**

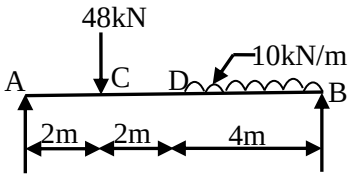
(b) Determine slopes at A and D and deflection at C and D for the overhanging beam as shown in Figure-6. E = 2 x 10^5 N/mm^2, I = 2 x 10^7 mm^4. **07**



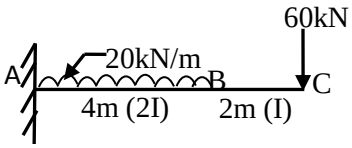
Q:-1 (b) Fig.:-1



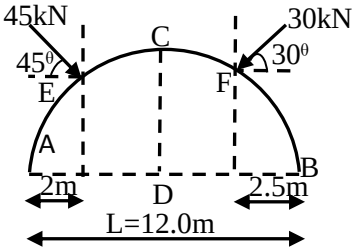
Q:-3 (b) Fig.:-2



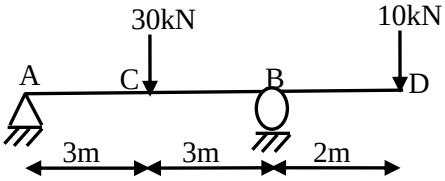
OR Q:-3 (a) Fig.:-3



OR Q:-3 (b) Fig.:-4



Q:-4 (a) Fig.:-5



OR Q:-5 (b) Fig.:-6

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