Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV EXAMINATION – WINTER 2015

Subject Code: 140201 Date:01/01/2016

Subject Name: Mechanics of Deformable Bodies

Time: 02:30pm to 05:00pm 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)** Calculate the diameter of the shaft required to transmit 45kW at 120 rpm. The maximum torque is likely to exceed the mean by 30 % for a maximum permissible shear stress of 55 N/mm^2. Calculate also the angle of twist for a length of 2 meter. G= 80 X 10^3 N/mm^2. **07**

(b) Explain the following stability conditions for retaining wall or dam. **07**

1) No tension at base 2) No overturning

Q.2 **(a)** Derive the torsion formula. **07**

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

(b) A rectangular column of size 30 cm x 50 cm is acted upon by compressive force of 900 KN at an eccentricity of 'e' cm from C.G on axes parallel to 50 cm side. Find the eccentricity, if maximum tensile stress not to exceed by 4.8 N/mm^2. Also find the maximum resultant stress in column. **07**

OR

(b) A hollow circular column having 200 mm external diameter and 120 mm internal diameter is subjected to an eccentric load 'P' kN due to which maximum and minimum stress developed at the base of column are 100 N/mm^2 and 20 N/mm^2 respectively. Find out the value of load 'P'. **07**

Q.3 **(a)** A metallic cantilever beam 150 mm x 200 mm and 2 meter span carries a uniformly varying load of 50 kN/m at free end of 150 kN/m at fixed end. Find slop and deflection at the free end. Take E = 100 GPa. **07**

(b) A beam 6 meter long is subjected to two couples as follows: **07**

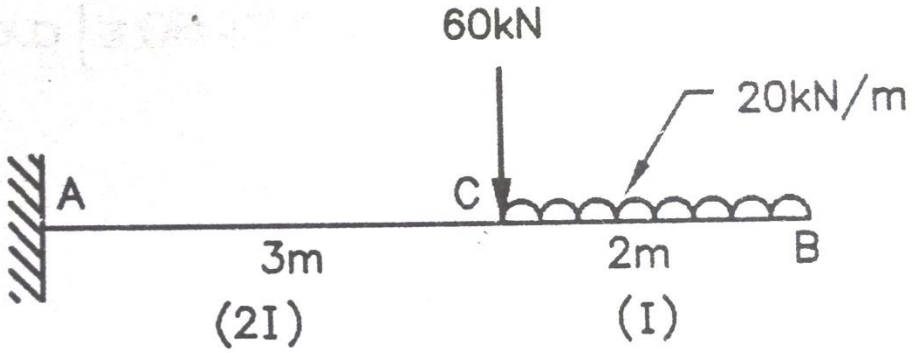
1) A clockwise couple 200 kN. m at a distance of 2 meter from the left end.
2) An anticlockwise couple of 80 kN.m at a distance of 4 meter from the left end.

Find the deflection at the point of application of the couples. Take EI=41500 $kN.m^2$.

OR

Q.3 **(a)** A masonry dam 6 meter high, 3 meter wide at base and 1.2 meter 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 presser intensities at the base. **07**

(b) Determine deflection at B and slop at C for a cantilever beam shown in figure. EI = 10 X 10^4 $kN.m^2$. **07**



Q.4 **(a)** Explain the followings : **07**

1) Effective length of column for different end conditions.
2) Limitation of Euler's formula.

(b) Compare the strength of solid circular column and hollow circular column using Euler's formula. For hollow circular column internal diameter is 7/10 times the external diameter. Both the columns have same cross-sectional area, length and material and hinged at both ends. **07**

OR

Q.4 **(a)** Explain centroidal principal axes of a section. **07**

(b) A curved beam circular in plane symmetrically supported on six columns has radius 4 meter. The beam carries a uniformly distributed rod of 2 kN/m, including self-weight of beam. Determine the shear force, bending moment and twisting moment at important location and plot S.F., B.M. and T.M diagrams. **07**

Q.5 **(a)** A curved beam of rectangular cross section 20mm x 40 mm is subjected to pure bending with couple of 400 N.m . The mean radius of curvature is 50 mm. Find the maximum and minimum stress. Also find the position of the neutral axis. Sketch the bending stress variation across the section. **07**

(b) A Crane hook whose horizontal cross section is trapezoidal 50 mm wide at inner side, 25 mm wide at outer side and 50 mm thick carries a load P kN whose line of action is 60 mm from the inside edge of the section. The center of curvature is 50 mm from the inside edge. If maximum tensile stress in the hook material is 67.68 MPa, calculate the value of load P. **07**

OR

Q.5 **(a)** Write down the types of riveted joint and explain with neat sketch. **07**

(b) Two plates 300 mm x8 mm are single riveted and joined by double cover butt joint using 20 mm diameter rivets. Pitch of rivet is 80 mm. **07**

τ = 100 N/mm^2

σ_c = 200 N/mm^2

σ_t = 100 N/mm^2

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