

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- IVth SEMESTER-EXAMINATION – MAY/JUNE- 2012****Subject code: 140201****Date: 25/05/2012****Subject Name: Mechanics of Deformable Bodies****Time: 10:30 am – 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) Derive relation between slope, deflection and radius of curvature **07**
(b) A hollow circular shaft having external diameter 150 mm & internal diameter 100 mm. It is 4 m long & transmitting 200 kW power at 200 rpm. Calculate the shear stress on the external & internal surface of the shaft. Also calculate the angle of twist for the shaft if $G = 100 \text{ GPa}$ **07**

- Q.2** (a) A simply supported beam is loaded as shown in the fig.1. Determine the deflection under B and C using Macaulay's method. **07**
(b) Derive the basic equation of Torsion with usual notation. Give two practical application of structure subjected to torsion. **07**

OR

- (b) Analyze the circular beam in plan intercepting the central angle 2θ (or semi central angle: θ), fixed at ends and subjected to point load: W at mid span as shown in Fig.2. **07**

- Q.3** (a) A simply supported beam is loaded as shown in the fig.3. Determine the deflection under the point load by conjugate beam method. **07**
(b) A 3.0 m long column has a hollow circular cross-section of 150 mm external diameter and 100 mm internal diameter. One of the ends of the column is fixed in direction and position and other end is hinged. Taking factor of safety as 3, calculate the safe load using
(i) Rankine's formula. Take yield stress $f_c = 550 \text{ N/mm}^2$ and $\alpha = 1/1600$ **07**
(ii) Euler's formula. Young's modulus for C.I. $= 1.3 \times 10^5 \text{ N/mm}^2$.

OR

- Q.3** (a) Find the shear centre for the channel section having web 100X 10 mm and flange 50 X 10 mm. **07**
(b) A trapezoidal masonry dam is 12.0 m high and 3.0 m wide at top and 9.0 m at bottom. It retains water up to 10.0 m height on its vertical face. Find maximum and minimum resultant stress induced at the base of the section. Draw stress distribution diagram. **07**

- Q.4** (a) Derive Euler's formula for crippling load if both ends of columns are fixed. Also state limitation of Euler's formula. **07**
(b) A beam of a rectangular section 120 mm wide by 200 mm deep is subjected to bending moment of 24 kN-m. The trace of the plane of loading is inclined at 30° to y-y axis of the section. Locate the neutral axis of the section & Calculate the maximum bending stress induced in the section. **07**

OR

Q.4 (a) Determine the maximum bending moment, maximum twisting moment and maximum shear force in a circular beam of 6.0m diameter supported symmetrically on 4 columns and loaded by UDL of 15.0kN/m. The beam has uniform section throughout. **07**

(b) A single riveted double cover butt joint in plate 16mm thick is made with 23.5mm finished diameter rivets at a pitch of 100mm. If the allowable tensile stress 150 N/mm^2 , bearing stress 300 N/mm^2 , and shearing stress 100 N/mm^2 . Find the efficiency of the joint. **07**

Q.5 (a) Define term riveted joint. Describe different types of failure of a riveted joint. **04**

(b) A masonry pier 2 m x 3 m supports a vertical load of 500 kN at an eccentricity of 1 m in both the directions. Find the stresses at the corners of the piers and draw the stress distribution diagram. What additional load should be applied at the centre of the pier so that there is no tension anywhere in the pier section. **10**

OR

Q.5 (a) Differentiate riveted and welded connections. **04**

(b) A beam of square section is subjected to uniform bending moment 750 N.m. If the cross section the beam is 60 mm x 60 mm. Find maximum & minimum stress for the following cases (a) The beam is straight and (b) The beam is curved to a radius of 225 mm along the centroidal axis and bending moment increases the curvature and also find position of Neutral axis. **10**

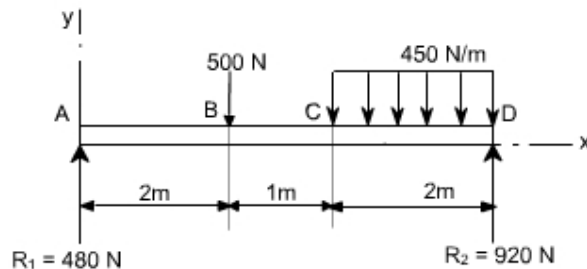


Fig. 1

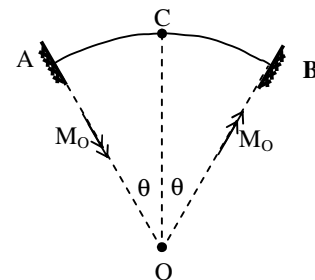


Fig.2

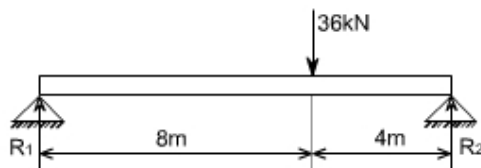


Fig. 3