

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-IV • EXAMINATION – SUMMER • 2014****Subject Code: 140201****Date: 20-06-2014****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)** Select most appropriate answer from options and rewrite the complete sentence **07**
- (1) Torsional Rigidity of a circular shaft is equal to
 - (i) Product of Polar moment of inertia and c/s area
 - (ii) Rigidity modulus
 - (iii) Product of Polar moment of inertia and Rigidity modulus
 - (iv) Polar moment of Inertia
 - (2) In conjugate beam, the loading is the _____ diagram of the actual beam
 - (i) S.F. (ii) B.M. (iii) $M/(EI)$ (iv) Loading
 - (3) The diameter of core of an eccentric loaded circular column is
 - (i) $d/3$ (ii) $d/2$ (iii) $d/4$ (iv) $d/8$
 - (4) Rankine's formula for column is based on
 - (i) Initial curvature of the column (ii) Direct compressive stress
 - (iii) Eccentricity of the load (iv) All of above
 - (5) The minimum pitch of a riveted joint is _____ times the effective diameter of rivets
 - (i) 1.5 (ii) 2 (iii) 2.5 (iv) 3
 - (6) In a _____ welded joint, the parent members are placed side by side
 - (i) Butt (ii) Fillet (iii) Plug (iv) Lap
 - (7) The ratio of equivalent length to original length of a column having both end hinged is _____
 - (i) $\sqrt{2}$ (ii) $1/\sqrt{2}$ (iii) 1 (iv) 2
- (b)** Find the maximum torque that can be safely applied to a shaft of 100 mm diameter. The permissible shear stress and the allowable twist are respectively 200 N/mm^2 and 3° per 10 diameter length of the shaft. Take $G = 1 \times 10^5 \text{ N/mm}^2$. **07**
- Q.2 (a)** (i) Write assumptions made in theory of pure torsion. **03**
 (ii) Derive equation for pure torsion with usual notations. **04**
- (b)** A beam AB of 4 m span is simply supported at the ends and is loaded as shown in fig.1. Determine deflection at D and slope at the end A. **07**
- OR**
- (b)** Determine the horizontal and vertical deflection at joint C of truss shown in fig.2. All members of truss are assumed to have the axial rigidity AE. **07**
- Q.3 (a)** A short column of 200 mm external diameter and 150 mm internal diameter, when subjected to a load the stress measurements indicate that the stress varies from 150 N/mm^2 compressive at one end to 25 N/mm^2 tensile at the other end. Estimate the load and distance of the line of action from the axis if the column. **07**
- (b)** Calculate the safe load given by Rankine's and Euler's formulae for tubular strut 2.25 m long having outer diameter and inner diameter of 37.5 mm and 32.5 mm respectively loaded through pin jointed at both ends. **07**
 Take yield stress as 315 MN/m^2 ; $a = 1/7500$; $E = 200 \text{ GPa}$ and F.O.S = 3

OR

- Q.3 (a)** (i) Write assumptions made in Euler's formula. 03
(ii) Derive Euler's formula for crippling load when both ends of the column are hinged. 04
- (b)** A retaining wall is 3 m wide at the top and 8 m wide at the bottom and is 18 m high and retains earth which is level upto top. It is subjected to earth pressure on the back. If the weight of masonry is 25 kN/m³ and that of earth 16 kN/m³ and the angle of repose of earth be 30°, find the maximum and minimum intensities of pressure on the base. 07
- Q.4 (a)** A simply supported beam AB of span 4 m, carrying a load of 100 kN at its mid span at point C. Beam has c/s moment of inertia $24 \times 10^6 \text{ mm}^4$ over the left half of the span and $48 \times 10^6 \text{ mm}^4$ over right half. Find the slopes at the supports and the deflection under the load. Take $E = 200 \text{ GPa}$. Use conjugate beam method. 07
- (b)** A masonry pier of 4 m x 3 m supports a vertical load of $W = 40 \text{ kN}$ as shown in fig.3. find (i) the stresses developed at each corner of pier (ii) What additional load should be placed at the centre of pier so that there is no tension anywhere in the pier section? (iii) What are stresses at the corners with additional load in centre of pier? 07
- OR**
- Q.4 (a)** A close circular ring made up of 25 mm diameter steel bar is subjected to a pull of 15 kN, the line of action passes through the centre of ring. The mean diameter of ring is 140 mm. Find the maximum value of tensile and compressive stresses in the ring. 07
- (b)** Calculate principal moment of inertia for angle section 80mm x 80mm x 10 mm 07
- Q.5 (a)** (i) Explain various types of riveted joints with neat sketch. 03
(ii) Write advantages and disadvantages of welded joints. 04
- (b)** Design a lap joint to carry a load of 350 kN. The rivets are 2 cm in diameter and placed in a double row. 07
Take $\sigma_t = 150 \text{ MN/m}^2$, $\tau = 100 \text{ MN/m}^2$, $\sigma_c = 246 \text{ MN/m}^2$
- OR**
- Q.5 (a)** Locate the position of shear centre for a thin channel section having total depth of 400 mm, width of flanges 120 mm, thickness of flange 10 mm and thickness of web equal to 6 mm. 07
- (b)** A quarter circular beam curved in plan with radius of circle R. The beam is fixed at one end and free at the other end. It carries a point load P at free end. Draw shear force, bending moment and twisting moment diagrams for the beam. 07


