

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-IV • EXAMINATION – WINTER • 2014****Subject Code: 140201****Date: 29-12-2014****Subject Name: Mechanics of Deformable Bodies****Time: 02:30 pm - 05:00 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)** Fill in the blanks **07**
1. A simply supported beam of length L subjected to central point load W , the maximum deflection is _____.
(a) $WL^3/48EI$, (b) $WL^3/3EI$, (c) $5WL^3/384EI$
 2. The load on a circular column of diameter d for keeping the stress wholly compressive may be applied anywhere within concentric circle of diameter _____.
(a) $d/8$, (b) $d/4$, (c) $d/2$
 3. Polar moment of inertia of solid circular shaft of diameter d is equal to _____.
(a) $\pi d^4/32$, (b) $\pi d^4/64$, (c) $\pi d^3/32$
 4. The Rankine's constant (α) in Rankine's formula is equal to _____.
(a) $E\sigma_c/\pi^2$, (b) $\pi^2 E/\sigma_c$, (c) $\sigma_c/\pi^2 E$
 5. A welded joint as compared to riveted joint has _____.
(a) Less strength, (b) more strength, (c) same strength
 6. A solid shaft of diameter d transmit the torque equal to _____.
(a) $f_s d^3 \pi / 32$, (b) $f_s d^4 \pi / 16$, (c) $f_s d^3 \pi / 16$
 7. A cantilever beam of length L subjected to uniformly distributed load w , the maximum slope occurs at _____.
(a) Support, (b) centre of the beam, (c) free end
- (b)** Draw the sketch of various riveted joints and explain the strength of the riveted joint. **07**
- Q.2(a)** A column has one end fixed and other end hinged with a length of 7m. It is made up of a tube having an external diameter 120mm and wall thickness of 15mm. The permissible strength of material is 410N/mm² and Rankine's constant is 1/4800. Calculate Euler's and Rankine's critical load. Take the modulus of elasticity is 2×10^5 N/mm². **07**
- (b)** A beam circular in plan is loaded with a uniformly distributed load of 120kN/m inclusive of self weight. The radius of the beam is 6m. The beam is supported by six symmetrically placed columns. Draw shear force and bending moment diagram for one of the spans. **07**
- OR
- (b)** Derive the Rankine's formula for Column. **07**
- Q.3(a)** A shaft has to transmit 125kW power at 200rpm. If the shear stress is not to exceed 70MPa and twist in a length of 4m must not exceed 1.5 degrees. Find suitable diameter of the shaft. Take the modulus of rigidity is 8×10^4 N/mm². **07**
- (b)** Find vertical and horizontal displacement at point C for cantilever frame as shown in figure 1. (Use unit load method). **07**
Take $E = 200 \times 10^6$ kN/m² and $I = 10 \times 10^{-6}$ m⁴.

OR

- Q.3(a)** For a simply supported beam shown in figure 2. Find slope at support and deflection at point C & D. (Use Macaulay's method).
Take $E = 200 \times 10^6 \text{ kN/m}^2$ and $I = 6.5 \times 10^{-4} \text{ m}^4$. **07**
- (b)** A solid shaft has to transmit 110kW at 550rpm. Find the diameter of the shaft if the shear stress is to be limited to 95 N/mm^2 . Estimate the possible % saving in the material of the shaft if the hollow shaft of internal diameter is 0.75 times the external diameter is replaced against solid shaft. **07**
- Q.4(a)** Find slope and deflection at the free end of cantilever beam shown in figure 3. (Use Castigliano's first theorem). Take $EI = 10 \times 10^4 \text{ kNm}^2$. **07**
- (b)** Explain the stability condition for the dam. **07**
- OR
- Q.4(a)** Draw core of a rectangular section of size $500 \times 400 \text{ mm}$. **04**
- (b)** A small concrete dam 8m high, 4m wide at base and 1.5m wide at top, retains water on vertical face for full height. Considering density of concrete 25 kN/m^3 and density of water as 10 kN/m^3 , find out the maximum and minimum stress intensities at the base. Also draw the stress diagram. **10**
- Q.5(a)** Explain centroidal principal axes of inertia. **07**
- (b)** A curved beam of circular cross section of 45mm diameter is subjected to pure bending moment of 450 N.m . The mean radius of curvature is 55mm. Calculate the maximum tensile and compressive stress. Also find the position of neutral axis. **07**
- OR
- Q.5(a)** A curved beam of hollow circular cross section of 90 mm external diameters and 5mm thickness. The mean radius of curvature is 140mm. Calculate the maximum tensile and compressive stress if the beam is subjected to pure bending moment 2.5 kN.m . **07**
- (b)** A crane hook whose horizontal cross section is trapezoidal, 60mm wide at the inner side, 35mm wide at outer side and 60mm thick, carries a load P in whose line of action is 60mm from the inside edge of the section. The centre of curvature is 50mm from inside edge. If the maximum tensile stress in the hook material is 70 MPa , calculate the value of load P. **07**

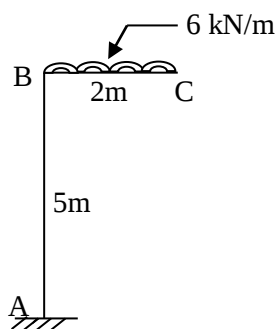


Figure :1, Q.3 (b)

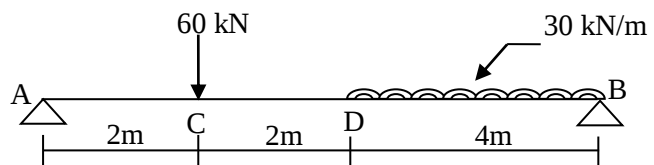


Figure :2, OR Q.3 (a)

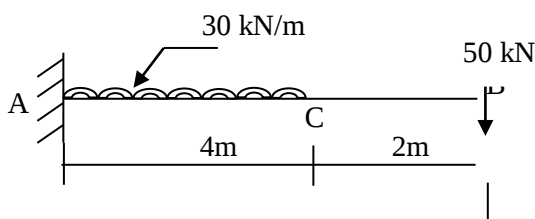


Figure :3, Q.4 (a)
