

GUJARAT TECHNOLOGICAL UNIVERSITY**PDDC - SEMESTER-I • EXAMINATION – WINTER 2013****Subject Code: X11901****Date: 21-12-2013****Subject Name: Strength of Materials****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) Define the following terms in brief **05**
 (1) Ductility (2) Creep (3) Toughness (4) Malleability (5) Hardness
- (b) Explain basic characteristic and stress-strain curve for ductile material (Mild steel) for Tension Test. **05**
- (c) In a tension test on Metal specimen with initial diameter of 20 mm and length of 200 mm, following readings were recorded: **04**
 i) Diameter after failure = 16.5 mm
 ii) Length after failure = 232 mm
 iii) Failure load = 105 kN
 Compute % contraction, % elongation, True stress at failure & engineering stress at failure.
- Q.2** (a) A solid circular steel shaft ($G = 80 \text{ GPa}$), 4 m long transmit 750 kW of power at 350 r.p.m. If the allowable shearing stress is limited to 120 MPa and allowable angle of twist is 0.085 radian, determine the minimum permissible diameter of the shaft. **07**
- (b) For torsion of a circular shaft, Prove with usual notations $\frac{T}{J} = \frac{G\theta}{L} = \frac{\tau}{R}$. Give suitable assumptions made in the above theory also. **07**
- OR**
- (b) Differentiate riveted and welded connections. Illustrate with neat sketches different types of riveted connections. **07**
- Q.3** (a) Define Resilience, Modulus of resilience & strain energy and Derive an expression for strain energy stored in a body when the member is subjected to an axial loading. **07**
- (b) A simply supported beam AB of span 5 m carries a uniformly distributed load 20 kN/m over its entire span. Determine the strain energy stored in the beam. Take $E = 2 \times 10^5 \text{ N/mm}^2$ and $I = 2 \times 10^8 \text{ mm}^4$. **07**
- OR**
- Q.3** (a) Define Shear force & bending moment and derive the relation between them. **07**
- (b) A cantilever beam of 6 m length, contain 20 kN and 30 kN load at 3 m and 6 m respectively from fixed end. And loaded with UDL with an intensity 10 kN/m over an entire span. Draw S.F. and B.M. diagram for the beam. **07**
- Q.4** (a) List the advantages and disadvantages of a fixed beam. And derive the fixed end moment for the beam subjected to centric point load. **07**
- (b) Analyse the fixed beam shown in figure 1. Draw shear force and bending moment diagram. **07**

OR

- Q.4 (a)** Explain (i) Distribution factor (ii) Relative stiffness (iii) Carry over Moment **06**
- (b)** Analyse the continuous beam ABC as shown in figure 2. using Moment distribution method. Draw shear force and bending moment diagram also. **08**
- Q.5 (a)** What are principal planes and principal stresses? **04**
- (b)** For the element shown in the figure 3, find the normal stress, tangential stress and resultant stress on the plane AB. Also, find principal stresses and principal planes. Use any method. **10**

OR

- Q.5 (a)** i. Which points should be take care while using Macaulay's Method. **06**
- ii. State the relation between Rate of loading, shear force, Bending moment, slope and deflection
- iii. Define Conjugate beam theorems
- (b)** Determine Slope and deflection at point C for the cantilever beam as shown in figure 4 using any method. Take $EI = 32000 \text{ kNm}^2$. **08**

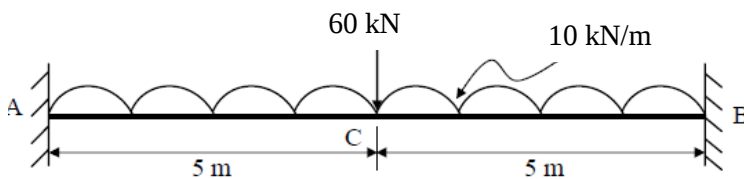


Figure 1

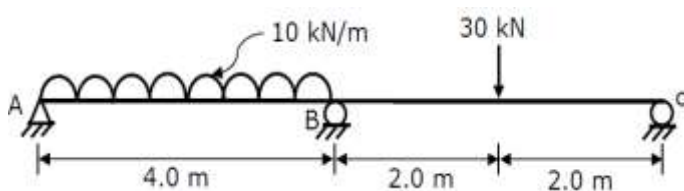


Figure 2

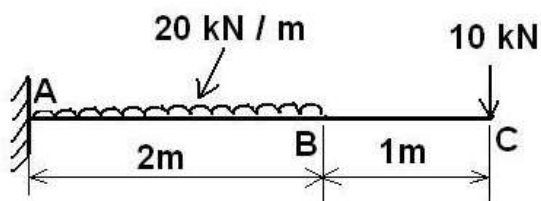


Figure 4

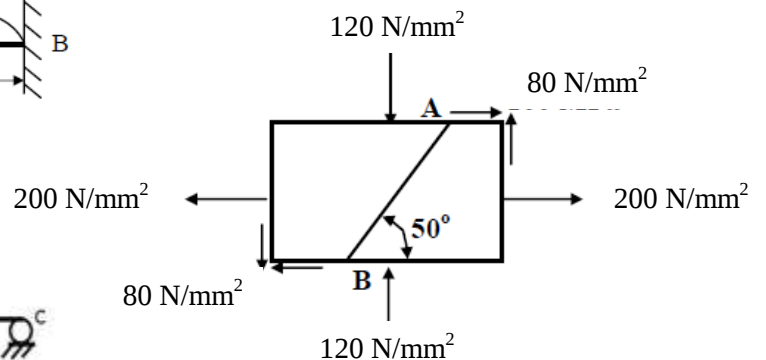


Figure 3