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Total No. of Pages : 02

Total No. of Questions : 09

B.Tech.(AE) (2011 Onwards) (Sem.-3)

MECHANICS OF MATERIALS

Subject Code : BTAE-301

Paper ID : [A1112]

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

SECTION-A**1. Write briefly :**

- a) What is a bending moment diagram?
- b) Define modulus of resilience.
- c) What is crippling load for a column?
- d) What is flexural rigidity of a beam?
- e) What are principal stresses?
- f) Define Modulus of rupture.
- g) What is the maximum deflection of a simply supported beam of span l and carrying a central point load W ?
- h) What do you understand by yielding?
- i) Explain generalized Hook's law.
- j) Define torsional rigidity of shaft.

SECTION-B

2. A brass bar, having cross-sectional area of 900 mm^2 , is subjected to axial forces as shown in Fig. 1. Find the total elongation of the bar. Take $E = 100 \text{ GPa}$.

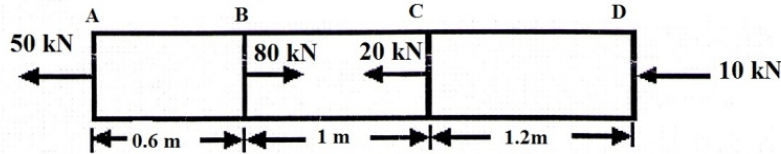


Fig. 1

3. Derive the general equations to find out slope and deflection in a cantilever beam of length L , carrying a point load W at the free end and hence obtain the maximum deflection. Take EI as flexural rigidity of the beam.
4. Derive the relation $E = 2G(1 + 1/m)$ where; $E =$ Young's modulus, $G =$ modulus of rigidity, $1/m =$ Poisson's ratio.
5. Calculate the safe compressive load for a hollow cast iron column (one end rigidly fixed and other end hinged) of 150 mm external diameter, 100 mm internal diameter and 10 m in length. Use Euler's formula with a factor of safety of 5 and $E = 90 \text{ GPa}$.
6. Write a note on shear strain energy theory of failure.

SECTION-C

7. A steel shaft has to transmit a mean power of 150 kW at 300 rpm. The allowable shear stress is 80 MPa and the maximum power transmitted exceeds the mean power by 20%.
- Determine the suitable diameter of a solid shaft.
 - Determine the suitable diameter of a hollow shaft, whose inside diameter is 0.75 times the outside diameter.
 - What percentage saving in weight is achieved when the solid shaft is replaced by hollow shaft?
8. A 250 mm (depth) \times 150 mm (width) rectangular beam is subjected to maximum bending moment of 750 KNm. Determine :
- The maximum stress in the beam.
 - If the value of E for beam material is 200 GN/m^2 , find out the radius of curvature for that portion of the beam where bending is maximum.
 - The value of longitudinal stress at a distance of 65 mm from the top surface of the beam.
9. Derive the torsion formula $\left(\frac{T}{I_p} = \frac{\tau}{\rho} = \frac{G\theta}{L} \right)$ for circular members. State also the assumptions made.