R13

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year II Semester Examinations, May - 2016
MECHANICS OF SOLIDS
(Mining Engineering)

Time: 3 Hours   Max. Marks: 75

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit.
Each question carries 10 marks and may have a, b, c as sub questions.

PART - A   (25 Marks)

1.a) Define factor of safety and explain its importance.   [2]
  b) Find the elongation of a bar due to its self weight.   [3]
  c) Define point of contra flexure.   [2]
  d) Explain briefly various types of supports.   [3]
  e) Define and explain pure bending.   [2]
  f) Derive the expression for section modulus of rectangular section.   [3]
  g) Explain the terms principal stresses and principal strains.   [2]
  h) Draw the Mohr's circle for the state of pure shear.   [3]
  i) What assumptions are taken in the analysis of thin cylinders? Explain. [2]
  j) Explain torsional rigidity of the shaft.   [3]

PART - B   (50 Marks)

2.   A bronze bar is fastened between a steel bar and an aluminum bar as shown in figure 1. Axial loads are applied at the positions indicated. Find the largest value of P that will not exceed an overall deformation of 3.0 mm, or the following stresses: 140 MPa in the steel, 120 MPa in the bronze, and 80 MPa in the aluminum. Assume that the assembly is suitably braced to prevent buckling. Use E_{st} = 200 GPa, E_{al} = 70 GPa, and E_{br} = 83 GPa.   [10]

Figure: 1
OR

3. At room temperature the gap between bar A and bar B shown in figure 2 is 0.2 mm. What are the stresses developed in the bars, if temperature rise is 30^0C? Given: [10]

$A_a = 800 \text{ mm}^2$ $A_b = 600 \text{ mm}^2$

$E_a = 2 \times 10^5 \text{ N/mm}^2$ $E_b = 1 \times 10^5 \text{ N/mm}^2$

$\alpha_a = 12 \times 10^{-6}/°C$ $\alpha_b = 23 \times 10^{-6} /°C$

$L_a = 250 \text{ mm}$ $L_b = 200 \text{ mm.}$
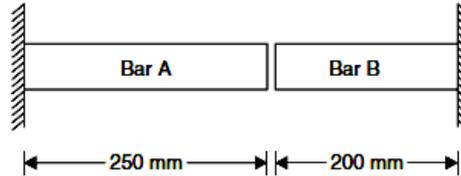
Figure: 2

4. A bar of length 'l' is supported at A and B which are at distances 'a' from the ends as shown in figure 3. Find the distance 'a' such that maximum moment is least. Using the above results find the most economical length of railway sleeper if the rails are 1.6 m apart. [10]
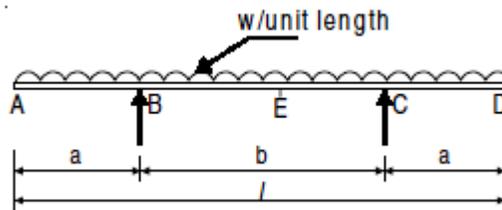
Figure: 3

OR

5. Draw the shear force and bending moment diagram for the given beam. Find the values of maximum shear force and maximum bending moment. (figure 4) [10]
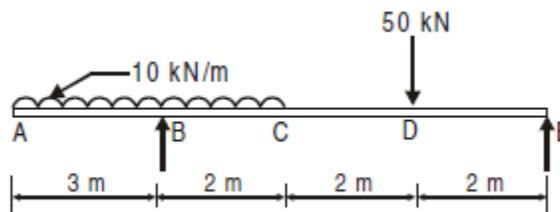
Figure: 4

6. State the assumptions made in deriving bending equation and derive the simple bending equation $\dfrac{M}{I} = \dfrac{f}{y} = \dfrac{E}{R}$. [10]

OR

7. Draw the variation of shear stresses across the following three cases shown in figure 5:

(a) Rectangular   (b) Circular and   (c) Isosceles triangle.   [3+3+4]
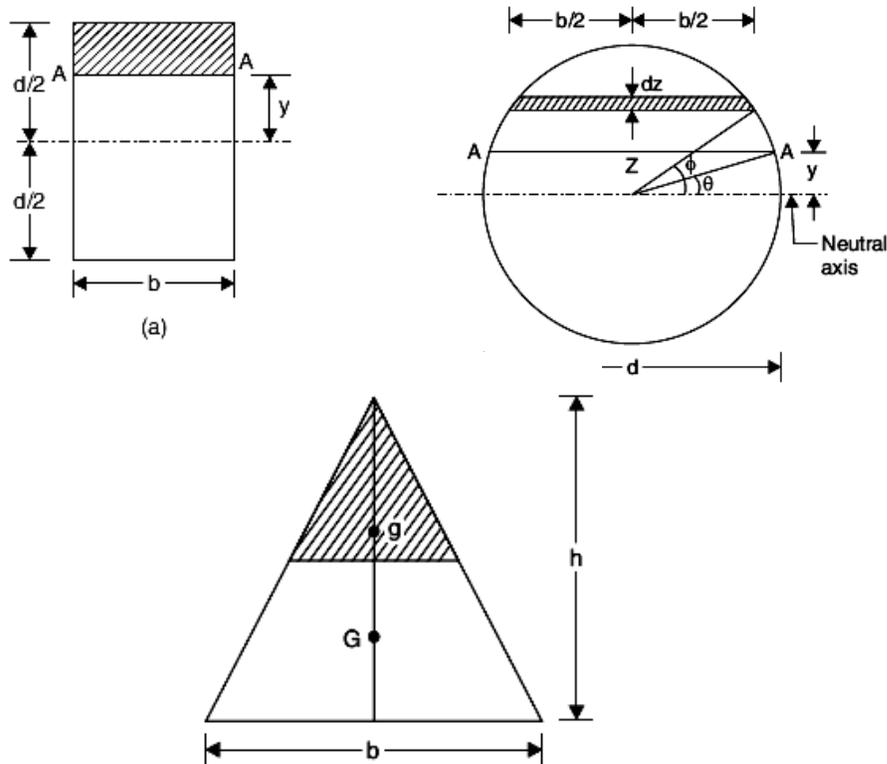

Figure: 5

8. The principle strains at a point in a two-dimensional stress system are observed to be 0.00035 extension and 0.00025 contraction. Determine:

a) The principle stresses

b) The maximum shear stress

Take $E = 2 \times 10^5$ N/mm^2 and Poisson's ratio=1/3.   [5+5]

OR

9. Two planes AB and BC which are right angles carry shear stresses of intensity 17.5 N/mm^2 while these planes also carry a tensile stress of 70 N/mm^2 and a compressive stress of 35 N/mm^2 respectively. Determine the principle planes and the principal stresses. Also determine the maximum shear stress and the planes on which it acts.   [10]

10. A solid Alloy shaft 50 mm in diameter is to be coupled in series with a hollow steel shaft of same external diameter. Find the internal diameter of the steel shaft if the angle of twist per unit length of the steel shaft is to be 75% of that of the alloy shaft. Determine the speed at which the shafts are to be driven to transmit 18.75 KW, if the limits of shearing stress are to be 56 N/mm^2 and 80 N/mm^2 in alloy and steel respectively. Take rigidity modulus of steel = 2.2 of rigidity modules of alloy.   [10]

OR

11. A closed end copper tube of 72 mm internal diameter, 800 mm long and 2 mm thick is filled with water under pressure. Find the change in additional volume of 4000 mm^3 of water is pumped into the tube. Neglect any distortion of the end plates. Take E = 102 GPa, K = 2200 MPa and Poisson's ratio = 0.3.   [10]

--ooOoo--