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**[4857]-1002**

**S.E. (Civil) (First Semester) EXAMINATION, 2015**  
**STRENGTH OF MATERIALS**  
**(2012 PATTERN)**

**Time : Two Hours****Maximum Marks : 50**

- N.B. :-** (i) Answer Q. No. 1 or Q. No. 2; Q. No. 3 or Q. No. 4;  
 Q. No. 5 or Q. No. 6 and Q. No. 7 or Q. No. 8.  
 (ii) Neat diagrams must be drawn wherever necessary.  
 (iii) Figures to the right indicate full marks.  
 (iv) Use of electronic pocket calculator is allowed.  
 (v) Assume suitable data, if necessary.

1. (a) Two vertical rods, one of steel and the other of copper are each rigidly fixed at the top and are 500 mm apart, diameter and length of each rod are 20 mm and 4 m respectively. A cross bar fixed to the rods at the lower ends carries a load of 5000 N such that the cross bar remains horizontal even after loading. Find the tension in each rod. Take  $E_s = 2 \times 10^5 \text{ N/mm}^2$  and  $E_c = 1 \times 10^5 \text{ N/mm}^2$  (Refer Fig. 1) : [6]

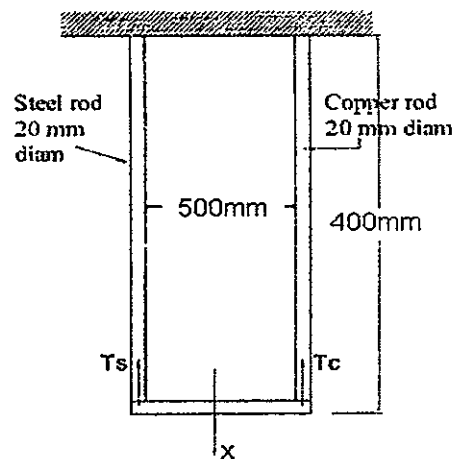


Fig. 1

P.T.O.

- (b) A simply supported beam is having 3.5 m long span. Find the maximum udl it can carry. Its allowable compressive and tensile stress are 55 MPa and 30 MPa respectively. Draw a diagram showing the variation of stress over mid span section of beam (Refer Fig. 2) : [6]

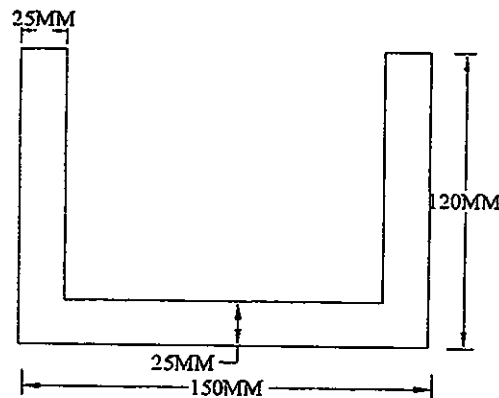


Fig. 2

Or

2. (a) Determine the temp. change that will cause a compressive stress of 36 MPa in the composite bar as shown in Figure. If  $E_S = 210$  GPa,  $E_A = 70$  GPa,  $\alpha = 12 \times 10^{-6}/^\circ\text{C}$ ,  $A = 23 \times 10^{-6}/^\circ\text{C}$ . [6]

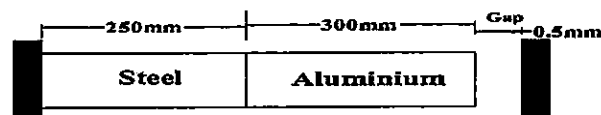


Fig. 3

- (b) A channel section is shown in Fig. 4. It is used as a beam and carries a shearing force of 40 kN. Obtain the maximum shear stress and draw shear stress distribution diagrams : [6]

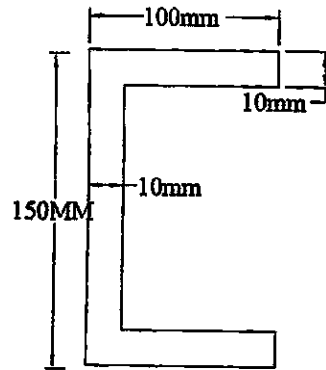


Fig. 4

3. (a) A hollow cylindrical is 3 m long. It has an inner and outer diameter respectively equal to 80 mm and 120 mm. What is the largest torque that can be applied to the shaft if the shearing stress is not to exceed 240 MPa ? What is corresponding minimum value of shearing stress in the shaft ? [6]
- (b) A plane element in a boiler is subjected to tensile stresses of 400 MPa on one plane and 150 MPa on the other at right angles to the former. Each of the above stresses is accomplished by a shear stress of 100 MPa such that when associated with the minor stress tends to rotate the element in anticlockwise direction. Find : [6]
- (a) Principal stresses and their direction
- (b) Maximum shearing stresses.

Or

4. (a) Using equation of strain energy derive the stress intensity due to the following types of axial loading : [6]
- (i) Suddenly applied load
- (ii) Impact load
- (b) In a circular shaft subjected to a twisting moment  $T$  and a bending  $M$ , show that when  $M = 1.2 T$ . The ratio of the greatest principal stress to shear stress is nearly 1.768.[6]
5. (a) Draw shear force and bending moment diagram for the beam as shown in Fig. 5 : [6]

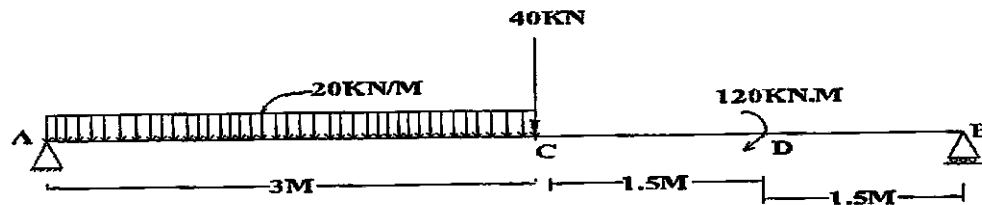


Fig. 5

- (b) The bending moment diagram of beam for span 12 m as shown in Fig. 6. Construct shear force diagram and load diagram. [7]

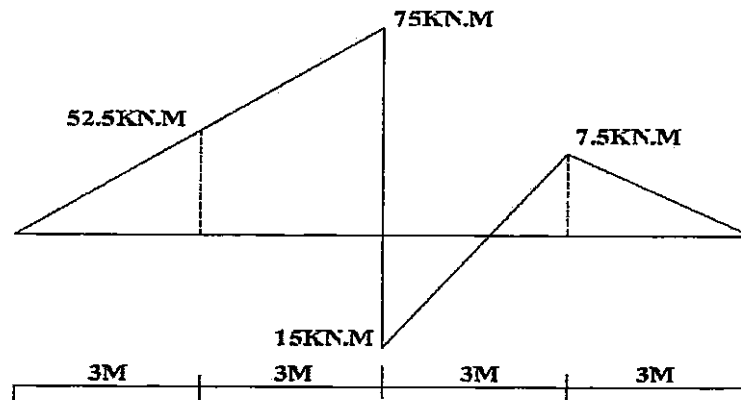


Fig. 6

Or

6. (a) Construct S.F. and B.M. diagram for the beam. Find the point of contraflexure. (Refer Fig. 7). [7]

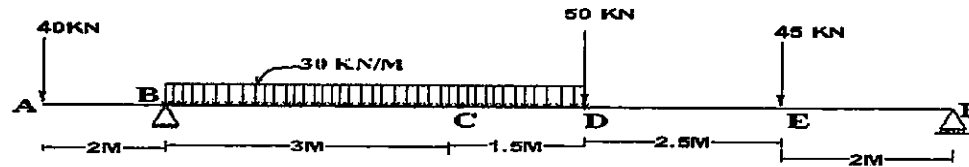


Fig. 7

- (b) Draw the loading diagram and bending moment diagram from the given shear force diagram on the beam. (Refer Fig. 8): [6]

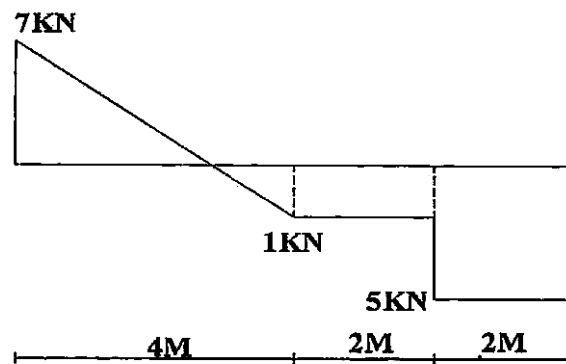


Fig. 8

7. (a) A T section  $150 \text{ mm} \times 120 \text{ mm} \times 20 \text{ mm}$  is used as a strut of 4 m long with hinged at its both ends. Calculate the crippling load, if Young's modulus for the material be 200 Gpa. (Refer Fig. 9) : [6]

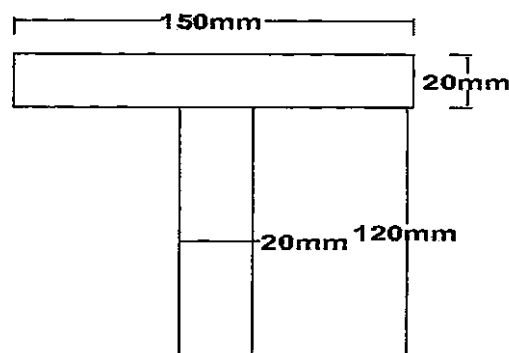


Fig. 9

- (b) Define the following terms : [6]
- (i) Column
  - (ii) Crushing load
  - (iii) Crippling load
  - (iv) Long column
  - (v) Short column
  - (vi) Slenderness ratio.

*Or*

8. (a) A hollow rectangular masonry pier is  $1.2 \times 0.8$  m. Overall, the wall thickness be 0.15 m a vertical load of 1000 kN is transmitted in vertical plane bisecting 1.2 m side at an eccentricity of 0.1 m from axis of section. Calculate maximum and minimum stress in stress in section and draw stress distribution diagram. [www.sppuonline.com](http://www.sppuonline.com) [7]
- (b) A square chimney 12 m high has an opening  $1.25 \text{ m} \times 1.25 \text{ m}$  inside. The external dimensions are  $2.5 \text{ m} \times 2.5 \text{ m}$ . The wind intensity is  $1.3 \text{ kN/m}^2$  on projected area specific weight of masonry is  $22 \text{ kN/m}^3$ . Calculate maximum and minimum intensities of stresses at the base of the chimney. [6]