Hall Ticket No | | | | | | | | | | |  Question Paper Code: ACE001

# INSTITUTE OF AERONAUTICAL ENGINEERING

**(Autonomous)**

Four Year B.Tech III Semester End Examinations (Supplementary) - July, 2018

**Regulation: IARE – R16**

## STRENGTH OF MATERIALS – I

**Time: 3 Hours** **(CE)** **Max Marks: 70**

**Answer ONE Question from each Unit**
**All Questions Carry Equal Marks**
**All parts of the question must be answered in one place only**

### UNIT – I

1. (a) Define Hooke's Law, Poisson's ratio. Derive the relationship between stress and strain. **[7M]**

   (b) A brass bar having cross sectional area of 1000 $mm^2$ is subjected to axial forces as shown in Figure 1. Find the total elongation of bar. Take E= 1.05 x $10^5$ N/$mm^2$. **[7M]**

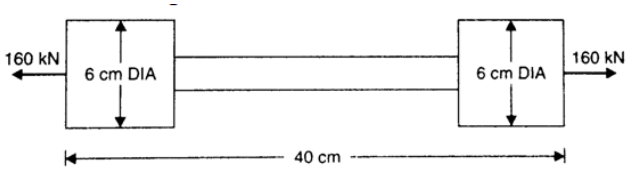


Figure 1

2. (a) A bar 250mm long, cross-sectional area 100mm x50mm, carries a tensile load of 500kN along lengthwise, a compressive load of 5000kN on its 100X250mm faces and a tensile load of 2500kN on its 50X250mm faces. Calculate **[7M]**

   i. The change in volume,

   ii. What change must be made in the 5000 kN load so that no change in the volume of bar occurs. Take E = 1.8X$10^5$ N/$mm^2$ and Poission's ratio = 0.25.

   (b) If the tension test bar is found to taper from (D+a) diameter to (D –a) diameter, prove that the error involved in using the mean diameter to calculate Young's modulus is $\left(\frac{10a}{D}\right)^2$ percent. **[7M]**

### UNIT – II

3. (a) Draw the shear force and bending moment diagrams for a cantilever beam of span 4m, loaded with uniformly distributed load of 6kN/m is acting through out the length. **[7M]**

   (b) A simply supported beam of length 6m loaded with two point loads of 10kN each acting at 2m from left support and 2m from right support. Draw shearforce diagram and bending moment diagram. **[7M]**

4. (a) For the beam loaded as shown in Figure 2, calculate the value of U.D.L of w kN/m so that B.M at C is 50 kNm. Draw the S.F and B.M diagrams for this beam for the calculated value of w. Locate the point of inflexion, if any. **[7M]**

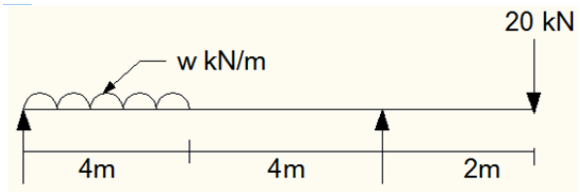


Figure 2

(b) Simply supported beam of 5m has over hangs of 1m each on both sides. The beam is loaded with an UDL of 10 kN/m throughout the length. Find the maximum positive and negative bending moments and draw the bending moment diagram. **[7M]**

## UNIT – III

5. (a) Derive the expression for distribution of shearing stress over a triangular section. **[7M]**

(b) Three beams have the same length, the same allowable stress and the same bending moment. The cross section of the beams are a square, a rectangle with depth twice the width and a circle. Find the ratios of weights of the circular and the rectangular beams with respect to the square beam. **[7M]**

6. (a) Derive the bending equation. **[7M]**

(b) A rolled steel joist of I-section has dimensions as shown in Figure 3. This beam of I-section carries a uniformly distributed load of 40 kN/m run on a span of 10m. Calculate the maximum stress produced due to bending. **[7M]**

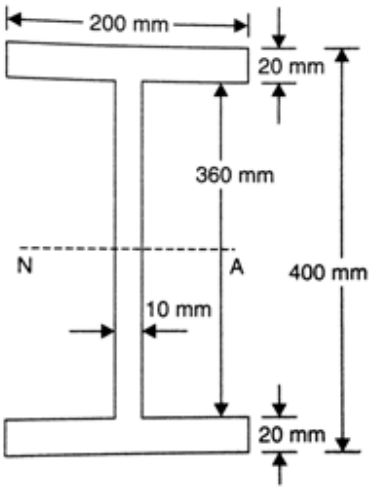


Figure 3

## UNIT – IV

7. (a) Derive an expression for torque in terms of polar moment of inertia. **[7M]**

(b) A solid circular shaft transmits 75 kW power at 200 rpm. Calculate the shaft diameter, if the twist in the shaft is not to exceed 10 in 2m length of shaft and shear stress is limited to 50 $N/mm^2$. Take C = 1 x $10^5$ $N/mm^2$. **[7M]**

8. (a) A composite spring is made by two close-coiled helical springs in series. Each spring's mean coil diameter is 8 times of its wire diameter. One spring has 20 coils and wire diameter 2mm. Find the diameter of the wire if the other spring has 10 coils. Take stiffness of the composite spring as 1 N/mm. Take C = 8 x 10 $N/mm^2$. **[7M]**

   (b) A solid shaft of 5 m length is securely fixed at each end. A torque of 100Nm is applied to the shaft at a section 2m from one end. Find the fixing torques set up at the ends of the shaft. If the shaft is of 50mm diameter, find the maximum shear stresses in the two portions. Also find the angle of twist for the section where the torque is applied. Take C = 100000 $N/mm^2$. **[7M]**

## UNIT – V

9. (a) State and explain Slenderness ratio. **[7M]**

   (b) Derive the Euler's formula for columns under eccentric loading for both ends are hinged. **[7M]**

10. (a) Determine the maximum bending moment, deflection and stress of a strut subjected to compressive axial load or axial thrust and a transverse uniformly distributed load of intensity w per unit length. Both ends are pinned. **[7M]**

    (b) A column of cross section 200X300mm having length 5m. Find the critical buckling load for the following cases.Take E = 2 $X10^5$ $N/mm^2$. **[7M]**

    i. Both ends hinged
    ii. Both ends fixed
    iii. One end is hinged and other end is fixed
    iv. One end is fixed and other end is free