Hall Ticket No | | | | | | | | | | | Question Paper Code: ACEB07

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech IV Semester End Examinations (Regular/Supplementary) - July, 2021

Regulation: R18

STRENGTH OF MATERIALS

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

Answer FIVE Questions choosing ONE question from each module
(NOTE: Provision is given to answer TWO questions from any ONE module)
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE – I

1. (a) Derive the strain energy stored in the material when it is subjected to an impact load. **[7M]**

   (b) A steel bar of a diameter of 20 mm and a length of 400 mm is subjected to a tensile force of 40kN. Determinei) The tensile stress ii) The axial strain developed in the bar if the Young's modulus of steel $E = 200kN/mm^2$ **[7M]**

2. (a) Derive the change in length of the taper bar when it is subjected to an axial load 'P'. **[7M]**

   (b) At a point in a strained material stresses on two planes, BC and AC perpendicular to each other are as shown in Figure 1. Draw the Mohr's stress circle and determine:

   i) Stresses on the inclined plane AB
   ii) Principal stresses
   iii) Direction of the principal planes with respect to plane BC
   iv) Maximum shear stress
   v) Directions of planes carrying maximum shear stress **[7M]**

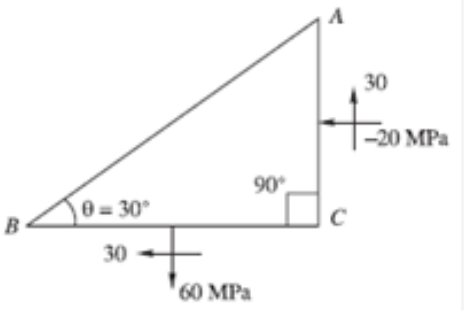

Figure 1

MODULE – II

3. (a) Determine the equation for section modulus of the following cross section of beam about horizontal axis i) Circular ii) Equilateral triangular. **[7M]**

   (b) An I section steel girder with $I_{xx} = 2,502 * 10^4 mm^4$ is used as a beam for a span length of 4 m. The beam carries a UDL of $4\,kN/m$ throughout its length. Determine the maximum deflection in the beam and slope at ends of the beam. **[7M]**

4. (a) Derive the relation between bending moment and radius of curvature **[7M]**

   (b) A cantilever of *10m* span carries loads of *4kN* and *6kN* at 2m and 6m respectively from the fixed end along with another load of 6kN at the free end. Draw the shear force and bending moment diagrams **[7M]**

MODULE – III

5. (a) State the assumptions made in deriving the bending equation. **[7M]**

   (b) A beam is of circular section of diameter d mm. Bending moment on a section is $2 * 10^6\, Nmm$. What is the diameter d, if the maximum stress in the section does not exceed $50 N/mm^2$? **[7M]**

6. (a) Derive the shear stress distribution across the triangular beam with neat sketch **[7M]**

   (b) A cast iron bracket of I section has its top flanges as $200mm\, X\, 40mm$, bottom flanges as $120mm\, X\, 40mm$ and the web as $300m\, X\, 40mm$. The overall depth of the section is 380mm. The bracket is subjected to bending, if the maximum tensile stress in the top flange is not to exceed 15 MPa. Determine the bending moment at the section can take. If the beam is subjected to a shear force of 150kN, sketch the shear stress distribution over the depth of the section **[7M]**

MODULE – IV

7. (a) Mention the assumptions made to derive the torsion equation. **[7M]**

   (b) A hollow shaft of diameter ratio 3/5 is required to transmit 800kW at 110rpm. The maximum torque being 20% greater than the mean. The shear stress is not to exceed 63MPa and the twist in a length of 3m is not to exceed 1.40. Calculate the minimum external diameter satisfying these conditions.

   [7M]

8. (a) Determine the relation between twisting moment, shear stress and angle of twist. **[7M]**

   (b) The internal diameter of a hollow shaft is $\frac{2}{3}$ of its external diameter. Compare its resistance to torsion with that of solid shaft of the same weight and material. **[7M]**

MODULE – V

9. (a) Derive the expressions for hoop and axial stresses developed in a thin cylindrical shell subjected to internal pressure p. **[7M]**

   (b) A closed end copper tube of 72mm internal diameter, 800mm long and 2mm thick is filled with water under pressure. Find the change in pressure if the additional volume of $4000mm^3$ of water is pumped into the tube. Neglect the distortion of the end plates. Take E=102GPa, K=2200MPa and Poisson's ratio as 0.3. **[7M]**

10. (a) Take a small element of a thin spherical shell and show the stresses acting on this element.**[7M]**

    (b) A 600mm long steel cylinder is made up of 4mm thick plates. The inside diameter of the cylinder is 120mm. When it is subjected to an internal pressure of 5MPa, the increase in its volume is found to be $5000mm^3$. Determine the value of Poisson's ratio and the modulus of rigidity. Take E=205GPa **[7M]**

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