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Question Paper Code: ACEC02

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal-500043, Hyderabad

B.Tech III SEMESTER END EXAMINATIONS (REGULAR/ SUPPLEMENTARY) - FEBRUARY 2024
Regulation: UG20

STRENGTH OF MATERIALS

Time: 3 Hours **(CIVIL ENGINEERING)** **Max Marks: 70**

Answer ALL questions in Module I and II
Answer ONE out of two questions in Modules III, IV and V
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE – I

1. (a) Draw and explain stress- strain curve for mild steel based on Hook's law and explain components of curve with neat sketch. [BL: Understand| CO: 1|Marks: 7]

   (b) Determine the maximum weight W that can be supported by two wires as shown in Figure 1, if the stress in each wire is 120N/mm^2. [BL: Apply| CO: 1|Marks: 7]

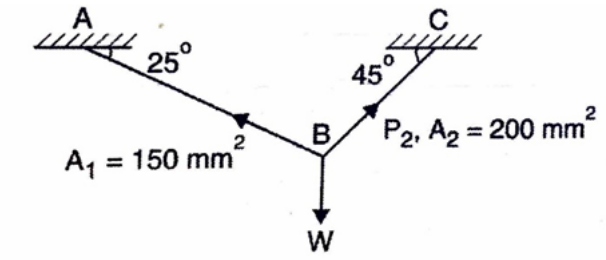

Figure 1

MODULE – II

2. (a) Classify the types of support and types of beams with neat diagram and explain them with symbol or usual notation. [BL: Understand| CO: 2|Marks: 7]

   (b) A beam AB 8 meters long has supports at its ends A & B. It carries a point load of 10kN at 2.5 meters from A and a UDL of 2kN per meter between the point loads. Draw SF and BM diagrams for the beam. [BL: Apply| CO: 2|Marks: 7]

MODULE – III

3. (a) What are the assumptions in theory of pure bending in a beam? Elaborate derivation of flexural formula for pure bending. [BL: Understand| CO: 3|Marks: 7]

   (b) A T section of flange 160mm×20mm and web 280mm×20mm is simply supported at both ends, It carries two concentrated loads of 100kN each acting 2m distance from each support. Span of the beam is 8m. Determine the maximum bending stress induced in the beam and draw bending moment distribution diagram and also find bending stress at the layer 100mm from the bottom. [BL: Apply| CO: 3|Marks: 7]

4. (a) Develop the equation for shear stress in a beam with neat sketch and formulation.
[BL: Understand| CO: 4|Marks: 7]

(b) A timber beam 100mm wide and 150mm deep supports a uniformly distributed load over a span of 2 meters. If the safe stresses are 28MPa in bending and 2MPa in shear, calculate the maximum load which can be supported by the beam. [BL: Apply| CO: 4|Marks: 7]

MODULE – IV

5. (a) State the assumptions made in the determination of the shear stress in circular shaft subjected to torsion. Determine the expression for torsional formula. [BL: Understand| CO: 5|Marks: 7]

(b) A hollow shaft transmits 100kW at 120RPM. Allowable shear stress in material is 50N/mm^2. Shaft shall not twist 2^0 in 1m length. Ratio of internal diameter to external diameter is 0.25. Take G= 80kN/mm^2. Maximum torque is 15% more than mean torque. Calculate maximum external diameter of the shaft. [BL: Apply| CO: 5|Marks: 7].

6. (a) With a neat sketch, explain the polar modulus for solid and hollow shaft. Outline about torsional rigidity, torsional stiffness and torsional flexibility. [BL: Understand| CO: 5|Marks: 7]

(b) A compound shaft consisting of a steel segment and an aluminium segment is acted upon by two torques as shown in Figure 2. Determine the maximum permissible value of T subjected to the following conditions.

Shear stress for steel= 83MPa

Shear stress for aluminium= 55MPa

The angle of rotation at free end is limited to 6^0 G_{st} = 83GPa, G_{al} = 28GPa.
[BL: Apply| CO: 5|Marks: 7]

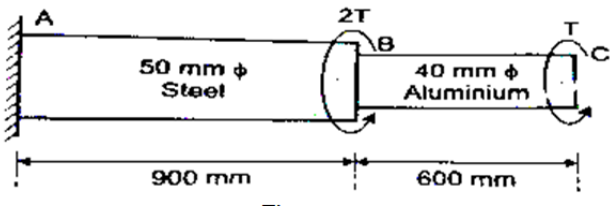

Figure 2

MODULE – V

7. (a) Obtain the equation to find principal stresses due to normal and shear stresses on two mutually perpendicular planes. [BL: Understand| CO: 6|Marks: 7]

(b) A plane element in a boiler is subjected to tensile stresses of 400MPa on one plane and 150MPa on the other at right angle to the former. Each of the above stresses are accomplished by a shear stress of 100MPa such that when associated with the minor stress tends to rotate the element in anticlockwise direction. Find

i) Principal stresses and their direction

ii) Maximum shearing stresses. [BL: Apply| CO: 6|Marks: 7]

8. (a) Explain Mohr's circle method to find normal stress and tangential stress.
[BL: Understand| CO: 6|Marks: 7]

(b) An element in a strained body is subjected to a tensile stress of 180MPa and shear stress of 50MPa tending to rotate the element in an anticlockwise direction. Find

i) The magnitude of normal and shear stresses on a section inclined at 40 ° with the tensile stress.

ii) The magnitude and direction of maximum shear stress that can exist on the element.
[BL: Apply| CO: 6|Marks: 7]