Hall Ticket No | | | | | | | | | | | Question Paper Code:AAEC01

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal-500043, Hyderabad

B.Tech III SEMESTER END EXAMINATIONS (REGULAR / SUPPLEMENTARY) - FEBRUARY 2023
Regulation:UG20

MECHANICS OF SOLIDS

Time: 3 Hours **(AERONAUTICAL 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) Illustrate the stress-strain diagram of steel marking all the important points on the diagram. [BL: Understand| CO: 1|Marks: 7]

   (b) A steel rod, 20 mm in diameter and 1.5 m long, is constrained between supports A and B as shown in Figure 1. The material is stress-free at 27^0C. Determine the stress in the material when the temperature increases to 50^0C i) If the supports are unyielding ii) If the support at B yields by 0.1 mm. E for steel = 200 GPa and α of steel = 12 x $10^{-6}/^0$C. [BL: Apply| CO: 1|Marks: 7]

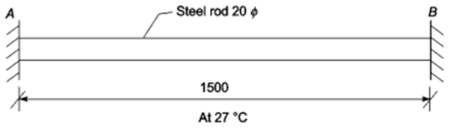

Figure 1

MODULE – II

2. (a) Briefly explain the types of beam and supports. Mention the number of unknowns for each supports. [BL: Understand| CO: 2|Marks: 7]

   (b) An overhanging beam as shown in Figure 2 of span L between supports and overhang length 'a' is subjected to a UD load of w/m over the whole length. Draw SF and BM diagrams indicating maximum moment and shear force. [BL: Apply| CO: 2|Marks: 7]

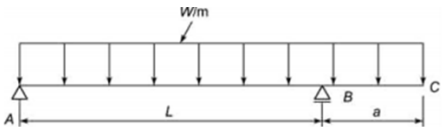

Figure 2

MODULE – III

3. (a) Prove that shear stress at any point in the rectangular cross-section of a beam which is subjected to a shear force F, given by τ= AFy/bI [BL: Understand| CO: 3|Marks: 7]

(b) A steel plate of dimensions 20 mm x 2 mm is bent into a circular arc of radius 2 m by applying end couples. If E =200 GPa, find the end couples applied and the maximum stress in the bar. [BL: Apply| CO: 3|Marks: 7]

4. (a) State the assumptions made in theory of simple bending. Draw the bending stress and shear stress profiles for a hollow circular beam section. [BL: Understand| CO: 4|Marks: 7]

(b) A hollow circular section of outside diameter 200 mm and thickness 10mm carries an SF of 25kN. Find the maximum shear stress and the shear stress at the inner edge and draw the shear stress distribution diagram. [BL: Apply| CO: 4|Marks: 7]

MODULE – IV

5. (a) What is the value of slope at the point of maximum deflection? Compare the relation between slope, deflection and radius of curvature. [BL: Understand| CO: 5|Marks: 7]

(b) A cantilever 3 m long carries a UD load of 20 kN/m for a length of 2 m from the free end as shown in Figure 3. Calculate the values of slope and deflection at the free end, if E = 200 GN/m^2 and Z = 5000cm^4. [BL: Apply| CO: 5|Marks: 7]

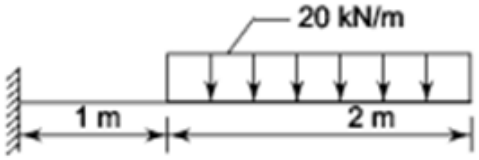

Figure 3

6. (a) Determine the slope and deflection of a simply supported beam subjected to concentrated load at centre. [BL: Understand| CO: 5|Marks: 7]

(b) A simply supported beam of span L carries an eccentric concentrated load P as shown in Figure 4. Derive the general expressions for slope and deflection. [BL: Apply| CO: 5|Marks: 7]

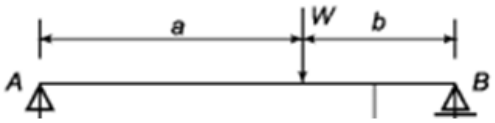

Figure 4

MODULE – V

7. (a) Explain the condition of maximum shear stress on a oblique section of a member subjected to two direct stresses in two mutually perpendicular directions. [BL: Understand| CO: 6|Marks: 7]

(b) A shaft is subjected to a torque of 16,000Nm. If the maximum permissible stress in the material of the shaft is 65 N/mm^2. Find i) The diameter of a solid shaft ii) The dimensions of a hollow circular shaft if the thickness is 10% of the internal diameter. [BL: Apply| CO: 6|Marks: 7]

8. (a) Develop the expression for normal and tangential stress on a oblique plane when a member is subjected to a simple shear stress v. [BL: Understand| CO: 6|Marks: 7]

(b) At a point in a strained material, the principal stresses are 100 MPa and 50 MPa both tensile. Identify the normal and shear stresses at a section inclined at 30° with the axis of the major principal stress. [BL: Apply| CO: 6|Marks: 7]

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