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

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal-500043, Hyderabad

B.Tech III SEMESTER END EXAMINATIONS (REGULAR/ SUPPLEMENTARY) - FEBRUARY 2024
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) Determine an expression for the total elongation of a bar due to its own weight, when the bar is fixed at its upper end and hanging freely at the lower end. [BL: Understand| CO: 1|Marks: 7]

   (b) Circular rod of diameter 16 mm and 500 mm long is subjected to a tensile force 40 kN. The modulus of elasticity for steel may be taken as 200 kN/mm^2. Calculate stress, strain and elongation of the bar due to applied load. [BL: Apply| CO: 1|Marks: 7]

MODULE – II

2. (a) Draw the S.F and B.M diagrams for a simply supported beam carrying a uniformly distributed load of w per unit length over the entire span. Also calculate the maximum B.M. [BL: Understand| CO: 2|Marks: 7]

   (b) A cantilever of length 4 m carries a gradually varying load, zero at the free end to 2 kN/m at the fixed end. Draw the S.F and B.M diagrams for the cantilever. [BL: Apply| CO: 2|Marks: 7]

MODULE – III

3. (a) Prove that the maximum shear stress in a circular section of a beam is 4/3 times average shear stress. [BL: Understand| CO: 3|Marks: 7]

   (b) A rectangular beam 200 mm deep and 300 mm wide is simply supported over a span of 8 m. What is the uniformly distributed load per metre the beam may carry, if the bending stress is not to exceed 120 N/mm^2. [BL: Apply| CO: 3|Marks: 7]

4. (a) Predict the section moduli of circular section and hallow circular section of diameter 'd' [BL: Understand| CO: 4|Marks: 7]

   (b) A beam has cross-section as shown in Figure 1. If the shear force acting on this is 25 kN, draw the shear stress distribution diagram across the depth. [BL: Apply| CO: 4|Marks: 7]

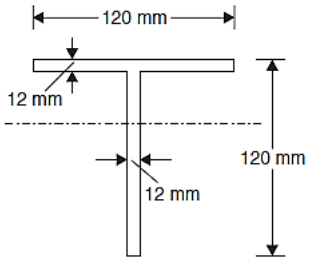

Figure 1

MODULE – IV

5. (a) Obtain an expression for the slope at the supports of a simply supported beam, carrying a point load at the centre. [BL: Understand| CO: 5|Marks: 7]

   (b) A beam 6 m long, simply supported at its ends, is carrying a point load of 50 kN at its centre. The moment of inertia of the beam is given as equal to $78 \times 10^6 mm^4$. If E for material of the beam $= 2.1 \times 10^5 N/mm^2$, calculate the deflection at the centre of the beam and slope at the supports. [BL: Apply| CO: 5|Marks: 7].

6. (a) Determine the slope and deflection of a simply supported beam carrying a point load at the centre and uniformly distributed load over the entire length. [BL: Understand| CO: 5|Marks: 7]

   (b) A beam of length 6 m is simply supported at its ends and carries two-point load of 48 kN and 40 kN at a distance of 1m and 3m respectively from the left support. Find deflection under each load using $E = 2 \times 10^5 N/mm^2$ *and* $I = 85 \times 10^6 mm^4$. [BL: Apply| CO: 5|Marks: 7]

MODULE – V

7. (a) When a circular shaft is subjected to torsion show that the shear stress varies linearity from the axis to the surface. [BL: Understand| CO: 6|Marks: 7]

   (b) A hollow shaft is to transmit 300 kW power at 80 r.p.m. If the shear stress is not to exceed $60 N/mm^2$ and the internal diameter is 0.6 times of the external diameter. Find the external and internal diameters assuming that the maximum torques is 1.4 times the mean. [BL: Apply| CO: 6|Marks: 7]

8. (a) Derive an expression for the shear stress produced in a circular shaft which is subjected to torsion. What are the assumptions made in the derivation? [BL: Understand| CO: 6|Marks: 7]

   (b) At a point in a strained material the principal stresses are 100 N/mm^2 (tensile) and 60 N/mm^2 (tensile). Determine the normal stress, shear stress and resultant stress on a plane inclined at 50^0 to the axis of major principal stress. [BL: Apply| CO: 6|Marks: 7]

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