Hall Ticket No | | | | | | | | | | | Question Paper Code: AMEC05

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal-500043, Hyderabad

B.Tech III SEMESTER END EXAMINATIONS (REGULAR/ SUPPLEMENTARY) - FEBRUARY 2024
Regulation: UG20
SOLID MECHANICS
Time: 3 Hours **(MECHANICAL 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) When the bar is subjected to direct stresses (tensile) in two mutually perpendicular directions accompanied by a shear stress then derive the various design parameters using Mohr's circle. [BL: Understand| CO: 3|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: 3|Marks: 7]

4. (a) Obtain an expression for the major and minor principal stresses on a plane, when the body is subjected to direct stresses in two mutually perpendicular directions accompanied by a shear stress [BL: Understand| CO: 4|Marks: 7]

   (b) A circular shaft of 12 cm dia. is subjected to combined bending and twisting moments. The bending moment being three times the twisting moment. If the direct tensile yield point of material is 350 MN/m^2 and factor of safety on yield is 4, find the allowable twisting moment by

   i) Maximum principal stress theory

   ii) Maximum shear stress theory [BL: Apply| CO: 4|Marks: 7]

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 I-section has flanges of size 200 × 12 mm and its overall depth is 360 mm. Thickness of web is also 12 mm. It is used as a simply supported beam over a span of 4 m to carry a load of 60 kN/m over its entire span. Determine the bending and shear stress at various critical points of the section. Draw the variation of bending and shearing stresses

   [BL: Apply| CO: 5|Marks: 7].

6. (a) State the assumptions made in the theory of simple bending and derive the bending formula. [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) Derive the expressions for hoop and axial stresses developed in a thin cylindrical shell subjected to internal pressure. [BL: Understand| CO: 6|Marks: 7]

   (b) A cylindrical shell is 3m long, and having 1cm internal diameter and 1.5mm thickness. Calculate the maximum intensity of the shear stress and also the change in the dimensions of the shell if it is subjected to an internal fluid pressure of $1.5 N/mm^2$. [BL: Apply| CO: 6|Marks: 7]

8. (a) Derive an expression for the angle of twist for a hollow circular shaft with external diameter D, internal diameter d, length l and rigidity modulus G. [BL: Understand| CO: 6|Marks: 7]

   (b) A thin cylinder 75 mm internal diameter, 250 mm long with walls 2.5 mm thick is subjected to an internal pressure of 7 MPa. Determine the change in internal diameter and the change in length. If the cylinder is subjected to a torque of 200 N-m, find the magnitude and nature of the principal stresses set up in the cylinder.

   Young's Modulus = 200 GPa. Poisson's ratio= 0.3. [BL: Apply| CO: 6|Marks: 7]

– ○ ○ ◯ ○ ○ –