Hall Ticket No | | | | | | | | | | | Course Code: AMEC05

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

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

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) Find the 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) A tensile load of 40 kN is acting on a rod of diameter 40 mm and of length 4 m. A bore of diameter 20 mm is made centrally on the rod. To what length the rod should be bored so that the total extension will increase 30% under the same tensile load. Take E = 2×10^5 N/mm^2. [BL: Apply| CO: 1|Marks: 7]

MODULE – II

2. (a) Draw the shear force and bending moment diagrams for a simply supported beam with an eccentric point load W. [BL: Understand| CO: 2|Marks: 7]

   (b) Draw the S.F. and B.M. diagrams for the overhanging beam carrying uniformly distributed load of 2 KN/m over the entire length and a point load of 2 KN as shown in Figure 1. Locate the point of contra-flexure. [BL: Apply| CO: 2|Marks: 7]

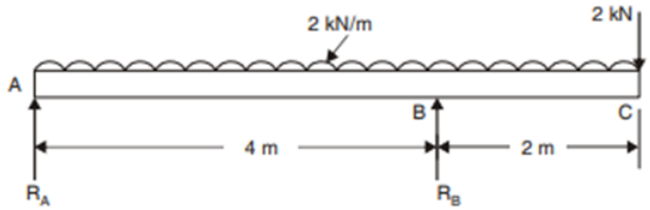

Figure 1

MODULE – III

3. (a) Develop an expression for calculation of principal stresses and their location for member subjected to like direct stresses in two mutually perpendicular directions. [BL: Understand| CO: 3|Marks: 7]

   (b) A rectangular block of material is subjected to a tensile stress of 110 N/mm^2 on one plane and a tensile stress of 47 N/mm^2 on the plane at right angles to the former. Each of the above stresses is accompanied by a shear stress of 63 N/mm^2 and that associated with the former tensile stress tends to rotate the block anticlockwise. Find the direction and magnitude of each of the principal stress [BL: Apply| CO: 3|Marks: 7]

4. (a) Describe maximum principal stress theory. How do you classify the theories of failures according to brittle and ductile materials? [BL: Understand| CO: 4|Marks: 7]

   (b) At a certain point in a strained material, the intensities of stresses on two planes at right angles to each other are 20 N/mm^2 and 10 N/mm^2 both tensile. They are accompanied by a shear stress of magnitude 10 N/mm^2. Find graphically or otherwise, the location of principal planes and evaluate the principal stresses. [BL: Apply| CO: 4|Marks: 7]

MODULE – IV

5. (a) Determine an expression for deflection of a simply supported beam with an eccentric point load. [BL: Understand| CO: 5|Marks: 7]

   (b) A beam of length 5 m and of uniform rectangular section is simply supported at its ends. It carries a uniformly distributed load of 9 kN/m run over the entire length. Calculate the width and depth of the beam if permissible bending stress is 7 N/mm^2 and central deflection is not to exceed 1 cm. [BL: Apply| CO: 5|Marks: 7]

6. (a) What is the bending stress in symmetrical and un symmetrical sections? Develop an expression for bending equation of beam. [BL: Understand| CO: 5|Marks: 7]

   (b) A beam is simply supported and carries a uniformly distributed load of 40 KN/m run over the whole span. The section of the beam is rectangular having depth as 500 mm. If the maximum stress in the material of the beam is 120 N/mm^2 and moment of inertia of the section is 7×10^8 mm^4, find the span of the beam. [BL: Apply| CO: 5|Marks: 7]

MODULE – V

7. (a) Discuss the failure of long columns and short columns. Determine relation for the maximum stress in an eccentrically loaded column. [BL: Understand| CO: 6|Marks: 7]

   (b) A spherical shell of internal diameter 0.9 m and of thickness 10 mm is subjected to an internal pressure of 1.4 N/mm^2. Determine the increase in diameter and increase in volume. Take E = 2×10^5 N/mm^2 and $\mu = 1/3$. [BL: Apply| CO: 6|Marks: 7]

8. (a) Explain the term 'slenderness ratio' and describe with mathematical expression, how it limits the use of Euler's formula for crippling load? [BL: Understand| CO: 6|Marks: 7]

   (b) A cylinder of thickness 1.5 cm, has to withstand maximum internal pressure of 1.5 N/mm^2. If the ultimate tensile stress in the material of the cylinder is 300 N/mm^2, factor of safety 3.0 and joint efficiency 80%. Determine the diameter of the cylinder. [BL: Apply| CO: 6|Marks: 7]

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