Hall Ticket No | | | | | | | | | | |

Question Paper Code:ACEC02

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
(Dundigal-500043, Hyderabad)

B.Tech III SEMESTER END EXAMINATIONS (REGULAR) - FEBRUARY 2022
Regulation:UG-20
STRENGTH OF MATERIALS

Time: 3 Hours **(CE)** **Max Marks: 70**

Answer ALL questions in Module I and II
Answer ONE out of two questions in Modules III, IV and V
NOTE: Provision is given to answer TWO questions from among one of the Modules III / IV / V
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE – I

1. (a) Briefly explain stress, strain, and state Hooke's law with formula. **[7M]**

   (b) A specimen of steel 20 mm diameter with a gauge length of 200 mm is tested to destruction. It has an extension of 0.25 mm under a load of 80 kN and the load at elastic limit is 102 kN. The maximum load is 150 kN. The total extension at fracture is 58 mm and diameter at neck is 18 mm. Analyze the behavior of steel specimen and calculate:

   i) Stress at elastic limit.

   ii) Young's modulus.

   iii) Percentage elongation.

   iv) Percentage reduction in area.

   v) Ultimate tensile stress. **[7M]**

MODULE – II

2. (a) List the different types of beams and explain them with neat sketches. **[7M]**

   (b) Draw the shear force and bending moment diagrams for the beam shown in Figure 1. **[7M]**

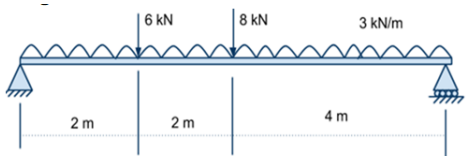

Figure 1

MODULE – III

3. (a) Write the bending equation and define all the terms in the equation. Discuss the assumptions in theory of simple bending. **[7M]**

   (b) A simply supported beam of span 5 m has a cross-section of 150mm x 250mm. If the permissible stress is 10 N/mm^2, find the maximum intensity of uniformly distributed load it can carry. **[7M]**

4. (a) Derive the expression for finding shear stress in a beam in the form q = F(ay)/bI with usual notations. **[7M]**

(b) An I -beam as shown in Figure 2 is subjected to a shearing force of 15 kN. Determine the distribution of horizontal shear stress in the beam. All dimensions are in "mm". **[7M]**.

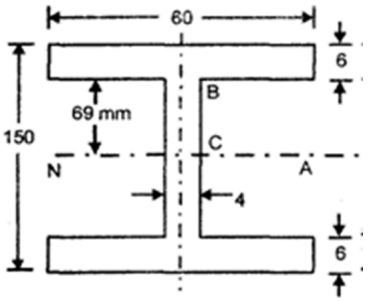

Figure 2

MODULE – IV

5. (a) Derive expression for strength and stiffness of a circular shaft when an external torque T is acting on it. **[7M]**

   (b) A hollow circular shaft, of outside diameter 50 mm and inside diameter 36mm, is made of steel, for which the permissible stress in shear is 90 MPa and G = 85 GPa. Find the maximum torque that such a shaft can carry and the angle of twist per metre length.

   [7M]

6. (a) Derive the relation between twisting moment, shear stress and angle of twist. **[7M]**

   (b) A closely coiled helical spring is to carry a load of 500 N. Its mean coil diameter is to be 10 times that of the wire diameter. Calculate these diameters if the maximum shear stress in the material of the spring is to be 85 N/mm^2. **[7M]**

MODULE – V

7. (a) Briefly explain about principal planes and principal stress. Write the equations for normal stress and tangential stress. **[7M]**

   (b) The direct stresses at a point in a strained material are 100 N/mm^2 compressive and 60 N/mm^2 tensile as shown in Figure 3. Find the normal and tangential stresses on the plane AC. **[7M]**

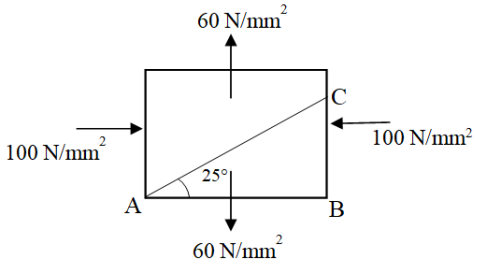

Figure 3

8. (a) Discuss the important points from theories of failures used in design. **[7M]**

   (b) Draw the graphical representation of theories for two dimensional stress system (max. principal stress, max. strain, shear stress and strain energy theory). **[7M]**

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