Hall Ticket No | | | | | | | | | | | Question Paper Code: AAEC15

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal-500043, Hyderabad

B.Tech V SEMESTER END EXAMINATIONS (REGULAR/ SUPPLEMENTARY) - FEBRUARY 2024

Regulation: UG20

ANALYSIS OF AIRCRAFT STRUCTURES

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) What is fatigue failure? Explain about low cycle fatigue and high cycle fatigue with proper example. [BL: Understand| CO: 1|Marks: 7]

   (b) A 50mm diameter shaft is made from carbon steel having ultimate tensile strength of 630 MPa. It is subjected to a torque which fluctuate between 2000 N-m to -800 N-m. Using Soderberg method, calculate the factor of safety. Assume suitable values for any other data needed. [BL: Apply| CO: 1|Marks: 7]

MODULE – II

2. (a) Obtain load–displacement relationship by using principle of the stationary value of the total complementary energy for non-linear form. [BL: Understand| CO: 2|Marks: 7]

   (b) A steel rod 5 m long and of 40 mm diameter is used as a column, with one end fixed and the other free. Determine the crippling load by Euler's formula. Take E as 200 GPa. [BL: Apply| CO: 2|Marks: 7]

MODULE – III

3. (a) Describe the manufacturing process involved in laminated fiber-reinforced composite materials. [BL: Understand| CO: 3|Marks: 7]

   (b) Write the number of independent elastic constants for three dimensional anisentropic, monoclinic, orthotropic, transversely isotropic, and isotropic. [BL: Understand| CO: 3|Marks: 7]

4. (a) Classify polymer matrix composites with examples. Write the advantages of composite materials. [BL: Understand| CO: 4|Marks: 7]

   (b) Enumerate six primary material selection parameters that are used in evaluating the use of a particular material. [BL: Understand| CO: 4|Marks: 7]

MODULE – IV

5. (a) Interpret the shear stress distribution of a closed section beam having shear flow q and rigidity modulus G at a built-in end of a closed section beam. [BL: Understand| CO: 5|Marks: 7]

(b) Calculate the shear stress distribution at the built-in end of the beam shown in Figure 1 when, at this section, it carries a shear load of 22000N acting at a distance of 100mm from and parallel to side 12. The modulus of rigidity G is constant through out the section and the wall length dimensions are given in Table 1. [BL: Apply| CO: 5|Marks: 7]

Table 1

Wall	12	34	23
Length(mm)	375	125	500

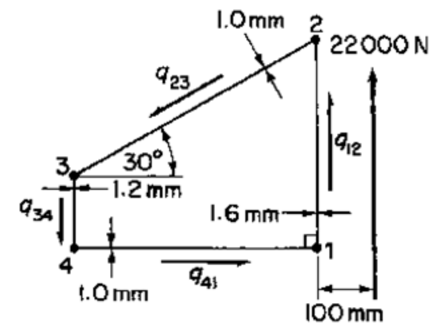

Figure 1

6. (a) Interpret the rate of twist and the shear flows (and hence shear stresses) in the beam in terms of the warping and the applied torque T based on the compatibility of displacement which exists at the cover/boom/web junctions. [BL: Understand| CO: 5|Marks: 7]

(b) A thin-walled beam with the singly symmetrical cross-section shown in Figure 2 is built-in at one end where the shear force Sy =111 250N is applied through the web 25. Assuming the cross-section remains undistorted by the loading, determine the shear flow and the position of the centre of twist at the built-in end. The shear modulus G is the same for all walls. [BL: Apply| CO: 5|Marks: 7]

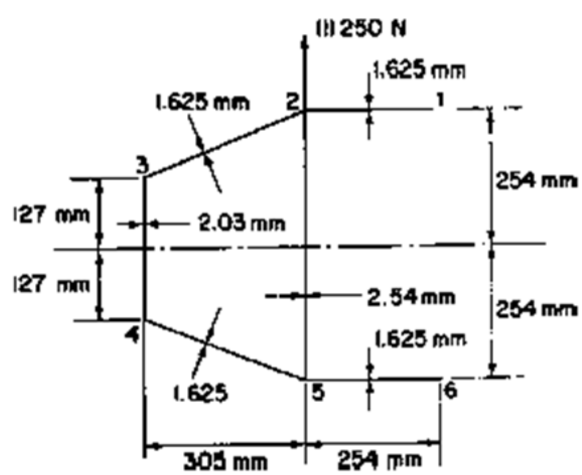

Figure 2

MODULE – V

7. (a) Illustrate the I-section beam subjected to torsion such that a beam is axially unconstrained and loaded by a pure torque T. [BL: Understand| CO: 6|Marks: 7]

   (b) An axially symmetric beam has the thin-walled cross-section shown in Figure 3. If the thickness t is constant throughout and making the usual assumptions for a thin-walled cross-section, show that the torsion bending constant τ_R calculated about the shear centre S is $\tau_R = 13/12\ d^5$ t. [BL: Apply| CO: 6|Marks: 7]

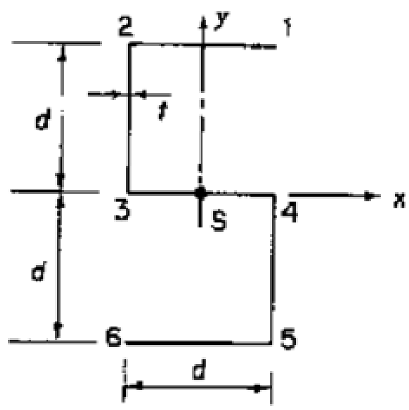

Figure 3

8. (a) Elucidate the Bi moment for an open section beam subjected to concentrated loads parallel to its longitudinal axis. [BL: Understand| CO: 6|Marks: 7]

   (b) The column shown in Figure 4 carries a vertical load of 100 kN. Calculate the angle of twist at the top of the column and the distribution of direct stress at its base.E = 200 000 N/mm^2 and G/E =0.36. [BL: Apply| CO: 6|Marks: 7]

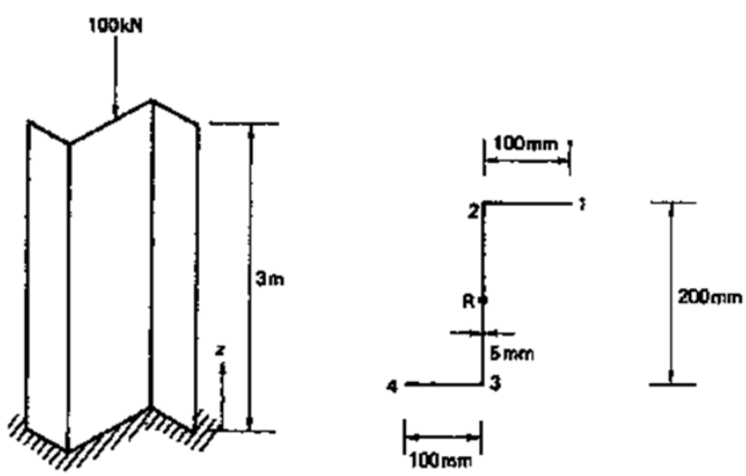

Figure 4

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