Hall Ticket No | | | | | | | | | | | Question Paper Code: AAEC06

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal-500043, Hyderabad

B.Tech IV SEMESTER END EXAMINATIONS (REGULAR/SUPPLEMENTARY) - AUGUST 2023

Regulation: UG-20

AEROSPACE 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) Explain about the strength of thin-walled columns and concept of effective sheet width. [BL: Understand| CO: 1|Marks: 7]

   (b) A beam of length L and uniform EI is simply supported at its ends and subjected to a load W at a distance 'a' from left end. Obtain deflection at the mid-point and at the point of application of the load using energy method. [BL: Apply| CO: 1|Marks: 7]

MODULE – II

2. (a) State and explain the basic theory of thin plates with the assumptions and boundary conditions of the plate. [BL: Understand| CO: 2|Marks: 7]

   (b) A plate 10mm thick is subjected to bending moments M_x equal to 10Nm/mm and M_y equal to 5Nm/mm. Find the maximum twisting moment per unit length in the plate and the direction of the planes on which this occurs. [BL: Apply| CO: 2|Marks: 7]

MODULE – III

3. (a) What is shear flow? Explain how shear stress is obtained from the shear flow? [BL: Understand| CO: 3|Marks: 7]

   (b) A thin-walled beam has the cross-section shown in Figure 1. Determine the direct stress distribution produced by a hogging bending moment M. [BL: Apply| CO: 3|Marks: 7]

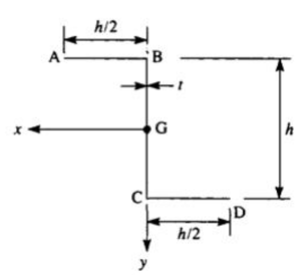

Figure 1

4. (a) In the elastic buckling of thin plates, explain where the elastic plate buckling formula is applicable? What parameters does the buckling constant K depend on?

[BL: Understand| CO: 4|Marks: 7]

(b) Calculate the position of the shear centre of the thin-walled channel section shown in Figure 2. The thickness t of the walls is constant. [BL: Apply| CO: 4|Marks: 7]

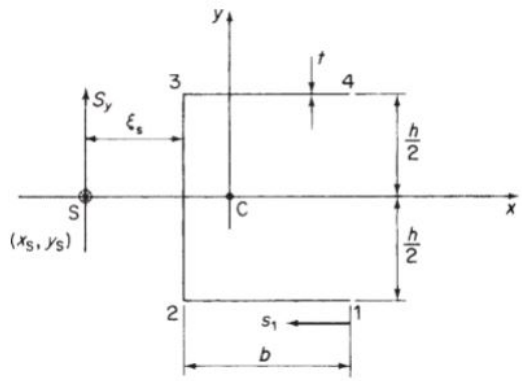

Figure 2

MODULE – IV

5. (a) What is boom area in an idealized aircraft structures? Discuss structural idealization and its principle. [BL: Understand| CO: 5|Marks: 7]

(b) The section indicated in Figure 3 is subject to a vertical shear force 1.2 kN acting through the shear center. Obtain and plot the resulting shear flow pattern. Area of boom 1, 2, 3, 4 = 2 cm^2. Find the horizontal distance between the shear center and point 4.

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

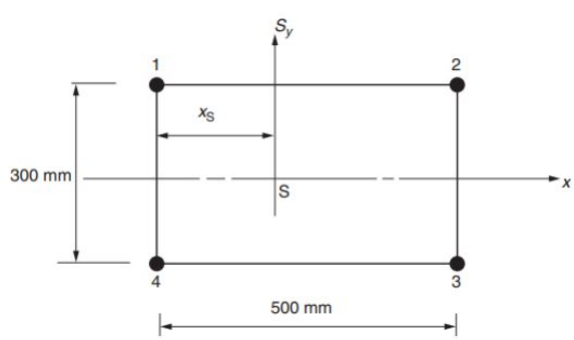

Figure 3

6. (a) Draw the neat sketches of idealized simple fuselage section and explain stress distribution over the fuselage. [BL: Understand| CO: 5|Marks: 7]

(b) The fuselage of a light passenger carrying aircraft has the circular cross-section shown in Figure 4. The cross-sectional area of each stringer is 100 mm^2 and the vertical distances given in Figure 4 are to the mid-line of the section wall at the corresponding stringer position. If the fuselage is subjected to a bending moment of 200 kN m applied in the vertical plane of symmetry, at this section, calculate the direct stress distribution. [BL: Apply| CO: 5|Marks: 7]

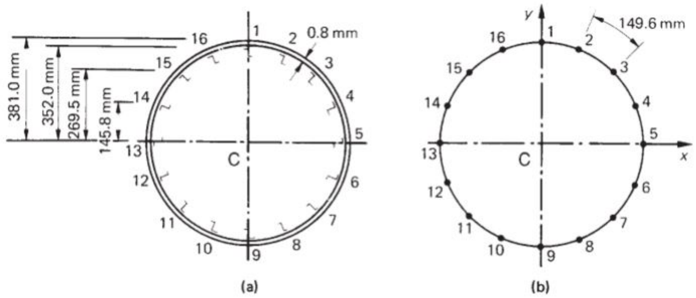

Figure 4

MODULE – V

7. (a) Describe the analysis of a semi cantilever type aircraft wing. [BL: Understand| CO: 6|Marks: 7]

   (b) The beam shown in Figure 5 is simply supported at each end and carries a load of 6000 N. If all direct stresses are resisted by the flanges and stiffeners and the web panels are effective only in shear, calculate the distribution of axial load in the flange ABC and the stiffener BE and the shear flows in the panels. [BL: Apply| CO: 6|Marks: 7]

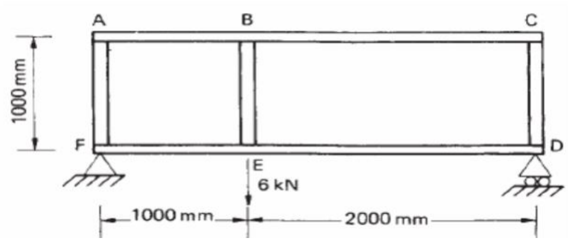

Figure 5

8. (a) Demonstrate direct stress distribution on wing section with neat sketch. Derive shear flow distribution on wing section with neat sketch. [BL: Understand| CO: 6|Marks: 7]

   (b) Determine the shear flow distribution in the web of the tapered beam shown in Figure 6 at a section midway along its length. The web of the beam has a thickness of 2mm.and is fully effective in resisting direct stress. The beam tapers symmetrically about its horizontal centroidal axis and the cross-sectional area of each flange is $400mm^2$. [BL: Apply| CO: 6|Marks: 7]

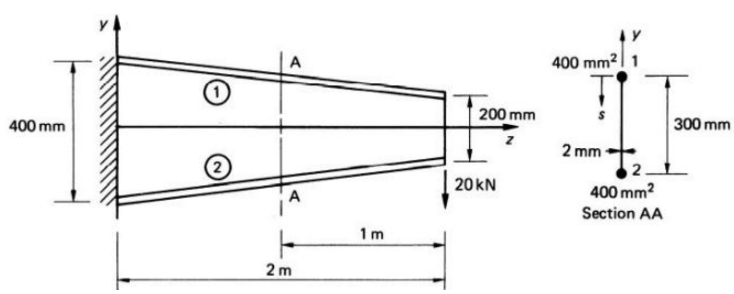

Figure 6

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