CBCS SCHEME

USN | | | | | | | | | |

18AE62

Sixth Semester B.E. Degree Examination, June/July 2025
Aircraft Structures II

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Derive an equation for direct stress due to bending in an unsymmetrical section. **(10 Marks)**

b. An I section beam with flanges 200 mm × 20 mm and web 260 mm × 25 mm is subjected to a bending moment of 100 KNm applied in a plane parallel to the longitudinal axis of the beam but inclined at 30° to the left of vertical. The sense of bending moment is clockwise when viewed from the left hand edge of the beam section. Determine the distribution of direct stress. **(10 Marks)**

OR

2 a. Determine the horizontal and vertical components of the tip deflection of the cantilever shown in Fig. Q. 2(a). The second moments of area are I_{xx} , I_{yy} and I_{xy} .

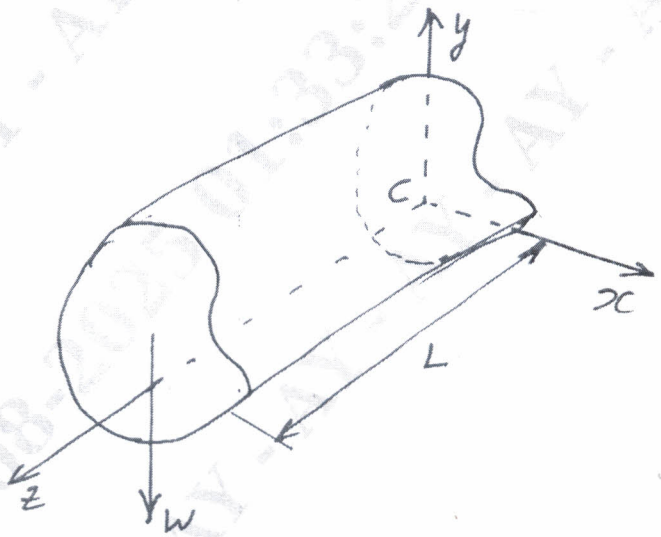

Fig. Q. 2 (a)

(10 Marks)

b. Determine direct stress distribution in the thin walled Z section shown in Fig. Q. 2 (b). Produced by a positive bending moment M_x. Thickness of the section is 't' constant throughout.

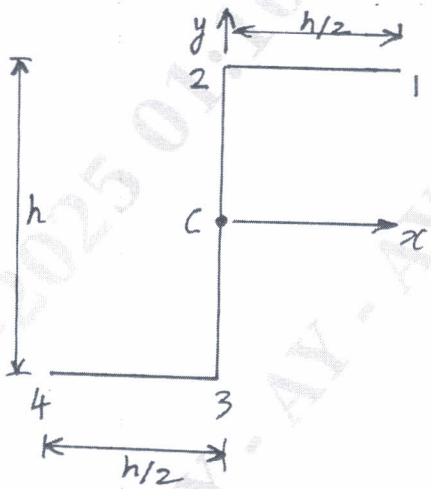

Fig. Q. 2 (b)

(10 Marks)

Module-2

3 a. Derive an equation for shear flow in closed section. **(10 Marks)**

b. If the wing box as shown in Fig. Q. 3(b) is subjected to a torque of 100KNm, calculate the rate of twist of the section and the maximum shear stress. The shear modulus is 25000 N/mm^2.

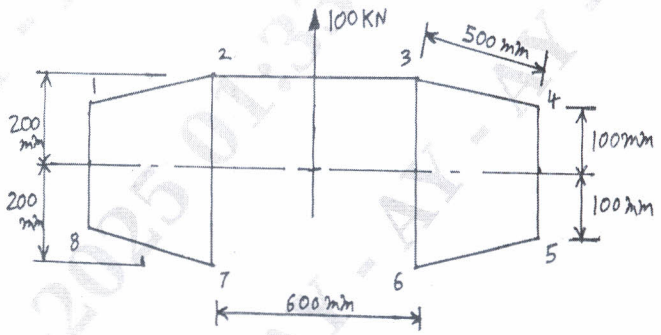

Fig. Q.3 (b) **(10 Marks)**

OR

4 A wing box has the cross section shown diagrammatically in Fig. Q 3(b) and supports a shear load of 100 KN in its vertical plane of symmetry. Calculate the shear stress at the mid point of the web 36 if the thickness of all walls is 2 mm. **(20 Marks)**

Module-3

5 a. Derive an equation for critical stress in a uniform rectangular plate subjected to compressive load. **(10 Marks)**

b. Determine the crippling stress using Needham and Gerard method. **(10 Marks)**

OR

6 a. Explain the failure modes in Rivets. **(10 Marks)**

b. Derive an expression for tension stress and normal stress in the web of wagner beam. **(10 Marks)**

Module-4

7 a. Explain safe life and Fail safe design criteria. **(10 Marks)**

b. Explain widespread fatigue damage and 2 bay crack criteria. **(10 Marks)**

OR

8 a. Define Idealization. Hence, arrive at the expression for boom area in the idealized panel. **(10 Marks)**

b. Idealize the wing section shown in Fig. Q. 8 (b) into an arrangement of direct stress carrying booms and shear stress only carrying panels. Take cross sectional area of angle section as 300 mm^2. Draw a neat sketch.

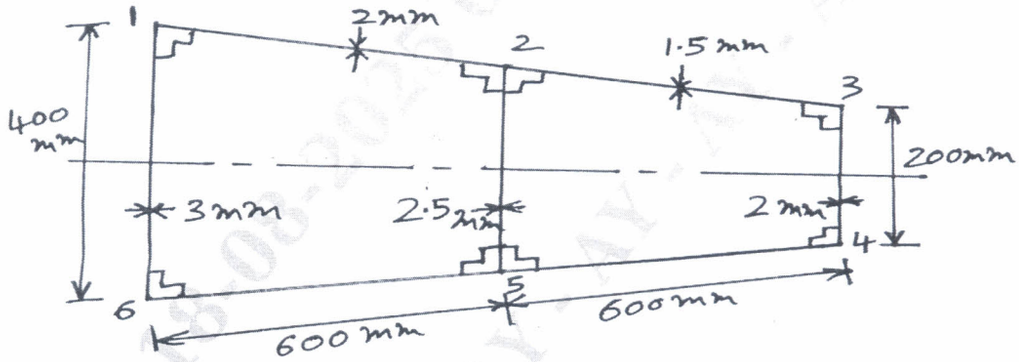

Fig. Q 8 (b) **(10 Marks)**

Module-5

9 The cantilever beam shown in Fig. Q. 9 is uniformly tapered and carries a load of 100 KN at its free end. Calculate the forces in the booms and shear flow distribution in the walls at a section 2 m from the built in end. Each corner boom has a cross sectional area of 900mm^2, while both central booms have 1200mm^2.

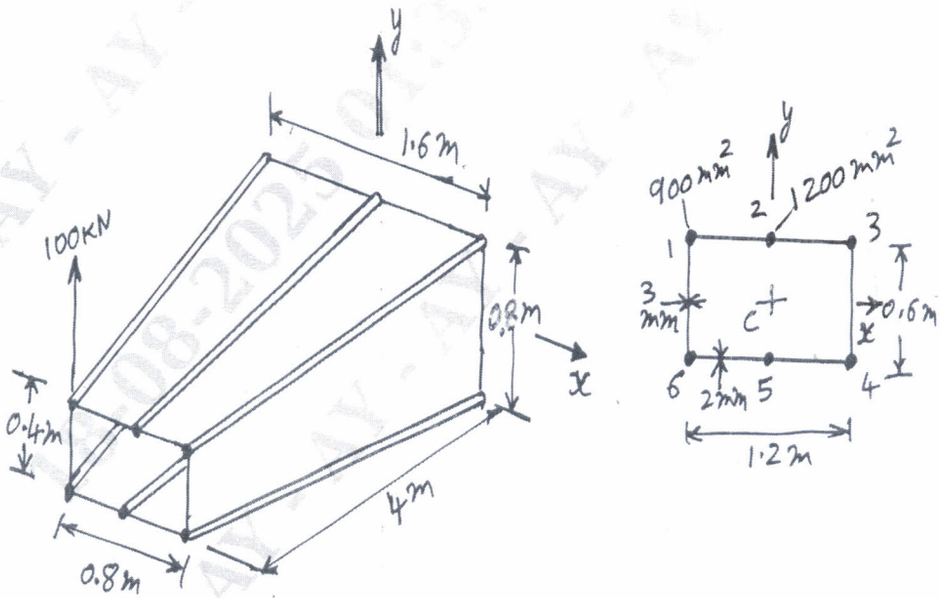

Fig. Q.9 **(20 Marks)**

OR

10 The fuselage as shown in Fig. Q. 10 is subjected to a vertical shear load of 100 kN applied at a distance of 150 mm from the vertical axis of symmetry, as shown for the idealized section. Calculate the distribution of shear flow in the section. Cross sectional area of each stringer is $100mm^2$.

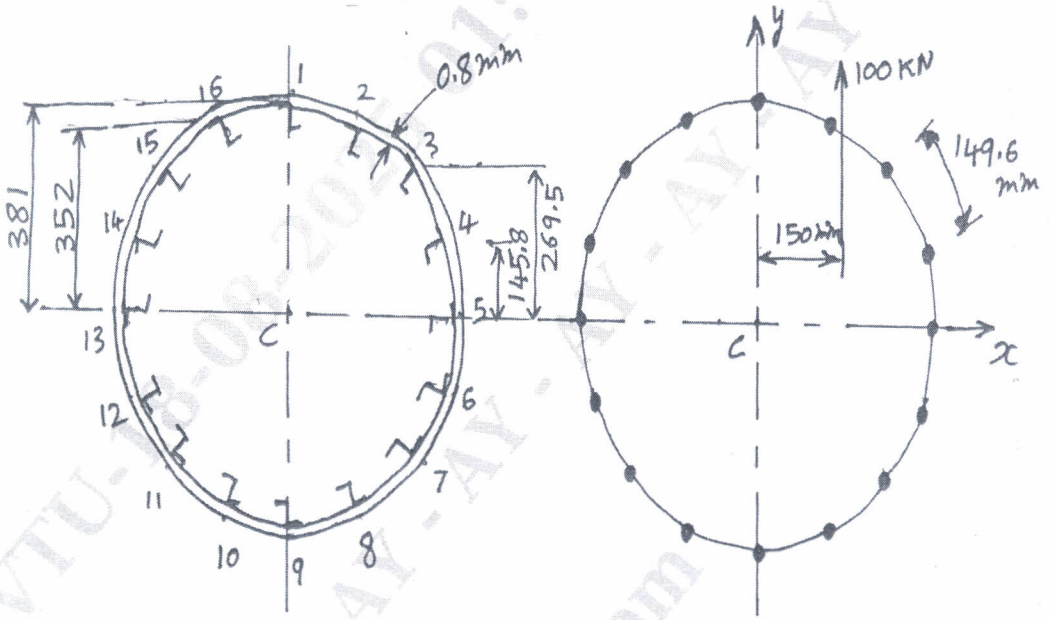

Fig. Q. 10 **(20 Marks)**

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