

# CBCS SCHEME

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18AE62

## Sixth Semester B.E. Degree Examination, Dec.2023/Jan.2024 Aircraft Structures – II

Time: 3 hrs.

Max. Marks: 100

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

### Module-1

- What are the assumptions made for unsymmetrical bending and derive the equation for direct stress distribution due to unsymmetrical bending and determine the position of neutral axis. (12 Marks)
  - Fig. Q1 (b) shows the section of an angle purlin. A bending moment of 3000 Nm is applied to the purlin in a plane at an angle of  $30^\circ$  to the vertical y axis. If the same of the bending moment is such that both its components  $M_x$  and  $M_y$  produces tension in the positive xy quadrant. Calculate the maximum direct stress in the purlin, stating clearly the point at which it acts.

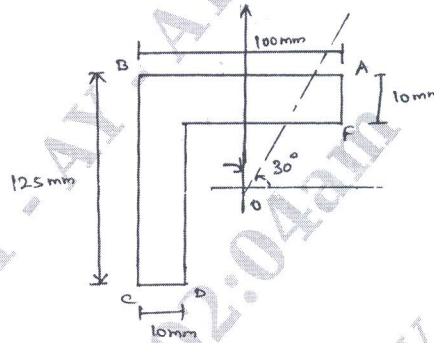


Fig. Q1 (b)

(08 Marks)

OR

- With the help of neat sketches, explain the approximations for thin-walled sections. (10 Marks)
  - Determine the deflection curve and the mid-span deflection of the simply supported beam shown in Fig. Q2 (b). The beam has a doubly symmetrical cross section.

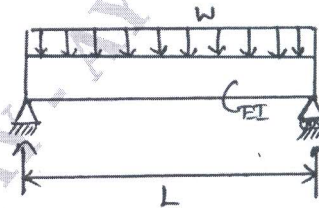


Fig. Q2 (b)

(10 Marks)

### Module-2

- Define shear center. Derive the equation for shear flow distribution in open section beams. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

- b. Calculate the shear flow distribution in the thin walled open section shown in Fig. Q3 (b), produced by a vertical shear load  $S_y$ , acting through its shear centre.

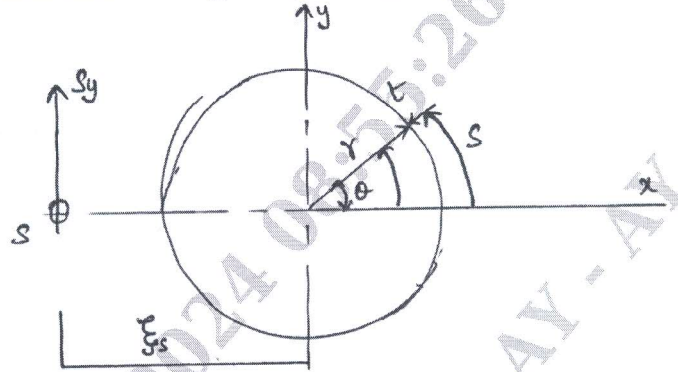


Fig. Q3 (b)

(10 Marks)

OR

- 4 a. Determine the shear flow distribution in the walls of the thin-walled closed section beam as shown in Fig. Q4 (a). The wall thickness,  $t$  is constant throughout.

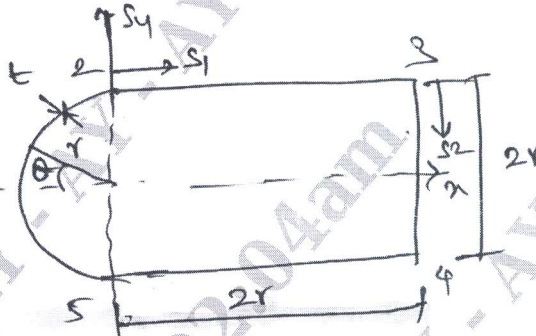


Fig. Q4 (a)

(12 Marks)

- b. Explain Bredt-Batho theory and determine the displacement associated with Bredt-Batho flow. (08 Marks)

**Module-3**

- 5 a. Explain the Needham and Gerard Methods for determining crippling stresses. (10 Marks)  
b. Discuss briefly the local crippling failure subjected in columns. (10 Marks)

OR

- 6 a. Explain the Eccentrically loaded connections in bolts and rivets. (10 Marks)  
b. Explain the buckling of isotropic flat planes in compressions. (10 Marks)

**Module-4**

- 7 a. Explain ; (i) Widespread Fatigue damage. (10 Marks)  
(ii) Two-bay crack criteria. (10 Marks)  
b. Explain the Life Assessment procedures for an aircraft with safe structural design. (10 Marks)

OR

- 8 The thin-walled single cell boom shown in Fig. Q8 has been idealized into a combination of direct stress carrying booms and shear stress only carrying walls. If the section supports a vertical shear load of 10 kN, acting in a vertical plane through boom 3 and 6, calculate the distribution of shear flow around the section.

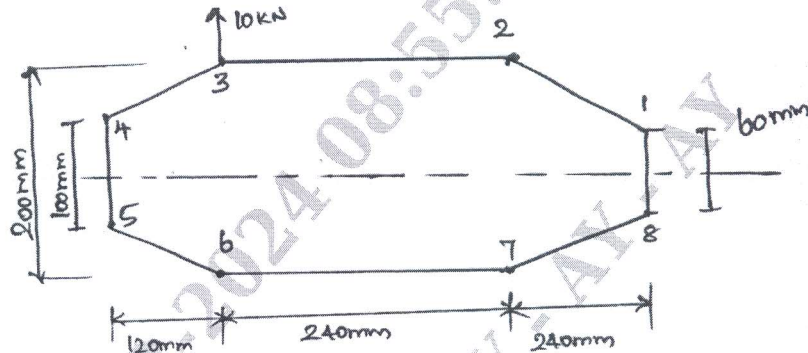


Fig. Q8

(20 Marks)

**Module-5**

- 9 a. A wing section shown in Fig. Q9 (a) has been idealized such that the booms carry all the direct stresses. If the wing section is subjected to a bending moment of 300 kNm applied in a vertical plane, calculate the direct stresses in the booms.

Boom Areas :  $B_1 = B_2 = 2580 \text{ mm}^2$ ,  $B_3 = B_4 = 3230 \text{ mm}^2$ ,  $B_5 = B_6 = 3880 \text{ mm}^2$

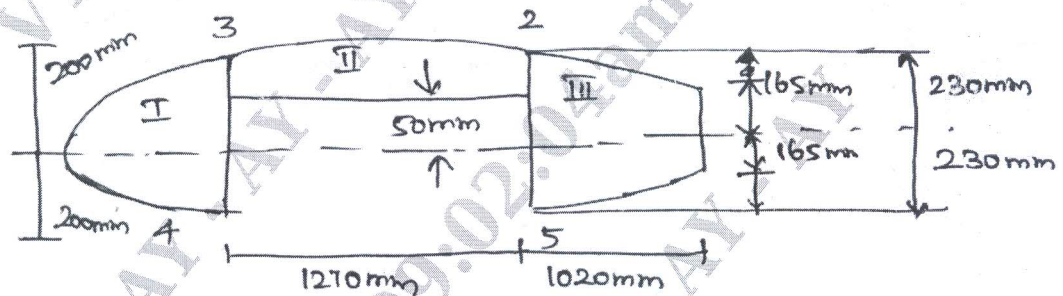


Fig. Q9 (a)

(10 Marks)

- b. A wing spur has the dimensions shown in Fig. Q9 (b) carries a uniformly distributed load of 15 kN/m along its complete length. Each flange has a cross sectional areas of  $500 \text{ mm}^2$  with the top flange being horizontal. If the flanges are assumed to resist all direct loads while the spur web is effective only in shear, determine the flange loads and the shear flow in the web at sections 1 and 2 m from the free end.

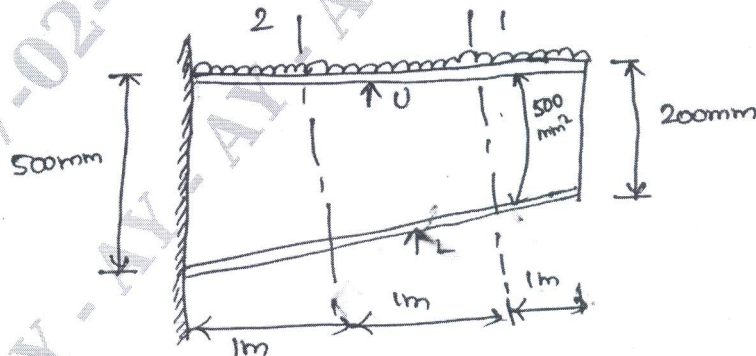


Fig. Q9 (b)

(10 Marks)

OR

- 10 a. The fuselage of a light passenger carrying aircraft has the circular cross section shown in Fig. Q10 (a). The cross sectional area of each stringer is  $100 \text{ mm}^2$  and the vertical distances given in Fig. Q10 (a) are to the mid line of the section wall at the corresponding stringer position. If the fuselage is subjected to a bending moment of  $200 \text{ kNm}$  applied in the vertical plane of symmetry, at this section, calculate the direct stress distribution. (10 Marks)

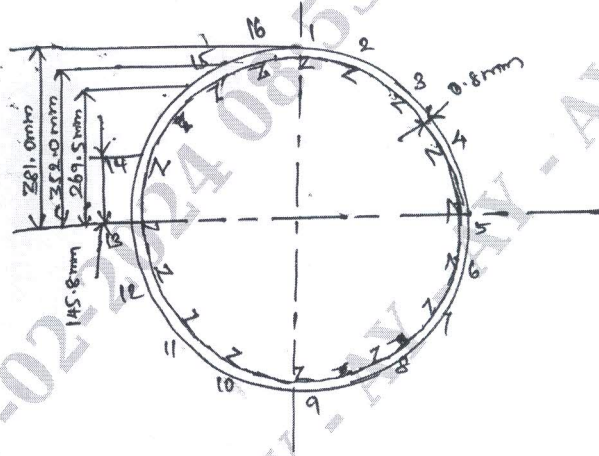


Fig. Q10 (a)

- b. Explain cut-outs in fuselages briefly with relevant sketches and equations. (10 Marks)

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