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**18AE62**

# Sixth Semester B.E. Degree Examination, July/August 2022
## 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. 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)**

b. 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˚ to the vertical y axis. If the sense of the bending moment is such that both its components Mx and My produce tension in the positive xy quadrant, calculate the maximum direct stress in the purlin, stating clearly the point at which it acts. **(08 Marks)**

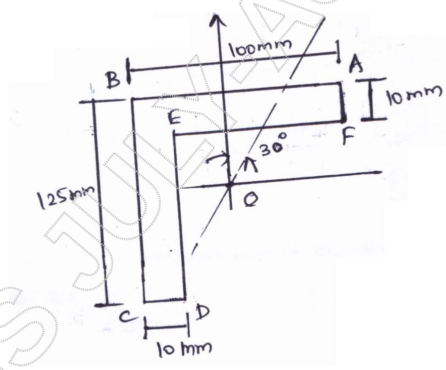


Fig. Q1 (b)

**OR**

**2** a. Derive the relationship between load intensity, shear force and bending moment. **(07 Marks)**

b. Derive an equation to determine the deflections due to bending. **(08 Marks)**

c. Write a short note on approximations for thin walled sections. **(05 Marks)**

### Module-2

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

b. Explain Bredt-Batho Theory and determine the displacement associated with Bredt-Batho shear flow. **(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. **(10 Marks)**

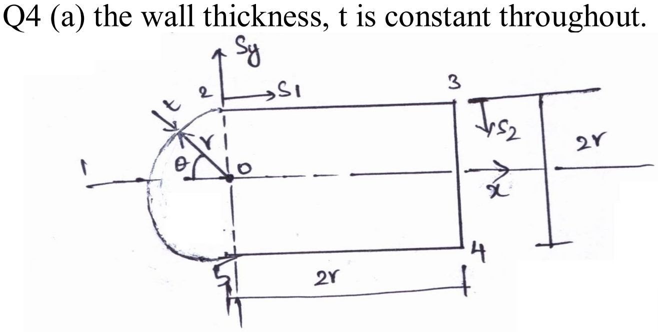


Fig. Q4 (a)

b. Derive the equation to determine the shear flow distribution in closed-section beams. **(10 Marks)**

## Module-3

**5** a. Discuss briefly the local crippling failure subjected in columns. **(10 Marks)**

b. Explain the Needham and Gerard methods for determining crippling stresses. **(10 Marks)**

**OR**

**6** a. Explain the buckling of Isotropic flat plates in compression. **(10 Marks)**

b. Explain the eccentrically loaded connections in bolts and Rivets. **(10 Marks)**

## Module-4

**7** a. Explain the Life Assessment procedures for an aircraft with safe-structural design. **(10 Marks)**

b. Explain : (i) Two – bay crack criteria. (ii) Widespread Fatigue damage. **(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. **(20 Marks)**

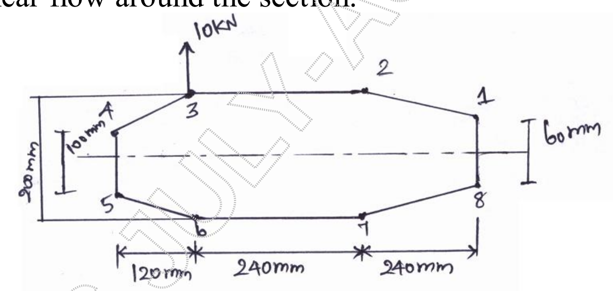


Fig. Q8

## Module-5

**9** a. A wing spur has the dimension shown in Fig. Q9 (a) carries a uniformly distributed load of 15 kN/m along its complete length. Each flange has a cross sectional area of 500 mm$^2$ with the top flange being horizontal. If the flanges are assumed to resist all direct loads while the spar 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. **(10 Marks)**

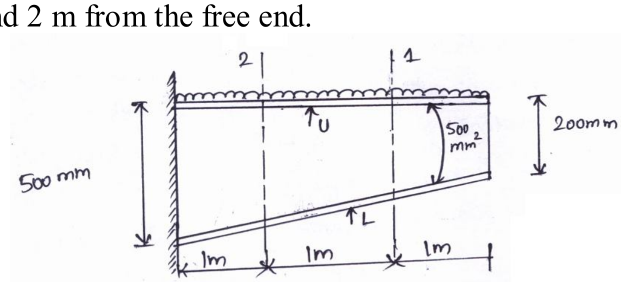


Fig. Q9 (a)

b. The wing section shown in Fig. Q9 (b) 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 : $B_1 = B_2 = 2580$ mm$^2$, $B_2 = B_5 = 3880$ mm$^2$, $B_3 = B_4 = 3230$ mm$^2$ **(10 Marks)**

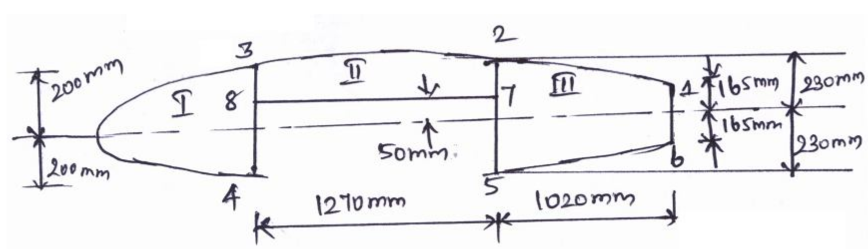


Fig. Q9 (b)

**OR**

10 a. Explain cut-outs in fuselages briefly with revelant sketches and equations. **(10 Marks)**

b. The fuselage of a light passenger carrying aircraft has the circular cross section shown in Fig. Q10 (b). The cross sectional area of each stringer is 100 $mm^2$ and the vertical distances given in Fig. Q10 (b) 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 kNm applied in the vertical plane of symmetry, at this section, calculate the direct stress distribution. **(10 Marks)**

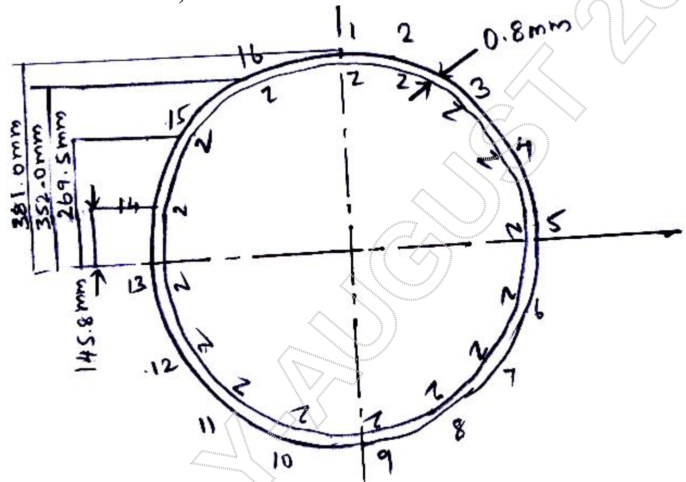


Fig. Q10 (b)

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