**Question Paper Code : 21027**

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2013.

Fifth Semester

Aeronautical Engineering

AE 2302/AE 52/AE 1302/10122 AE 502 — AIRCRAFT STRUCTURES — II

(Regulation 2008/2010)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State the assumptions made in the Bredt-Batho theory.

2. Define Shear flow and show that $q = T/2A$ for curved web.

3. Define Principal axis and Neutral axis and give an expression to determine them.

4. Differentiate between symmetric and unsymmetric bending and give examples.

5. Draw bending stress and shear stress distribution for an I-section.

6. Explain buckling in shear for a sheet and sketch the mode shape.

7. What is cladding?

8. Explain Wagner beam and its advantages.

9. Explain with neat sketches, shear flow around a multi cell structure.

10. Describe the semi-cantilever type of aircraft wing.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Find an expression for angle of twist per unit length of thin walled closed section. (4)

(ii) Find the shear flow distribution in thin walled Z section whose thickness is t, height h, flange width h/2 and subjected to a vertical load through shear centre. (12)

Or

(b) A beam having the cross-section shown in Fig. Q. 11 (b) is subjected to a bending moment of 1500 N m in a vertical plane. Calculate the maximum direct stress due to bending and indicate the point at which it acts.

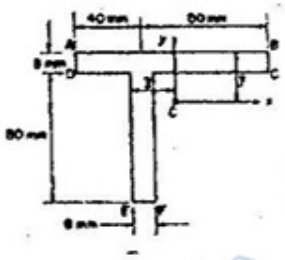

Fig. Q. 11 (b)

12. (a) Derive an expression for bending stress in an unsymmetrical section subjected to $M_X$ and $M_Y$ and modify this expression with respect to principal axis and neutral axis.

Or

(b) An Angle section in fig. Q. 12 (b) is subjected to $M_X = 20$ KNm and $M_Y = 15$ KNm, Find maximum bending stress.

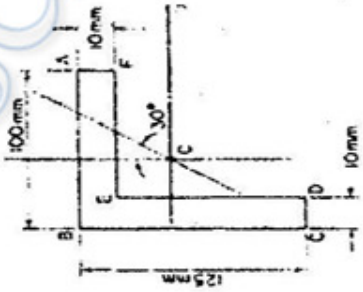

Fig. Q. 12 (b)

13. (a) Derive an expression for shear flow of an open tube of arbitrary cross section subjected to shear loads $Sx$ and $Sy$ without twist. Modify the above expression for a closed tube.

Or

(b) Find the position of the shear centre of the rectangular four boom beam section shown in Fig. Q. 13 (b). The booms carry only direct stresses but the skin is fully effective in carrying both shear and direct stress. The area of each boom is 100 mm².

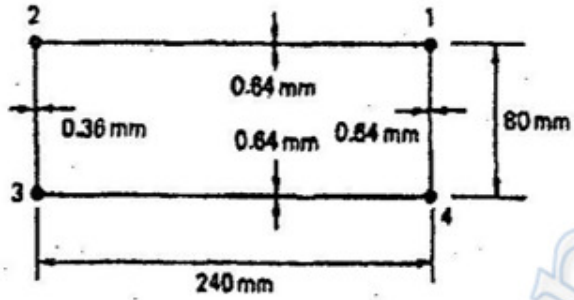


Fig. Q. 13 (b)

14. (a) Find the shear flow and angle twist for a length of two cell structure shown in fig. Q. 14 (a). The material used is alumimum = 70 GPa, Poisson ratio = 0.3 , $t$ = 0.1 cm.

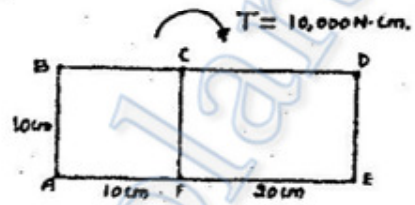


Fig. Q. 14 (a)

Or

(b) A uniform thin-walled beam is circular in cross-section and has a constant thickness of 2.5 mm. The beam is 2000 mm long, carrying end torques of 450 N m and, in the same sense, a distributed torque loading of 1 Nm/mm. The loads are reacted by equal couples R at sections 500 mm distant from each end. Calculate the maximum shear stress in the beam and sketch the distribution of twist along its length. Take G = 30,000 N/mm² and neglect axial constraint effects.

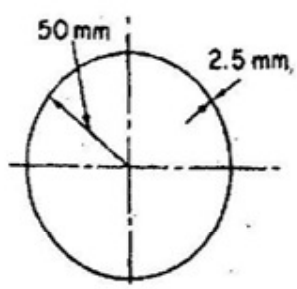


Fig. Q. 14 (b)

15. (a) (i) Explain Wagner beam. (8)

(ii) Explain lift load distribution on a cantilever wing. (8)

Or

(b) Find the Margin of Safety for the box beam shown in fig. Q. 15 (b) given : $P_1$ = 12 kN and $P_2$ = 10 kN. Area of each stringer = 3 $cm^2$ and the sheet thickness is 2 mm throughout. Assume the sheets are effective in bending and made of 2024-T3 Aluminum alloy. For a/b=2, Kc = 5, Ks = 6.5 and for a/b=3, Kc = 4, Ks = 5.8.

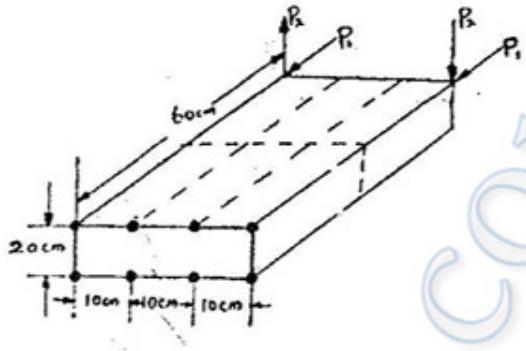


Fig. Q. 15 (b)