D.L. V.K

N 1002

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2004.

Sixth Semester

Aeronautical Engineering

AE 341 — AIRCRAFT STRUCTURES – II

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define 'redundancy' in a structure. How do you determine the order of redundancy?

2. What do you understand by unsymmetrical bending? Explain a method to find the stresses in an unsymmetrical section.

3. Explain the principle of virtual work and its application in solving structural problems.

4. How do you determine the shear flow and angle of twist for a closed single cell under torsion?

5. Indicate how Von Karman's effective width is computed knowing the stress distribution on the sheet–stiffener panel.

6. What is a lip? How does it affect the strength of a section?

7. Explain clearly the distinction between the strength and stiffness problems in structures.

8. Explain how a thin beam subjected to shear resists the load.

9. What is a semi tension field beam?

10. What do you understand by monocoque and semi monocoque type of aircraft construction?

PART B — (5 × 16 = 80 marks)

11. Obtain the shear flow around a three cell box beam (Fig. 1) when it is subjected to a torque of T = 100 kNm The thickness of vertical members, horizontal members and semicircle are 1.25, 0.75 and 0.6 cm respectively.

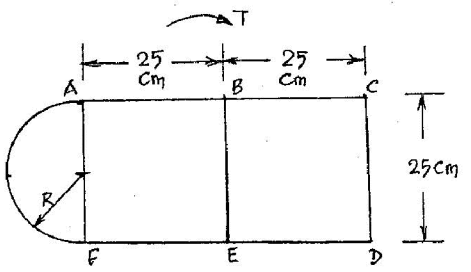

Fig. 1

12. (a) (i) Does the shear center always lies outside for the open section? Explain.

(ii) Obtain the shear flow and shear center location for the channel section subjected to a vertical shear load of 5 kN. The height of the vertical web is 50 mm and width of flanges is 25 mm. Thickness of the flanges and the web is 1.5 mm.

Or

(b) Obtain the shear flow distribution for the closed section shown in Fig. 2. Each stringer area is 6.5 cm^2.

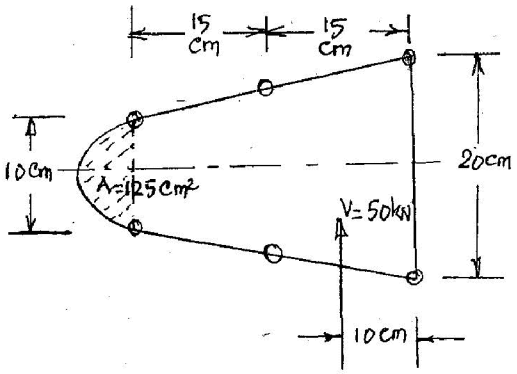

Fig. 2.

13. (a) (i) What is a rib? How does it transfer the load?

(ii) Determine the load distribution in all the members of the rib shown in Fig. 3.

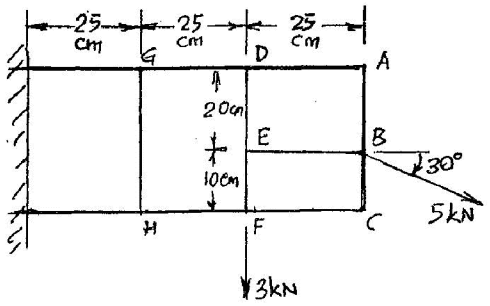

Fig. 3

Or

(b) A fuselage bulkhead of 1 m radius, has 12 stringers equally placed around the section starting from top point. Each stringer area is 6.25 cm². The bulk head is subjected to a symmetrical vertical shear load of 10 kN. Find the shear flow around the bulk head.

14. (a) (i) Show that the sum of the moment of inertia about any two orthogonal axes is invariant with respect to any other two orthogonal axes. (6)

(ii) Obtain the shear flow distribution and shear center location for the section shown in Fig. 4. When it is subjected to a shear load of 5 kN. (10)

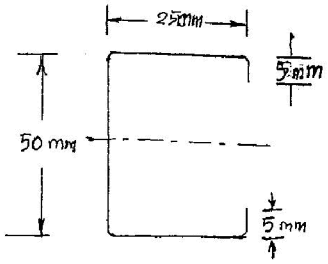

Fig. 4

Or

(b) A beam section shown in Fig. 5 has four stringers. The area of the stringers A, B, C and D are 6.25, 3.125, 4.5 and 6 sq.cm. respectively. Find the stresses in all the four stringers of the section due to $M_x = 50$ kNm and $M_y = -20$ kNm where x and y are the centroidal axes. Assume that webs and walls are ineffective in bending.

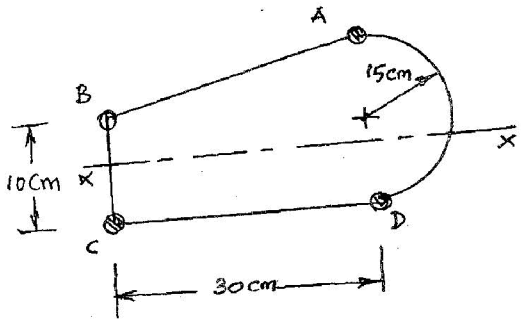

Fig. 5

15. (a) (i) Clearly bring out the difference between shear resistance beams and tension field beams. (6)

(ii) Find the crippling load for an angle section of aluminium alloy, 50 mm × 25 mm × 1 mm. (10)

Or

(b) Write short notes on :

(i) Formed and extruded section

(ii) Gerard method of finding crippling stress

(iii) Energy theorems in structural analysis.