D.E.V.K

Y 5004

M.E. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2006.

First Semester

Aeronautical Engineering

AN 132 — AIRCRAFT STRUCTURES

(Regulation 2002)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Sketch a semi-monocoque wing and state the assumptions made in its analysis.

2. Distinguish between symmetric and unsymmetric bending. Give examples.

3. Define principal axes and give an expression to determine it.

4. Define shear center and mark shear center

   (a) channel section

   (b) equal section.

5. Show that for a curved web the resultant force of a shear flow R = qL.

6. Give the expression for angle of twist for a thin walled closed section subjected to torque.

7. What is safe life and fail safe design?

8. Sketch buckling modes for a sheet in

   (a) Compression

   (b) Shear.

9. Why are Lips and Bulbs provided in extruded sections?

10. Explain effective width and give an expression to determine it.

PART B — (5 × 16 = 80 marks)

11. (a) A box beam with 50 cm length is subjected to loads $P_x = 8$ kN and $P_y = 25$ kN as shown in the fig.1. The stringer areas are 3 cm^2 each. Find the maximum bending stress.

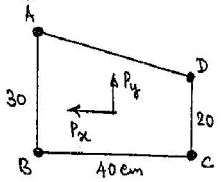

Fig.1

Or

(b) Find the max. bending stress for the section shown in the fig.2, subjected to a bending moment $M_x = 1500$ N – m.

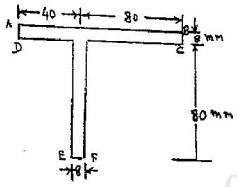

Fig. 2

12. (a) Derive an expression for shear flow of an open tube of arbitrary cross-section subjected to shear loads S_x & S_y without twist and modify this expression for a closed tube.

Or

(b) Find the shear flow distribution in a thin walled Z-section, whose thickeness is t, height h, flange width h/2 and subjected to a shear S_y through the shear center.

13. (a) Find the shear flow and shear center for the open section shown in the fig.3. The area of strings are, a = b = 6 cm^2, c = d = 2.5 cm^2. A vertical load of 10kN acts through the shear center.

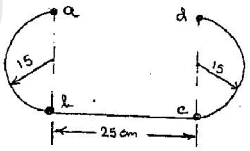

Fig.3
Or

(b) Find the shear flow of the closed tube shown in the fig.4. The area of stringers are, a = a' = c = c' = 1 cm², b = b' = 2 cm².

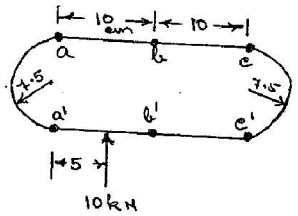

Fig.4

14. (a) Find the shear flow for the two cell structure shown in fig.5. The stringer areas are a = a' = 4 cm², c = c' = e = e' = 2 cm², b = b' = d = d' = 1 cm². The vertical webs a-a' and e-e' have 1.5 mm thickness and the remaining walls have 1 mm thickness each.

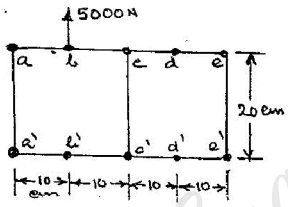

Fig.5

Or

(b) Find the shear flow and twist per unit length of the three cell tube made of Aluminium as shown in the fig.6 and subjected to a Torque 75,000 N-cm. E = 70 Gpa.

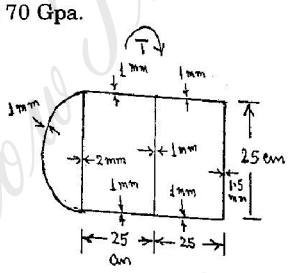

Fig.6

15. (a) (i) Explain buckling, local buckling and crippling with suitable examples. (6)

(ii) Explain Needham's method to determine crippling strength. (10)

Or

(b) (i) An Aluminium alloy Z section with 1.5 mm uniform thickness, flange width = 2 cm and web height = 4 cm is subjected to compression. Find the local buckling stress if $K_W = 2.9$ and E = 70 Gpa. (5)

(ii) Explain Inter-Rivet buckling. (5)

(iii) Explain principle of Semi-Tension field beam. (6)