Question Paper Code : 51027

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2014.

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. What is unsymmetrical bending? Give an example.

2. Define (a) Principal axis (b) Neutral axis and give an expression to determine them.

3. Sketch the shear flow distribution for a thin walled 'Z' section subjected to a vertical load through the shear centre.

4. Define shear centre and elastic axis.

5. Find an expression for angle of twist per unit length of a thin walled closed section.

6. Find the shear flow in a circular tube subjected to a vertical shear through its centre and sketch the variation.

7. Brief the buckling of sheets in shear and bending and sketch the mode shapes.

8. Find the buckling stress for the plate. The panel dimensions are 30cm × 15 cm × 2mm. All the edges are simply supported. The material used is 2024-T3. Given $K_C = 4$.

9. Write a short note on shear resistance web beams.

10. Draw a neat sketch of a fuselage structure showing all the structural details. Mention the loads resisted by each of them.

PART B — (5 × 16 = 80 marks)

11\. (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. (16)

Or

(b) Obtain the bending stress values at all the corner points for the section shown in Fig. Q. 11 (b). (16)

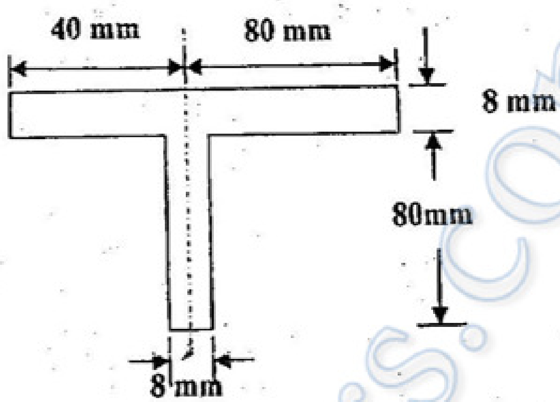

Fig. Q. 11 (b)

12\. (a) Find the shear flow distribution in a thin walled Z-section, whose thickness is 't', height 'h'. Flange width 'h/2' and subjected to vertical shear load through shear center. (16)

Or

(b) Find the shear centre location of the section shown in Fig. Q. 12 (b). The webs are ineffective in bending and area of each stringer = 2 cm^2.web thickness is 2 mm throughout. (16)

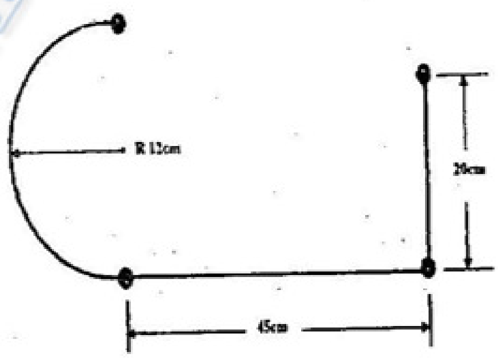

Fig. Q. 12 (b)

13. (a) Derive and obtain an expression for the cell twist when the section given in Fig. Q. 13 (a) is subject to a pure torque T. The shear modulus of the material used is 'G' while the wall thickness 't' is the same throughout. (16)

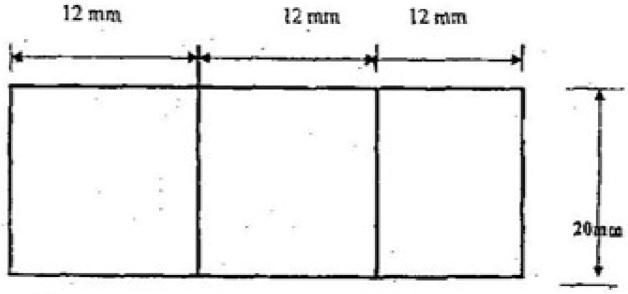

Fig. Q. 13 (a)

Or

(b) Find the shear flow distribution and locate the shear centre for the section shown in Fig. Q. 13 (b). Each of the stringers has an area of 4 cm^2 and the section subjected to vertical shear of 50kN. (16)

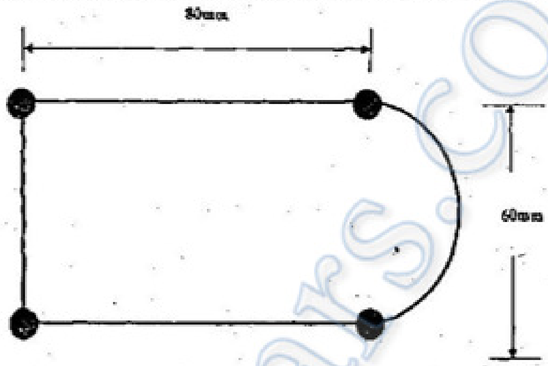

Fig. Q. 13 (b)

14. (a) The sheet-stringer panel shown in Fig. Q. 14 (a) is loaded in compression. The sheet is assumed to be simply-supported at the loaded ends and along the rivet lines, but free at the sides. Each stringer has an area of 0.7 cm^2. E = 70 GPa for the sheet and stringer material while the yield stress is 20 MPa. Determine the total compressive load carried under the following conditions :

(i) When the sheet first buckles (8)

(ii) When the stringer stress is 200 MPa. (8)

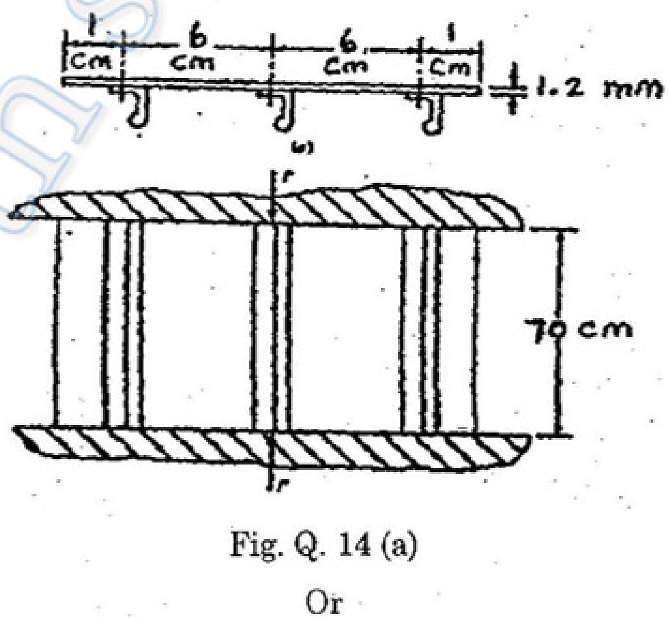

Fig. Q. 14 (a)

Or

(b) Calculate the crippling load of the section indicated in Fig. Q. 14. (b). The equivalent length of the member is 180 cm, Thickness is 2mm throughout. (16)

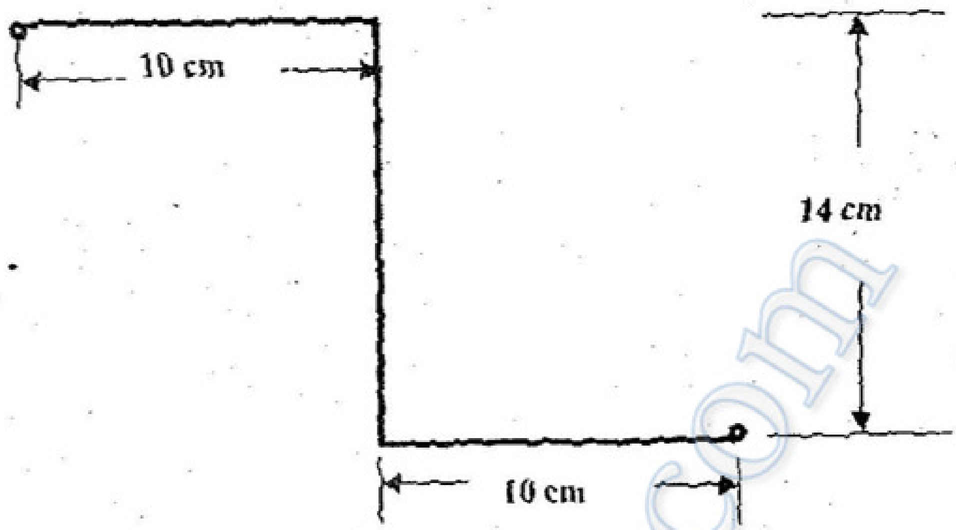

Fig. Q .14 (b)

15. (a) A Wagner beam of length 1200 mm, fixed as a cantilever is subjected to a tip load of 5 kN. The depth of the beam is 400mm and the stiffener spacing is 300 mm. The cross section areas of the flanges and stiffeners are 350 mm^2 and 300 mm^1 respectively. The elastic section modulus of each flange is 750 mm^3, the thickness of the web is 2 mm and the second moment of area of a stiffener about an axis in the plane of the web is 200 mm^4. Determine the maximum stress in a flange and also whether the stiffeners will buckle or not. B = 70000 N/mm^2. (16)

Or

(b) (i) Explain in detail about Tension field web beams (6)

(ii) Explain in detail the construction of shear force and bending moment diagrams for the aircraft wing. (10)