Reg. No. : 2 1 1 0 5 1 0 1 0 3 0

R 3017

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2007.

Fifth Semester

Aeronautical Engineering

AE 1302 — AIRCRAFT STRUCTURES – II

(Regulation 2004)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. In unsymmetrical bending, the neutral axis passess through the centroid of the cross-section. (True/False)

2. A rectangular cross-section is subject to a skew load. Mark the neutral axis and sketch the bending stress distribution.

3. What is shear flow? State its units.

4. In lumping a cross section, the booms are assumed to carry only ———— and the skin resists only ————.

5. A multi-cell structure subject to a torque load is statically indeterminate. Why?

6. Relate shear flow and angle of twist in a thin-walled structure subject to torque.

7. Differentiate between primary and secondary buckling.

8. Write down the expressions for the flexural rigidities of (a) a beam, and (b) a thin plate.

9. What is a Wagner beam?

10. What are the important factors that govern the selection of an aircraft material?

PART B — (5 × 16 = 80 marks)

11. (a) The section shown in Fig. 1 is subject to a bending moment M_x = 30 kNm. Determine the bending stresses at the corner points A, B, C and D.

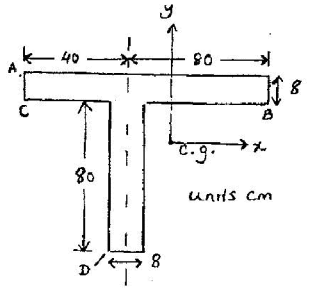

Fig. 1 Qn. 11 (a)

Or

(b) Derive and obtain an expression for the generalized flexure formula. What are the assumptions involved?

12. (a) Determine the shear center location for the section shown in Fig.2. All the webs are ineffective in bending.

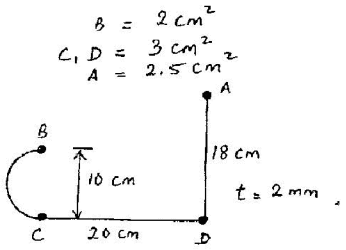

Fig. 2 Qn. 12 (a)

Or

(b) Locate the shear center for the section shown in Fig. 3. Plot the shear stress distribution when a vertical shear load of 1.2 kN acts through the shear center.

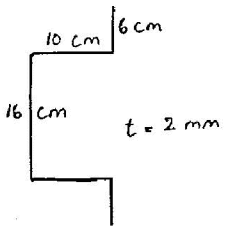

Fig. 3 Qn. 12 (b)

13. (a) The webs of the structure shown in Fig. 4 are effective in bending. Plot the shear flow distribution.

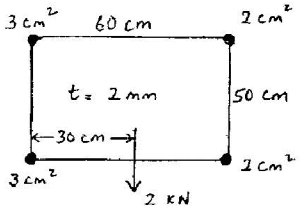

Fig. 4 Qn. 13 (a)

Or

(b) (i) The 2-cell structure shown in Fig. 5 is subject to a torque of 70 kNm. Plot the shear flow distribution, and find the cell twist. Use G = 75 GPa. (10)

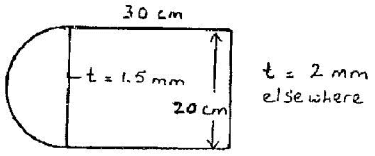

Fig. 5 Qn. 13 (b)

(ii) Outline the solution to the problem of 13. (b) (i) using an approximate method. (6)

14. (a) (i) Determine the crippling load of a 4 cm × 4 cm × 2 mm angle section column having an effective length 2.5 m. Material used is steel with E = 200 GPa. (10)

(ii) Outline the Needham method of crippling stress calculation. (6)

Or

(b) Derive the differential equation governing the buckling of a thin flat plate.

15. (a) (i) What are the different loads that an aircraft fuselage is subject to? Explain the construction of shear force and bending moment diagrams for an aircraft fuselage.

(ii) Explain the semi-monocoque type of fuselage construction with the help of neat sketches. (10 + 6)

Or

(b) Determine the shear flow distribution in the web of the tapered beam shown below, at a section mid-way along its length. The web of the beam has a thickness of 2 mm and is fully effective in resisting direct stress. The beam tapers symmetrically about its horizontal centroidal axis. The cross-section area of each flange is 400 mm^2.