

B.E DEGREE EXAMINATIONS: NOV/DEC 2014

(Regulation 2009)

Fifth Semester

AERONAUTICAL ENGINEERING

AER110: Aircraft Structures II

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Z cross section has.....
 - a) One line of symmetry
 - b) Many lines of symmetry
 - c) One line of anti symmetry
 - d) Many lines of anti symmetry
2. If bending stress is $\sigma = Cy + Dz$ in un symmetric bending the neutral plane is at angle θ given by $\tan \theta =$
 - a) C/D
 - b) -C/D
 - c) D/C
 - d) -D/C
3. Shear web beams consist of
 - a) Thin web, thick stiffener
 - b) Thin web, thin stiffener
 - c) Thick web, thin stiffener
 - d) Thick web thick stiffener
4. If bending carrying ability of a thin vertical web of height h and thickness t is lumped at top and bottom, the lumped areas are
 - a) $ht/6$
 - b) $ht/3$
 - c) $ht/2$
 - d) $ht/4$
5. Shear flow is related to shear stress τ and thickness as
 - a) $t\tau$
 - b) τ/t
 - c) t/τ
 - d) $\sqrt{t\tau}$
6. Shear flow in a single cell tube along its periphery is
 - a) Zero
 - b) Constant
 - c) Varies
 - d) Depends on thickness

7. Kirchhoff's boundary condition is applied at....edge of a plate
 - a) Simply supported
 - b) Clamped
 - c) Free
 - d) Any
8. The order of differential equation of bending of a thin plate is
 - a) 2
 - b) 4
 - c) 6
 - d) 8
9. In a shear resistant web beam _____ will happen.
 - a) Web resist bending
 - b) Flanges resist shear
 - c) Web resists shear
 - d) Flanges resist shear and bending
10. In a free fall the load factor is
 - a) 0
 - b) 1
 - c) -1
 - d) >1

PART B (10 x 2 = 20 Marks)

11. Define symmetric bending.
12. What are skew loads? Explain.
13. Define shear centre.
14. What is a shear web beam? Explain.
15. Explain Bredt-Batho formulas.
16. State the compatibility conditions in torsion of multi cells.
17. Explain effective width's concept.
18. What is crippling? Explain.
19. State the effects of gust loads on load factor.
20. Differentiate pure and semi tension field beam theories.

PART C (5 x 14 = 70 Marks)

21. a) Derive expression for the bending stresses in a Z-section.

(OR)

- b) Derive expression for the shear stress in thick walled Z-section.

22. a) (i) Find the shear centre position for a channel section of constant thickness. (10)
- (ii) Mark the approximate position of shear centre of the sections (Fig 1). (4)

(OR)

b) (i) By lumping the areas of thin webs of a channel section, find the position of shear centre. (8)

(ii) Calculate the areas of vertical and horizontal webs to be lumped. (6)

23. a) (i) Show that shear flow is constant along the periphery of the cell. (4)

(ii) Derive equation for the twist per unit length of a single cell in torsion. (10)

(OR)

b) Find the shear flows in all the webs and twist per unit length of Fig 2 under a torque of 5000 KNcm. Thickness is same for all webs. $G=30\text{GPa}$.

24. a) Derive the governing equation for the bending of a thin flat plate.

(OR)

b) Clearly explain the method of obtaining Navier's solution of plate.

25. a) (i) Explain the differences in the analysis of a cantilever and strutted wings. (8)
(ii) Briefly explain the different types of loads acting on aircraft structure. (6)

(OR)

- b) (i) Explain the construction and uses of velocity-load factor diagram. (8)
(ii) Sketch shears force, bending moment and torque diagrams for a cantilever wing. (6)
