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Question Paper Code : 90072

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Fifth Semester

Aeronautical Engineering

AE 8502 — AIRCRAFT STRUCTURES – II

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. How do you differentiate unsymmetrical bending of beams from symmetrical bending?

2. Define principal plane and give an expression to determine it.

3. Sketch the shear stress and bending stress variations on an 'I' section subject to bending in the vertical planet.

4. Define shear centre and indicate its location for a thin-walled 'L' section.

5. Find the shear flow in a circular tube subjected to a vertical shear load (P) through its centre and sketch its variation.

6. What is Bredt-Batho formula and how it is useful in shear flow calculations?

7. Explain buckling of plates is different from buckling of columns.

8. Give an expression for margin of safety when a panel is subjected to combined bending and shear load.

9. Define load factor for an aircraft.

10. Give the difference between complete tension field beam and semi-tension field beam.

PART B — (5 × 13 = 65 marks)

11. (a) A box beam of 50cm length is subjected to loads M_x = 8 kN and M_y = 25kN as shown in Fig. 11(a). Area of each stringer is 2cm². Assume the skin is ineffective in bending. Find the bending stress in the stringers.

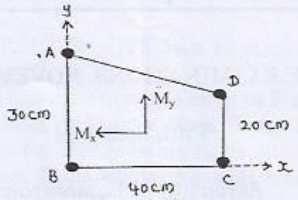

Fig.11(a)

Or

(b) The cross section of a beam shown in Fig. 11(b) is subjected to moments M_x = 1000 N-m and M_y = 500 N-m. Find the bending stress at points A and B.

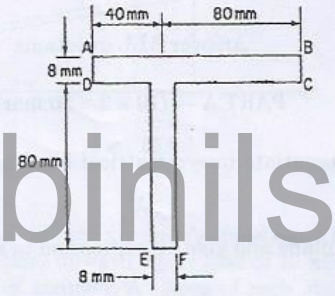

Fig.11(b)

12. (a) Locate the shear centre of the thin-walled channel section subject to a vertical shear load of 1000N as shown in Fig. 12(a). $t = 2mm$.

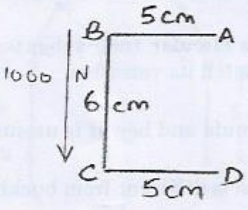

Fig.12(a)

Or

(b) Find the shear flow distribution in a thin - walled 'Z' section subjected to S_x = 5kN and S_y = 3kN acting through the shear centre. The section has a

13. (a) A two-cell structure shown in Fig. 13(a) has 2mm of uniform thickness. Take E = 90 GPa and Poisson's ratio as 0.3. Find the angle of twist per unit length.

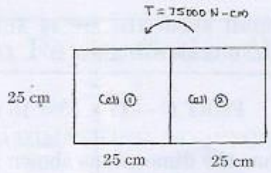

Fig. 13(a)

Or

(b) A closed section is subject to a vertical shear load of 10 kN as shown in Fig. 13(b). Area of each stringer is 1 cm². Find the final shear flow distribution. Webs are ineffective in bending

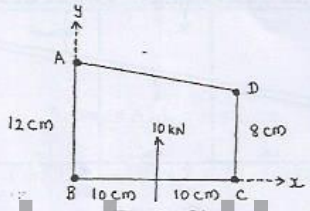

Fig. 13(b)

14. (a) (i) Derive the expression for the buckling stress of a rectangular plate simply supported on all the four edges and subjected to compressive stress on two opposite edges. (8)

(ii) Explain briefly about sheet stiffener panels and effective width. (5)

Or

(b) (i) What are the methods that employed to determine the crippling stress of composite Shapes? Discuss them in detail. (7)

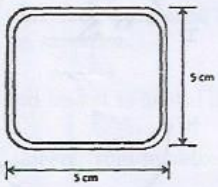

Fig. 14(b)

(ii) Use Gerard's method to find the crippling stress for the formed square tube shown in Fig. 14(b) made of Aluminum alloy whose thickness is 0.125 cm. Take F_{cy} = 280MPa; E = 70 GPa. (6)

15. (a) Sketch a typical aircraft V-n diagram with gust lines and explain the construction features of it.

Or

(b) Discuss in detail about the stress analysis of fuselage bulkheads and wing ribs with suitable sketches.

PART C — (1 × 15 = 15 marks)

16. (a) A wing spar has the dimensions shown in Fig. 16(a) and carries a UDL of 15 kN/m throughout its length. Each flange has a cross-sectional area of 500mm² with the top flange being horizontal. If the flanges are assumed to resist all direct loads while the spar web is effective only in shear, determine the flange load and the shear flow in the web at section 1-1 which is 1 m from the free end.

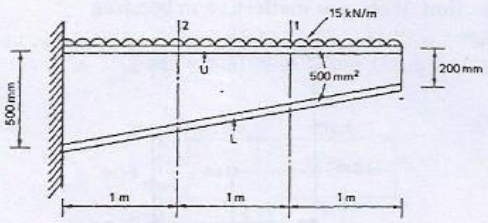

Fig. 16 (a)

Or

(b) The cross section of an airplane's fuselage shown in Fig. 16(b) is subjected to a vertical upward shear load of 10 kN acting at a distance of 2.5cm to the left of stringer 'A'. Area of each stringer is 3cm². Find the shear flow distribution by assuming the skin as ineffective in bending.

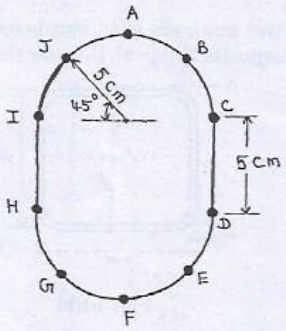

Fig. 16 (b)