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# Question Paper Code : 50027

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2017
Fifth Semester
Aeronautical Engineering
AE6502 : AIRCRAFT STRUCTURES – II
(Regulations 2013)

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 of beams ?
2. Define neutral axis and principle axis of a section.
3. Define shear center and elastic axis.
4. What is meant by structural idealization ?
5. State the assumptions of the Bredt-Batho Theory.
6. A thin curved web carries a constant shear flow 'q'. Calculate the torque due to the shear flow about and arbitrary point 'o'.
7. Define stress ratio and write margin of safety in terms of stress ratio.
8. Describe the buckling modes of a thin walled section.
9. What is meant by gust load ?
10. List any two major structural elements on an aircraft wing with their functions.

PART – B (5×13=65 Marks)

11. a) Derive the expression for bending stress for an unsymmetrical section subjected to bending moments $M_x$ and $M_y$. How do you modify the above bending stress expression for the principal axes and central axis.

(OR)

P.T.O.

b) Figure 11-(b) shows the section of an angle purlin. A bending moment of 3000 Nm is applied to the purlin in a plane at an angle of 30° to the vertical y axis. If the sense of the bending moment is such that its components $M_x$ and $M_y$ both produce tension in the positive xy quadrant, calculate the maximum direct stress in the purlin, stating clearly the point at which it acts.

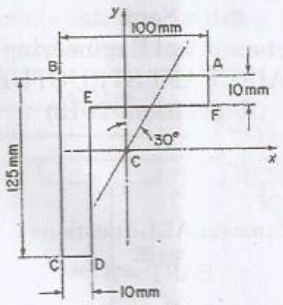


Fig 11-(b)

12. a) Derive an expression for shear flow in an arbitrary open section and how to modify the results you obtained for the case of closed section.

(OR)

b) Find the shear flow distribution and location of shear center for the thin walled channel section subjected to a vertical load of 1500 N whose thickness is 2 mm, flange width 30 cm and web height 40 cm.

13. a) A uniform thin-walled beam is circular in cross section and has a constant thickness of 2.5 mm as shown in figure 13-(a). The beam is 2 m long, carrying end torques of 450 N-m and in the same sense, a distributed torque loading of 1.0 N-m/mm. The loads are reacted by equal couples R at sections 500 mm distant from each end.

Calculate the maximum shear stress in the beam and sketch the distribution of twist along its length. Take G = 30000 N/mm$^2$ and neglect axial constraint effects.

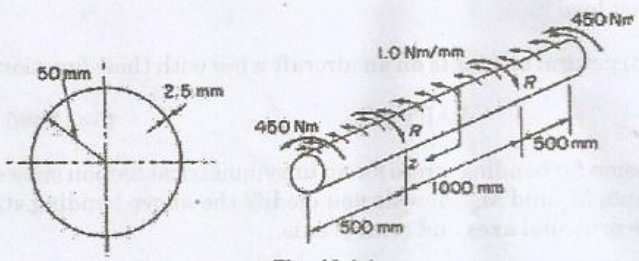


Fig. 13-(a)

(OR)

b) The thin-walled single cell beam shown in Figure 13 (b) has been idealized into a combination of direct stress-carrying booms and shear-stress-only-carrying walls. If the section supports a vertical shear load of 10 kN acting in a vertical plane through booms 3 and 6, calculate the distribution of shear flow around the section. Boom areas are given as : $B_1 = B_8 = 200\ mm^2$; $B_2 = B_7 = 250\ mm^2$; $B_3 = B_6 = 400\ mm^2$; $B_4 = B_5 = 100\ mm^2$.

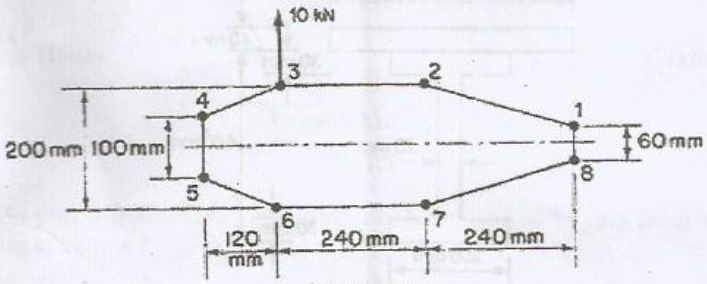


Fig 13 (b)

14. a) Explain in detail about Angle method and Gerard's method to calculate crippling strength.

(OR)

b) Explain in brief about the following :

i) Direct stress distribution in stiffened panels subjected to compression. (6)

ii) The concept of effective width. (7)

15. a) Draw the shear force and bending moment diagram on an aircraft wing if the lift load distribution is approximated by a trapezoidal variation. Also draw Schrenk's curve and give the expression for maximum shear force and bending moment.

(OR)

b) With necessary sketches, explain in detail about tension field beams.

PART – C (1×15=15 Marks)

16. a) A doubly symmetrical I-section beam is reinforced by a flat plate attached to the upper flange as shown in Figure 16-(a). If the resulting compound beam is subjected to a vertical shear load of 200 kN, determine the distribution of shear stress in the portion of the cross section that extends from the top of the plate to the neutral axis. Calculate also the shear force per unit length of beam resisted by the shear connection between the plate and the flange of the I-section beam.

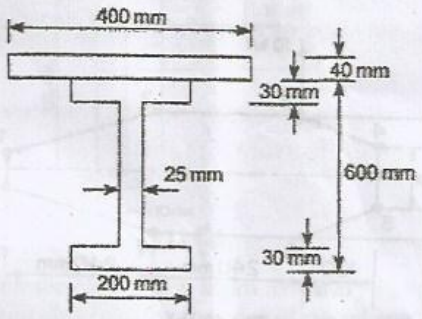


Fig. 16-(a).

(OR)

b) What are the various loads that an aircraft fuselage and wings are subjected to ? Discuss them in brief.