SNS COLLEGE OF TECHNOLOGY

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COIMBATORE-641 035, TAMIL NADU

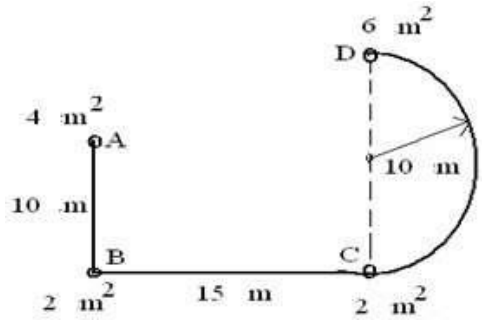
Department of Aerospace Engineering
Question Bank -IAE 3
23AST205 Aerospace Structures
Part -A

1. Explain the significance of locating the shear centre in open thin-walled sections. (GATE AE, 2023)
2. A closed thin-walled circular tube of radius 40 mm and thickness 2 mm is subjected to a torque of 120 Nm. Calculate the shear flow using Bredt-Batho theory. (GATE AE, 2022)
3. Differentiate between thin walled open and closed section?
4. Draw the V-n diagram?
5. What are the structural parts of an aircraft wing? List their functions.
6. A thin-walled closed section experiences torsion. State one advantage and one limitation of using Bredt-Batho theory in such analysis. (GATE AE, 2022)
7. For an I-beam, where is the shear centre located? Justify your answer with symmetry arguments. (GATE AE, 2020)
8. Write the expression for angle of twist due to torsion of the thin walled tube.
9. Define Inter-fastener buckling.
10. What is shear resistant web?
11. Define shear flow. How is it expressed in a thin-walled section?
12. What is the significance of the shear centre in structural analysis?
13. Explain the term "structural idealization" with respect to aerospace structures.
14. How does shear flow vary in open thin-walled sections?
15. State the Bredt-Batho theory and its application.
16. Differentiate between shear flow in open and closed sections.
17. Write the expression for shear flow in a circular closed section under torsion.
18. What happens when the load does not pass through the shear centre?
19. List two practical applications of shear centre in aircraft structures.
20. Define bending of thin plates and mention any one assumption made.
21. What is local buckling and how does it affect thin-walled structures?
22. State the expression for estimating crippling strength of a column.
23. Mention any two factors influencing the load carrying capacity of sheet stiffener panels.
24. Define inter-rivet buckling. In which type of structures is it critical?
25. What is the concept of effective width in thin sheet design?
26. Draw and label a V-n diagram. What does the 'n' represent?
27. What are gust loads? How are they represented in a V-n diagram?
28. Define shear force and bending moment. How are they related?
29. What is tension field action in web panels of thin-walled beams?
30. List any two assumptions of tension field beam theory.

Part B

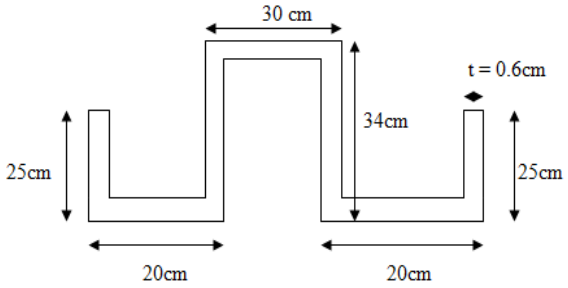
1. Find the Shear Center for the section shown in the section is subjected to shear load of S_y = 1500N applied at the shear center of the section.

2.



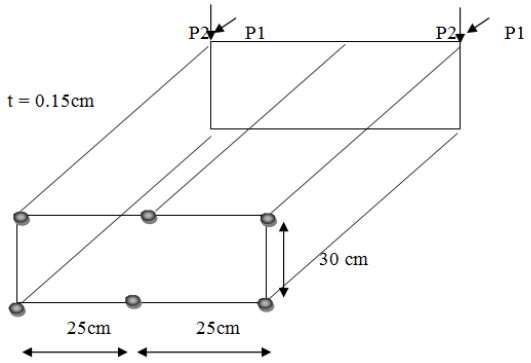
3. Derive the expression for angle of twist (θ) due to torsion of the thin walled tube.

4. Determine crippling stress by using Gerard method or Needham's method for the formed section if the material is AL2024. F_{cy}=55000 N/cm^2 .E=107*10^5 N/cm^2.



5. Check whether the box beam shown in figure will withstand the load without buckling and also find the margin of safety. Given P_1=P_2=6000N. Uniform skin thickness t=0.15 mm. Area of each stringer A= 3cm^2 assumes skin is effective in bending. For a/b=2, K_c=5, K_s=6.5.

6.

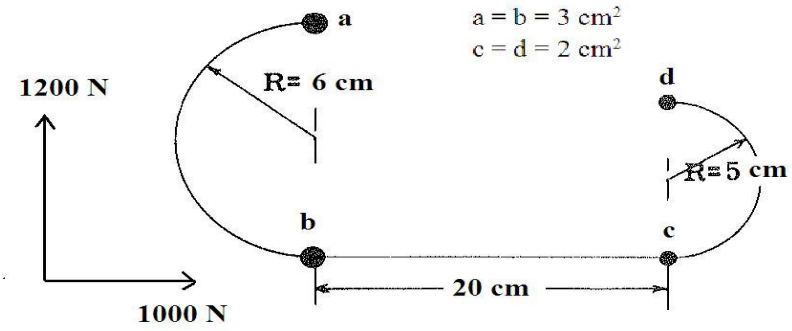


7. A thin-walled multi-cell section consists of two rectangular cells made of aluminum alloy. The section is subjected to a torque of 100 kN·mm**.** The thickness of the walls is uniform and equal to 3 mm. The material has a shear modulus G = 27 GPa. Assuming that the dimensions of the cells and wall lengths are such that each cell carries equal torque, calculate the angle of twist per unit length. Neglect warping and assume the walls resist

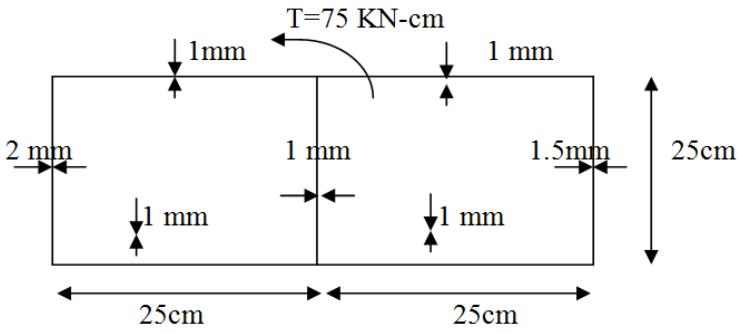
only shear. **(GATE AE, 2024)**

8. A thin-walled open rectangular section (100 mm × 20 mm) is subjected to a vertical shear force of 5 kN. Determine the maximum shear flow and the location of the shear center. (**GATE AE, 2022**)

9. Find the shear centre of the section shown in fig



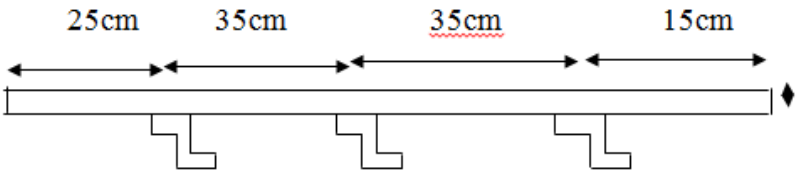
10. Find the shear flow and twist per unit length of the two-cell structure shown in fig. the material used is aluminum with E=70GPa, Poisson's ratio 0.3



11. i) Give a detailed explanation of the Wagner Beam Theory.

ii) Write short notes on shear resistant web beam.

12. Obtain the compressive load taken by the aircraft with sheet stringer combination panel are the following condition (i) when the aircraft sheet buckles first, (ii) when the aircraft stringer stress is 1200Mpa. Each stringer area is 1.35.cm2, take E= 70 GPa. t== 1.5cm



13. A semi-monocoque fuselage cross-section has stringers and thin skin. Derive and calculate the shear flow across an open channel section under a vertical shear force. Illustrate shear centre position and discuss its design relevance in aircraft. (GATE AE, 2021)

14. A thin-walled open rectangular section (100 mm × 40 mm) with wall thickness 2 mm is subjected to a vertical shear force of 5 kN. Calculate: Maximum shear flow in the vertical webs. (GATE AE, 2022)

15.