DEPARTMENT OF AERONAUTICAL ENGG

QUESTION BANK
AE1302-AIRCRAFT STRUCTURES-II

SYLLABUS

1. UNSYMMETRICAL BENDING

Bending stresses in beams of unsymmetrical sections – Bending of symmetric sections with skew loads.

2. SHEAR FLOW IN OPEN SECTIONS

Thin walled beams, Concept of shear flow, shear centre, Elastic axis. With one axis of symmetry, with wall effective and ineffective in bending, unsymmetrical beam sections.

UNIT-I

PART-A

1. In unsymmetrical bending, the neutral axis passes through the centriod of the cross-section. (True/False).
2. A rectangular cross-section is subjected to a skew load. Mark the neutral axis and sketch the bending stress distribution.
3. When does unsymmetrical bending takes place.
4. A beam bends about its neutral axis for both symmetrical and unsymmetrical bending. (True/False).
5. Explain unsymmetrical bending with examples.
6. Define neutral axis and give expression to determine it.
7. Define principle axis of a section and give an expression to determine it.
8. Draw bending stress variation across the depth for (a) Rectangular section (b) I-section.
9. Distinguish between symmetric and unsymmetric bending.
10. What do you understand by unsymmetrical bending? Explain a method to find the stress in an unsymmetrical bending
11. Explain the Euler-Bernoulli hypothesis in bending of beams.
12. Bending of a symmetric section subjected to a skew load will be (symmetric/Unsymmetric).Explain.

PART-B

1. Determine the normal stress at location A and G(refer fig.1)for the following cases of loading:
   (i) V_x=1.2 kN acting through shear center.
   (ii) V_y=1.2 kN acting through shear center.

   V_x and V_y are applied0.8 m away from the indicated cross-section.

2. (i)Derive and obtain an expression for the bending stress in an unsymmetrical section subjected to bending, using the generalized ‘k’ method (10)
   (ii) Explain the neutral axis method of bending stress determination mhen an arbitrary section is subjected to bending moments Mx and My. (6)

3. The section shown in fig.2 is subjected to bending moment Mx=30kNm.determine the bending stress at the corner points A, B, C and D.

4. A Z- section with 12 cm x 3 cm flanges and 20 cm x 3 cm web is subjected to Mx=10 kN-m and My=10 kN-m . Determine the maximum bending stress.
5. A box beam with 50 cm length is subjected to loads Px=8kN and Py=25kN as shown in fig.3. The stringer area is 3 cm^2 each. Find the maximum bending stress.

6. obtain the bending stress values at the points A,B,C and D for the section shown in fig.4.Compute the stresses using moment values with respect to x and y axis and the principle axis.

7. Compute the load on the lumped flanges due to bending of the section shown in fig.5.Assume the web do not take part in bending. Compute the loads using moment values with respect to x and y axis and principle axis.

8. A beam section shown in fig.6.has four stringers. Area of the stringers A, B, C and D are 6.25, 3.125, 4.5 and 6sq.cm respectively. Find the stresses in all the four stringers of the section due to Mx=50kNm and My=-20kNm where x and y are the centriodal axes. Assume that webs and walls are ineffective in bending.

9. Refer fig.7.The section is subjected to an 8 kNm bending moment in the x-z plane and a 10 kNm bending in the y-z plane. Determine the bending stresses in all the corner points, indicating whether they are tensile or compressive.

10. Determine the bending stresses in the stringer of the section shown in fig.8 .E_1= 70GPa , E_2=210GPa and E_3=100GPa.stringer areas are 2 cm^2

11. A C-section beam of length 50 cm is subjected to loads Px=100N .the C-section dimensions are (i) Flanges- 25 cm x3 cm (ii)web 30cm x 3cm.

ACS-II- UNIT- 1

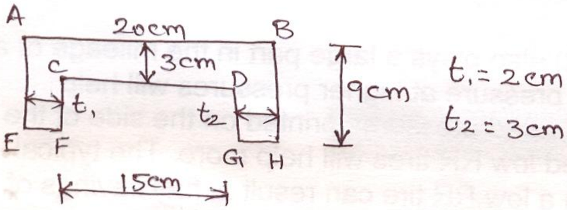


FIG. 1

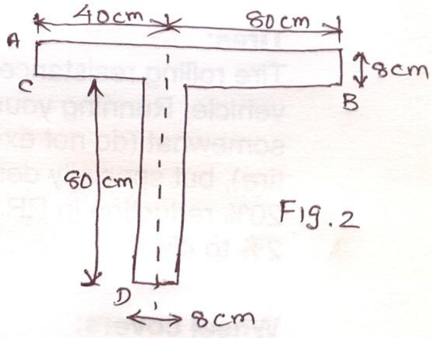


FIG. 2

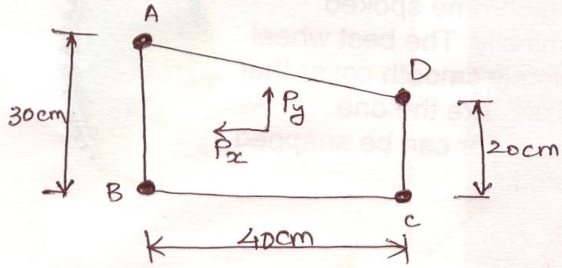


FIG. 3

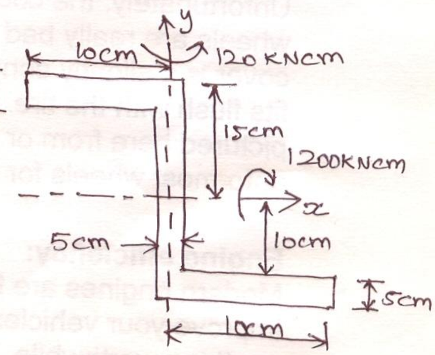


FIG. 4

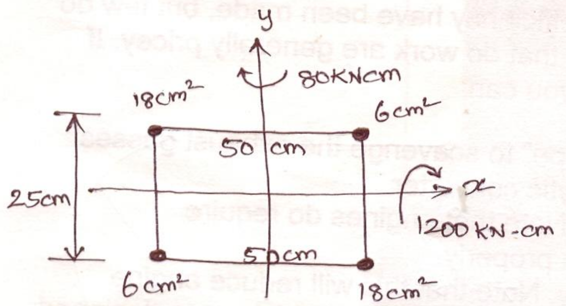


FIG. 5

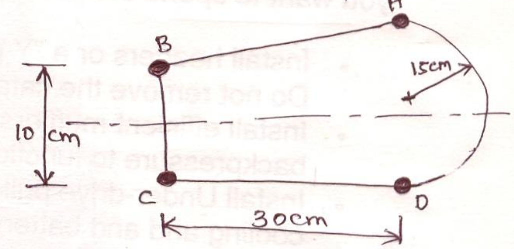


FIG. 6

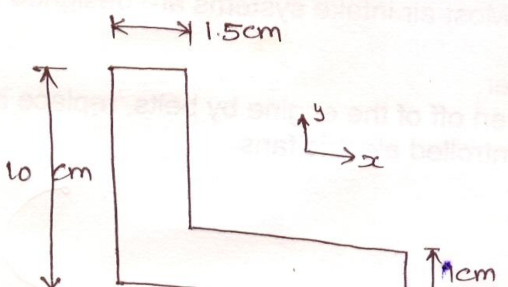
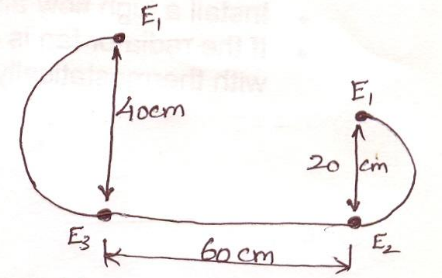


FIG. 7



$M_x = 6KNm$, $M_y = 4 KNm$

FIG. 8

UNIT-II

PART-A

1. Shear flow can be defined for both thin and thick walled section (true/false)
2. Sketch the shear flow distribution when a thin walled L-section is subjected to a vertical load.
3. Define shear center and elastic axis.
4. Define shear flow .How the shear stress is obtained from the shear flow?
5. Indicate the shear center for channel section and angle section.
6. Draw shear flow diagram for I section and Channel section.

PART-B

1. Derive and obtain an expression for shear flow due to bending in the case of an arbitrary thin walled open section subjected to bending. How to modify the results you obtained for the case of closed section.
2. Plot the shear flow and locate the shear center for the section shown in fig.9.
3. Plot the shear flow and locate the shear center for the section shown in fig.10.
4. Find the shear flow for the section shown in fig.11.The Area of the each stringer =6 cm^2.the loads are S_x=10kN and S_y=50kN through the shear center .Also find the Shear center
5. Find the shear center of the section shown in fig.12.Area a=b=4 cm^2 and c=d=2 cm^2
6. Find the shear flow distribution and locate the shear center for the section shown in fig.13.Each of the stringers has an area of 4 cm^2 and the section subjected to vertical shear of 50 kN.
7. Find the shear flow distribution in a thin walled Z-section, whose thickness is'‘t’, height’h’. Flange width ‘h/2’ and subjected to vertical shear load through shear center.

8. (i) Show that the sum of the moment of inertia about any two orthogonal axes is invariant with respect to any other two orthogonal axes. (6)
   (ii)Obtain the shear flow distribution and shear center location for the section in fig.14.When it is subjected to a shear load of 5 kN. (10)

9. Determine the shear center location for the section shown in fig.15. All the webs are ineffective in bending.
10. Locate the shear center for the section shown in fog.16.Plot the shear stress distribution when a vertical shear load of 1.2kNacts through the shear center.

ACS - II

UNIT - II

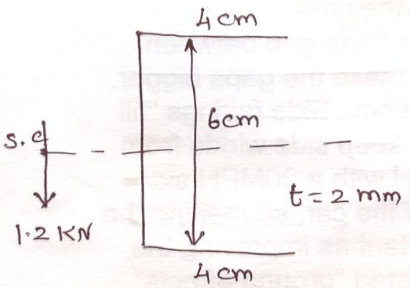


FIG. 9

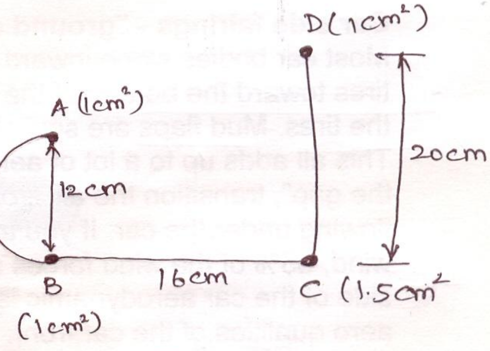


FIG. 10

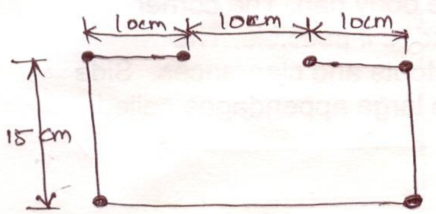


FIG. 11

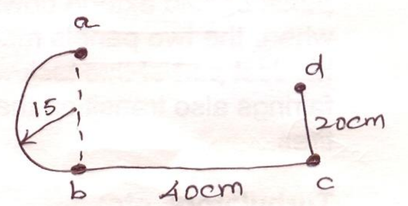


FIG. 12

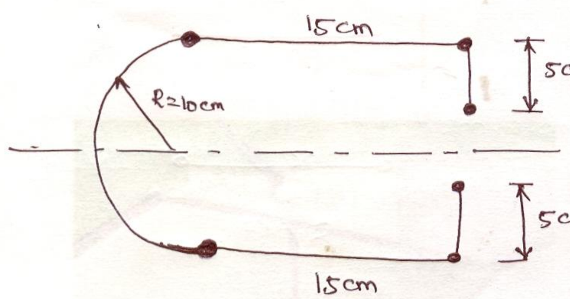


FIG. 13

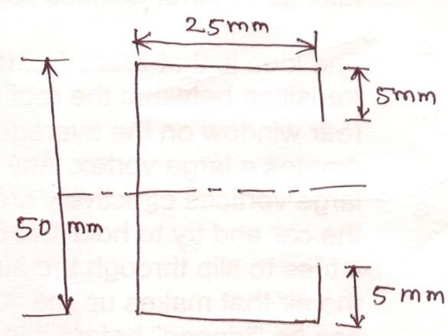


FIG. 14

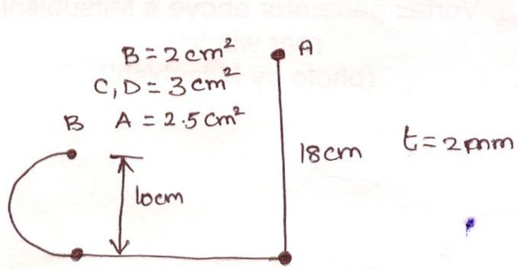


FIG. 15

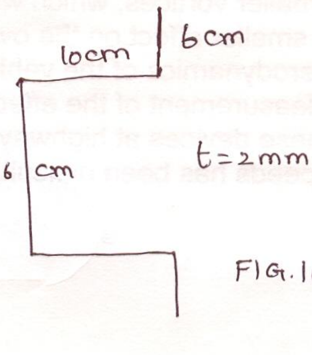


FIG. 16