Code No: 07A62102 **R07** **Set No. 2**

III B.Tech II Semester Examinations,APRIL 2011
AEROSPACE VEHICLE STRUCTURES - II
Aeronautical Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
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1. (a) What do you mean by shear centre. Explain with the help of sketch.
   (b) Calculate the shear flow in channel section and resultant forces in the flange and web. Plot the shear flow variation. Shown in figure 1b. [4+12]

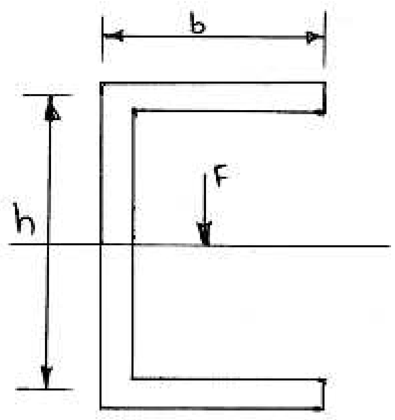

Figure 1b

2. A thin-walled cantilever beam of length L has the cross-section shown in Figure 2 and carries a load P positioned as shown at its free end. Determine the torsion bending constant for the beam section and derive an expression for the angle of twist θ_T at the free end of the beam. Calculate the value of this angle for P=100 N, a=30 mm, L =1000 mm, t =2.0 mm, E =70 000 N/mm^2 and G=25 000 N/mm^2. [16]

3. (a) What are monocoque and semi-monocoque structures? Explain briefly with suitable examples.
   (b) Find the shear flow in each web of the beam shown in the figure 3. Plot the distribution of axial load along each stiffening member when P_1=20kN, P_2=15kN and P_3=10kN. All dimensions are in cm. [4+12]

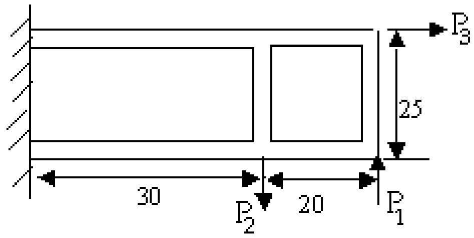

Figure 3

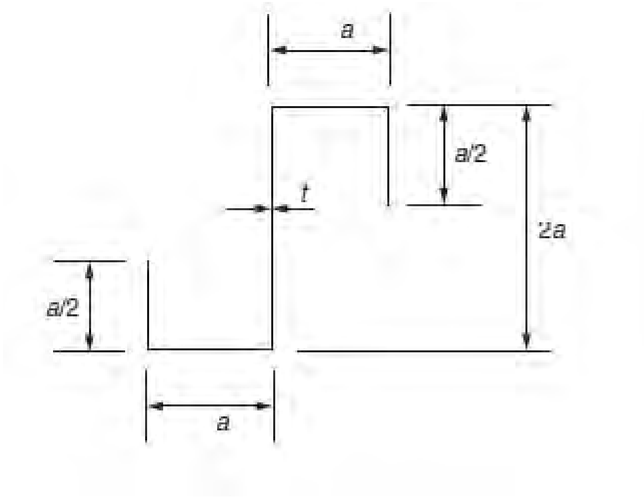

Figure 2:

4. A lipped channel dimensions and loading conditions as shown in figure 4, find out the shear centre. [16]

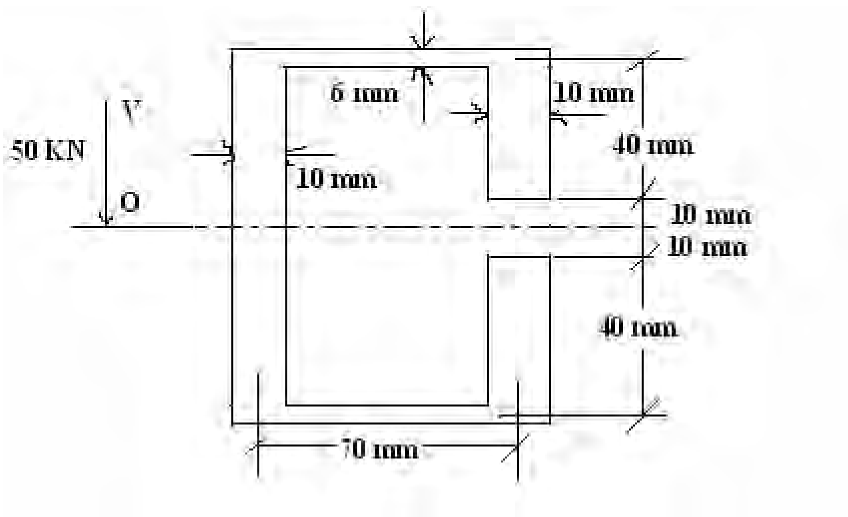

Figure 4:

5. What is structural idealization? Sketch the structural idealization for wing and fuselage? [4+12]

6. Explain pure bending of thin plates and show that the deformed shape of the plate Is spherical and of curvature $1/\rho$ = M/[D(1+υ)] Where υ = poisons ratio, D is flexural rigidity, M is moment. [16]

7. Determine the rate of twist per unit torque of the beam section shown in Figure 5 if the shear modulus G is 25 000 N / mm^2. [16]

8. (a) What are the various structural elements used in airplane wings? Explain their role with respect to different types of loads.

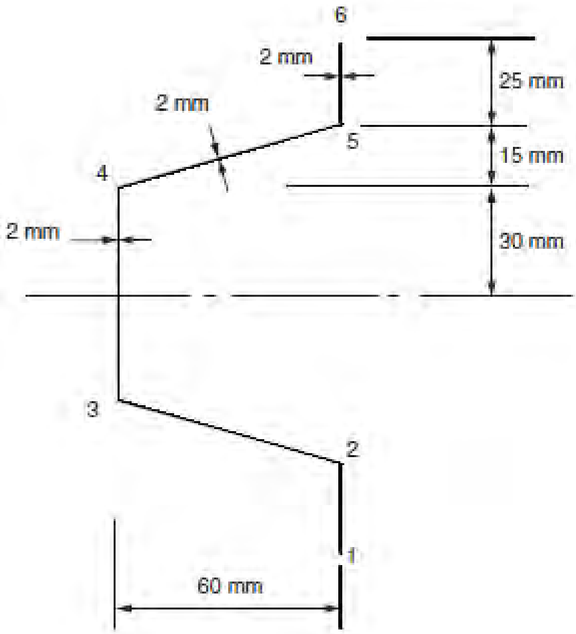

Figure 5:

(b) Find crippling stress for the sections shown in figure 6 using Gerard's method. [8+8]

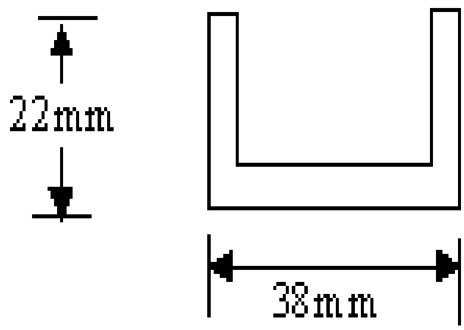

Figure 6

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Code No: 07A62102 **R07** **Set No. 4**

III B.Tech II Semester Examinations,APRIL 2011
AEROSPACE VEHICLE STRUCTURES - II
Aeronautical Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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⋆ ⋆ ⋆ ⋆ ⋆

1. (a) What do you mean by
    i. shear resistant beam
    ii. complete diagonal tension field beam and
    iii. incomplete diagonal tension field beam.

   (b) Find the shear flow in each web of the beam shown in the figure 1. Plot the distribution of axial load along each stiffening member when P_1=20kN and P_2=10kN. All dimensions are in cm. [6+10]

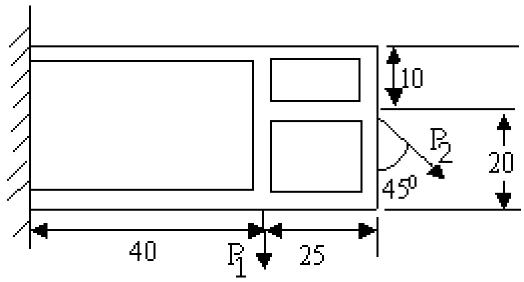

Figure 1

2. Explain about Buckling of flat plates in compression with neat sketches and graphs. Also discuss about End fixity of plates. [16]

3. A cross section of a slit rectangular tube of constant thickness is shown in figure 3. Show that shear centre e= b(2h+3b)/2(h+3b). [16]

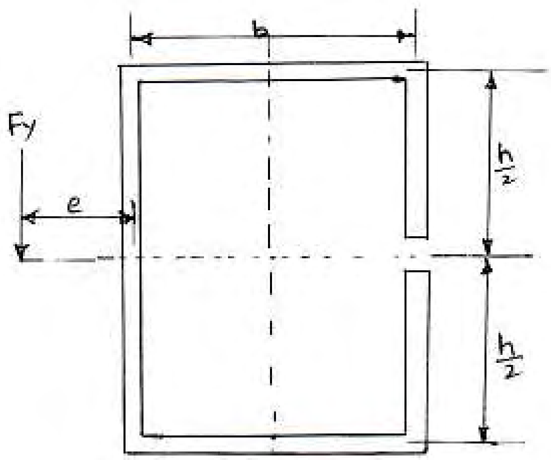

Figure 3

4. What is shear flow in structural elements? Explain shear flow in wing and fuselage sketch the variation? [16]

5. The thin-walled section shown in Figure 4 is symmetrical about the x axis. The thickness to of the centre web 34 is constant, while the thickness of the other walls varies linearly from to at points 3 and 4 to zero at the open ends 1, 6, 7 and 8. Determine the St. Venant torsion constant J for the section and also the maximum value of the shear stress due to a torque T. If the section is constrained to twist about an axis through the origin O, plot the relative warping displacements of the section per unit rate of twist.

   [16]

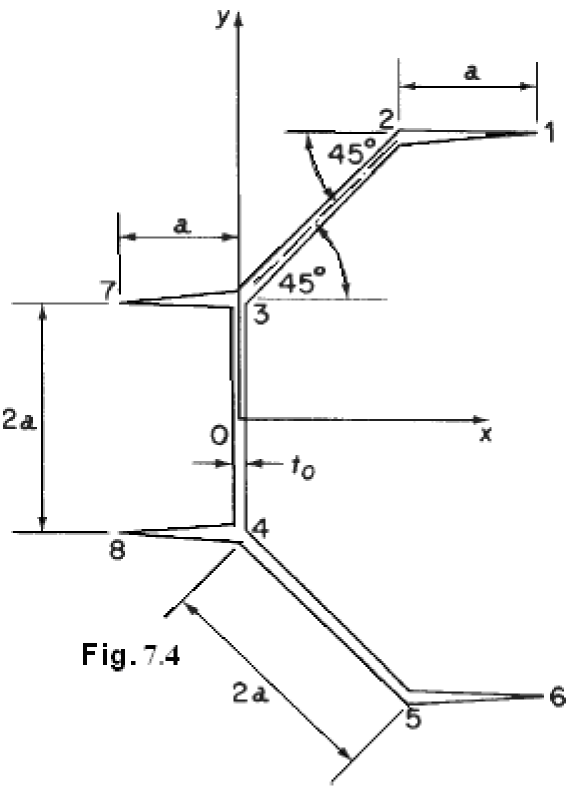

Figure 4:

6. Figure 5 shows the cross-section of a thin-walled beam in the form of a channel with lipped flanges. The lips are of constant thickness 1.27mm while the flanges increase linearly in thickness from 1.27mm where they meet the lips to 2.54mm at their junctions with the web. The web has a constant thickness of 2.54 mm. The shear modulus G is 26 700N/mm^2 throughout. The beam has an enforced axis of twist RR_ and is supported in such a way that warping occurs freely but is zero at the mid-point of the web. If the beam carries a torque of 100Nm, calculate the maximum shear stress according to the St. Venant theory of torsion for thin-walled sections. Ignore any effects of stress concentration at the corners. Find also the distribution of warping along the middle line of the section, illustrating your results by means of a sketch. [16]

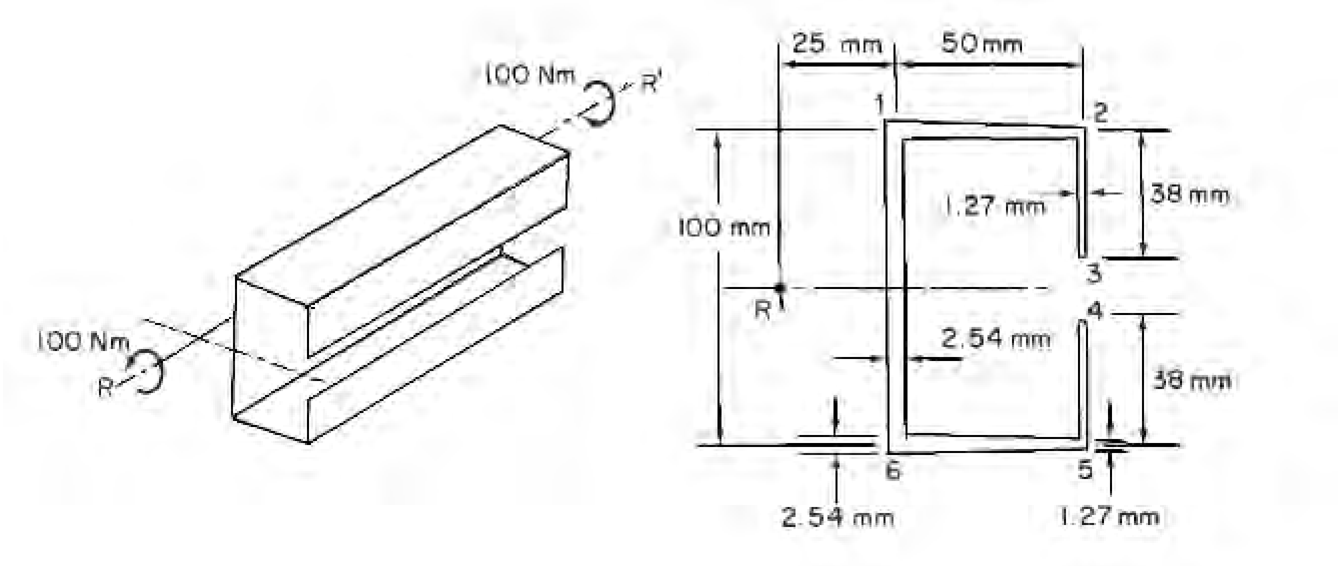

Figure 5:

7. (a) What are the various structural elements used in airplane wings? Explain their role with respect to different types of loads.

   (b) Find crippling stress of rectangular tubes shown in figure 7b using Nedham's method, when formed from aluminium. Uniform thickness, t = 1.5mm.Assume necessary data. [8+8]

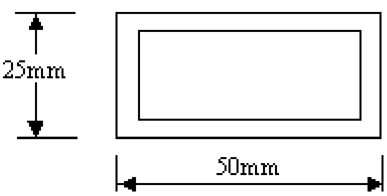

Figure 7b

8. A uniform beam has the point-symmetric cross- section shown in figure 6. Making the usual assumptions for a thin-walled cross-section, show that the torsion-bending constant Γ calculated about the shear centre S is $\Gamma = \frac{8}{3}a^5 t \sin^2 2\alpha$.The thickness t is constant throughout. [16]

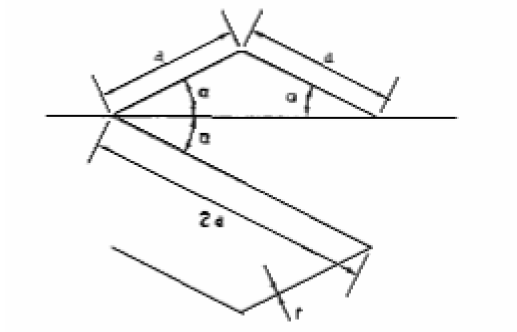

Figure 6

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Code No: 07A62102 **R07** **Set No. 1**

III B.Tech II Semester Examinations,APRIL 2011
AEROSPACE VEHICLE STRUCTURES - II
Aeronautical Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Derive the expression for the total torque of 'I' section beam subjected to torsion With the help of neat sketches. [16]

2. (a) What are monocoque and semi-monocoque structures? Explain briefly with suitable examples

   (b) Find the shear flow in each web of the beam shown in the figure 2b. Plot the distribution of axial load along each stiffening member when P_1=20kN, P_2=15kN and P_3=10kN. All dimensions are in cm. [4+12]

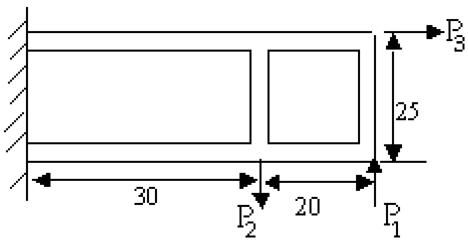

Figure 2b

3. (a) What do you mean by effective width in a long flat plate subjected to bending loads?

   (b) Determine the crippling stress of the panel, formed with hat-section stiffeners, as shown in figure 3b. Take σ_{cy} = 470MPa and E=70GPa for stiffeners while σ_{cy}=280MPa. [4+12]

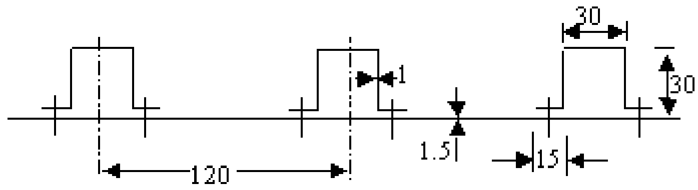

Figure 3b

4. For a circular section with outer radius 25mm, inner radius 20mm, having small slit. Find out the shear center of the section due to vertical load applied at shear center. [16]

5. Determine the maximum shear stress in the beam section shown in Figure 7 stating clearly the point at which it occurs. Determine also the rate of twist of the beam section if the shear modulus G is 25 000 N / mm^2. [16]

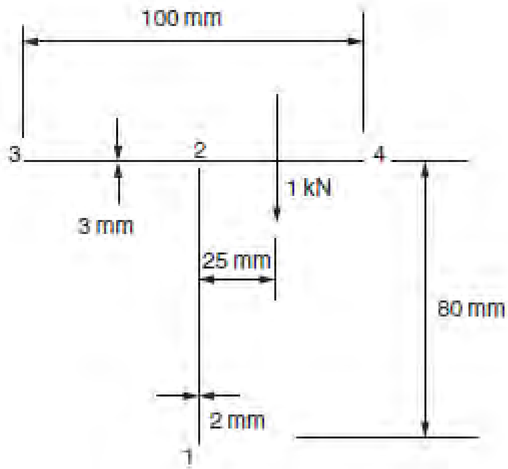

Figure 7:

6. What are the classification of aircraft loads? Explain the stresses due to air loads in detail? [6+10]

7. Determine the shear centre for the circular section of radius R, thickness t having a naviour slit. [16]

8. (a) What are the various structural elements used in airplane.
   i. wings and
   ii. fuselage.

   (b) Find crippling stress for the sections shown in figure 8b, using Gerard's method. [8+8]

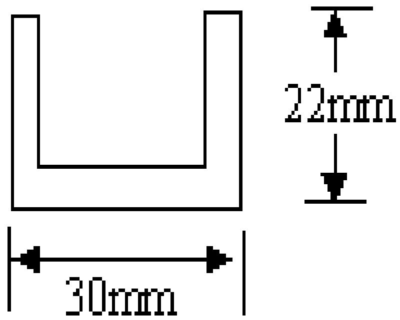

Figure 8b

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Code No: 07A62102 **R07** **Set No. 3**

III B.Tech II Semester Examinations,APRIL 2011
AEROSPACE VEHICLE STRUCTURES - II
Aeronautical Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What is symmetric and unsymmetric bending? Explain with the help of figures.
   (b) Derive the shear stress formula for a symmetric beam subjected to transverse shear force 'F'. [4+12]

2. For an Unlipped thin walled semicircular section with radius 'r' find the shear centre of the section due to vertical load V. [16]

3. (a) List out any six differences between Monocoque and semimonocoque structures.
   (b) For wing shown in figure 8, R = 1250mm. t=1.6mm. b=150mm and rib spacing L=450mm. Find the compressive stress in the skin at which buckling occurs Take E = 70 X 10^6 KPa. You can assume necessary values. [10+6]

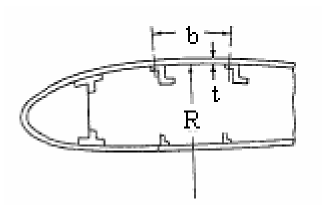

Figure 8:

4. (a) Explain shear buckling stress in curved plates.
   (b) Find the compression buckling stress for a sheet 10cm x 10cm x 3mm with all four edges simply supported, assuming E_t = 55 GPa. [6+10]

5. The thin walled section shown in Figure 9 is constrained to twist about an axis through R, the centre of the semicircular wall 34. Calculate the maximum shear stress in the section per unit torque and the warping distribution per unit rate of twist. Also compare the value of warping displacement at the point 1 with that corresponding to the section being constrained to twist about an axis through the point O and state what effect this movement has on the maximum shear stress and the torsional stiffness of the section. [16]

6. Determine the torsion bending constant for the thin-walled beam shown in Figure 10 and also derive an expression for the angle of twist at its free end. [16]

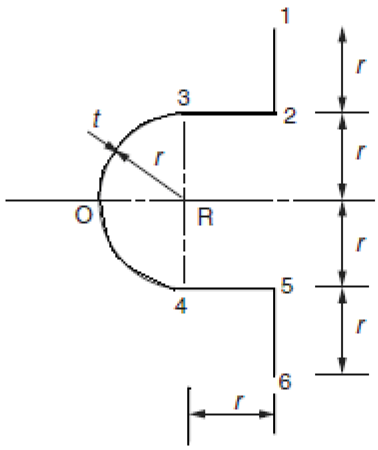

Figure 9:

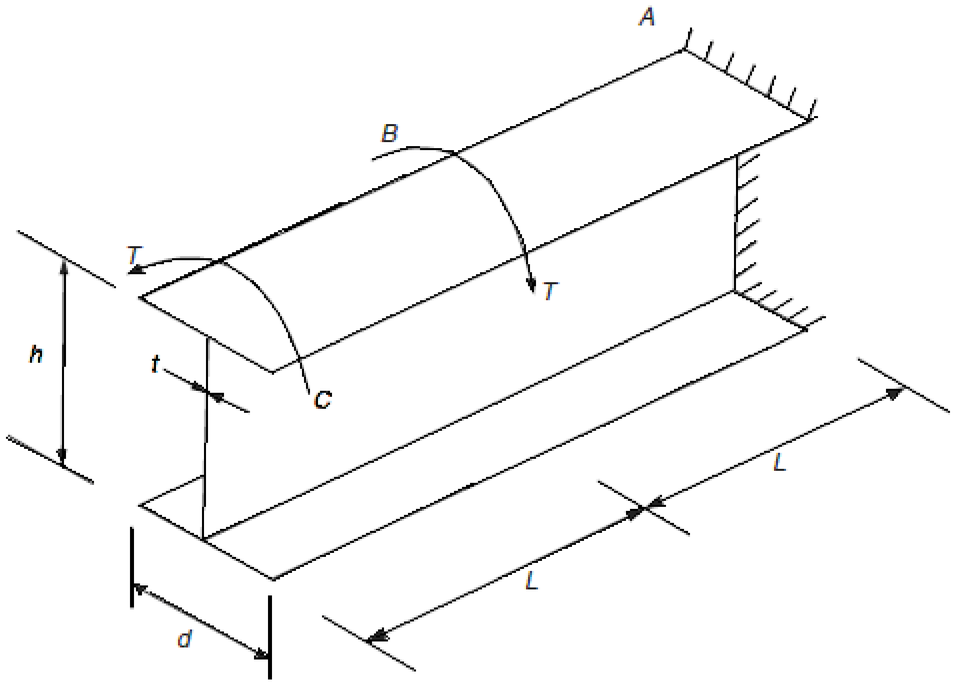

Figure 10:

7. (a) Derive the relationship for shear force at any section of a tapered diagonal tension field beam, subjected to a load at its free end perpendicular to the axis in the plane of the beam.

   (b) Find the shear flow in each web of the beam shown in the figure 11b. Plot the distribution of axial load along each stiffening member when P_1=20kN, P_2=15kN and P_3=10kN. All dimensions are in cm. [6+10]

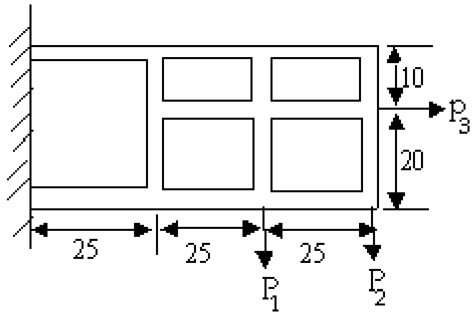

Figure 11b

8. Write short notes on the following:

   (a) Sketch tapered wing and fuselage

   (b) Sketch the shear flow variation over the symmetrical wing and fuselage. [16]

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