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

III B.Tech II Semester Examinations,December 2010
AEROSPACE VEHICLES 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 thin-walled cantilever beam of length L has the cross-section shown in Figure 1 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]

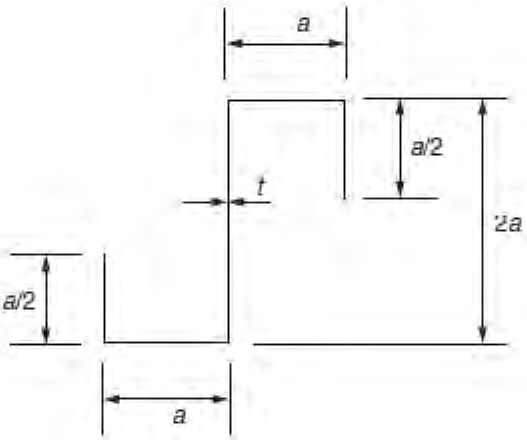

Figure 1:

2. (a) What do mean by shear centre? Explain with the help of figure.
   (b) Determine the location of shear centre for the thin walled section shown in figure 2. [4+12]

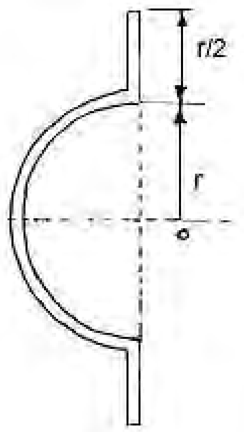

Figure 2

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

3. The Unlipped extruded beam has the cross section shown in figure 3, determine:
   (a) The location of the shear centre.
   (b) The distribution of shearing stresses caused by a 110 KN vertical shearing force applied at O. [16]

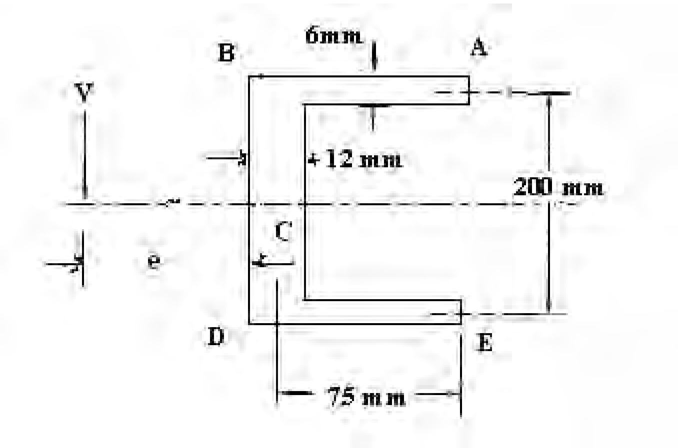

Figure 3:

4. (a) Explain critical crippling load for extruded sections and bent sheet sections.
   (b) Find crippling stress of rectangular tubes shown in figure 4b using Nedham's method, when formed from aluminium. Uniform thickness, t = 1.5mm. [6+10]

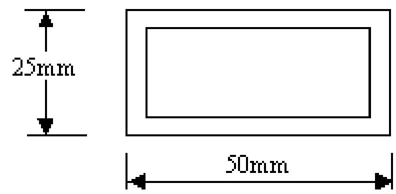

Figure 4b

5. The stringers panel shown in figure 5 is loaded in compression by means of rigid members. The sheet is assumed to be simply supported at the loaded ends and at the rivet lines and to be free at the sides. Each stringes has an area of 64.5mm^2. Find the total compressive load 'P' for the following conditions.

   (a) when the sheet first buckles.

   (b) when the stringer stress F_c is 68947.57KPa.

   (c) when the stringer stress F_c is 206842.71KPa take E = 71 X 10^6 KPa.

a/b	1.0	1.5	2	2.5	3.0
K	3.8	4.0	3.62	3.85	3.72

[16]

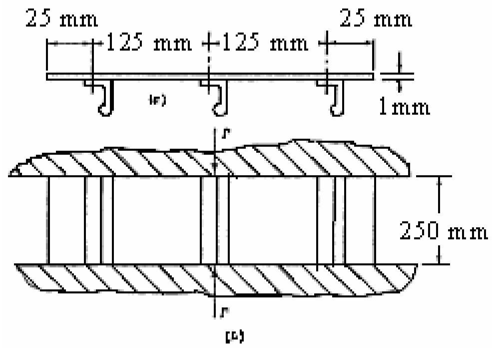

Figure 5:

6. The fuselage of light weight passenger carrying aircraft has the circular cross Section shown in figure 6. The cross-sectional area of each stringer is 100 mm^2 and the vertical distances given in figure are the mid line of the section wall at the corresponding srtringer positions. The fuselage is subjected to transverse shear load of 100 kN acting through the shear centre together with pure torque equal to 15 $\times$ 10^6 Nmm. Calculate the shear flow distribution. [16]

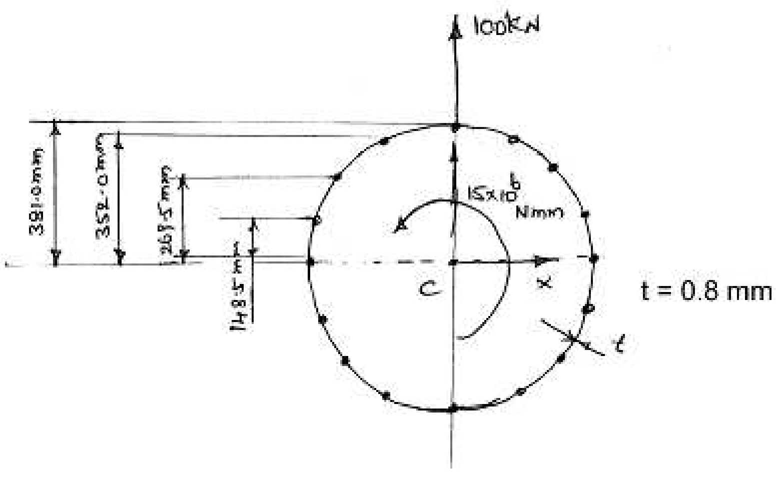

Figure 6

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

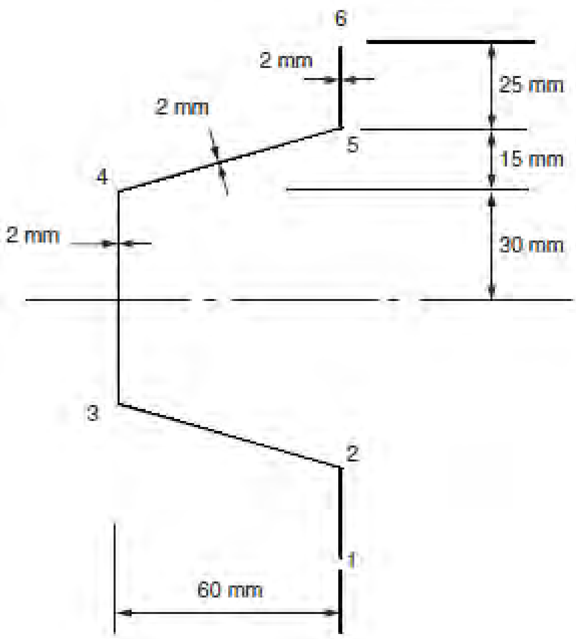

Figure 7:

8. (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 8b. 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]

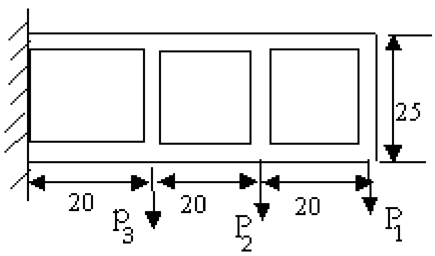

Figure 8b

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

III B.Tech II Semester Examinations,December 2010
AEROSPACE VEHICLES STRUCTURES - II
Aeronautical Engineering

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

Answer any FIVE Questions
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⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Explain critical buckling stress for a stiffened panel and how it differs from that of a flat plate.
   (b) Calculate crippling stress for the given extrusion section. Assume E=75 GPa, Thickness of web is 1.5mm and thickness of flanges is 2mm. Shown in figure 1b. [6+10]

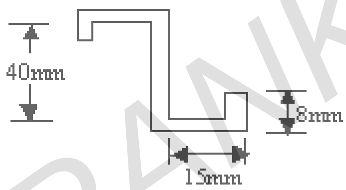

Figure 1b

2. (a) Explain different types of wing structures.
   (b) Explain the advantages and disadvantages of different materials used for aircraft structures.
   (c) Explain Wagner's theory. [4+6+6]
3. Derive the expression for the total torque of 'I' section beam subjected to torsion With the help of neat sketches. [16]
4. Explain pure bending of thin plates and show that the deformed shape of the plate Is spherical and of curvature $1/\rho = M/[D(1+\upsilon)]$ Where υ = poisons ratio, D is flexural rigidity, M is moment. [16]
5. A lipped channel dimensions and loading conditions as shown in figure 5, find out the shear centre. [16]
6. The fuselage of light weight passenger carrying aircraft has the circular cross Section. The cross-sectional area of each stringer is 100 mm^2 is subjected to a vertical load of 100 kN applied at a distance of 150 mm from the vertical axis of symmetry as shown in figure 6. Calculate the distribution shear flow in the section. [16]

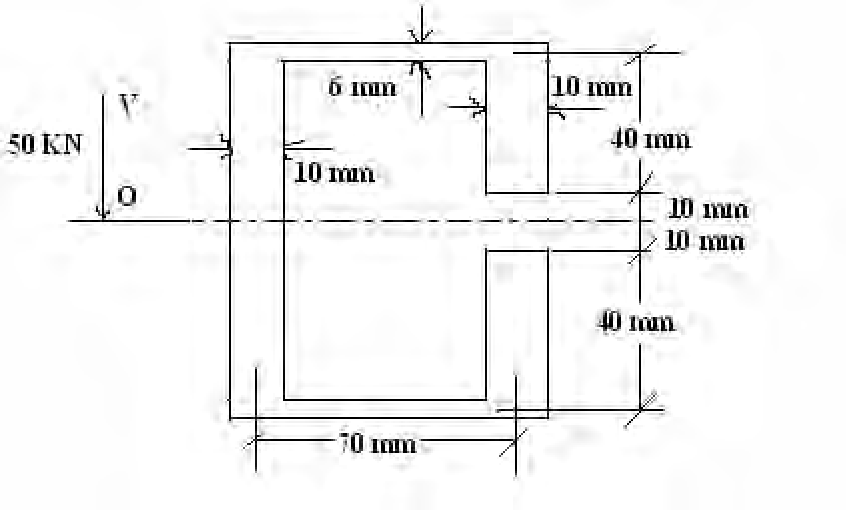

Figure 5:

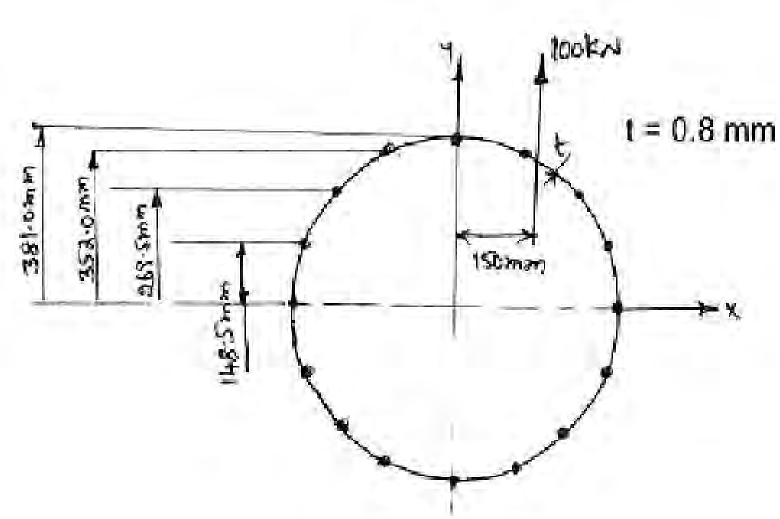

Figure 6

7. Determine the Shear centre for the thin walled section, assuming uniform Thickness Shown in figure 7. All dimensions are in mm. [16]

8. Determine the maximum shear stress and the warping distribution in the channel section shown in Figure 8 when it is subjected to an anticlockwise torque of 10Nm. G=25 000N/mm^2. [16]

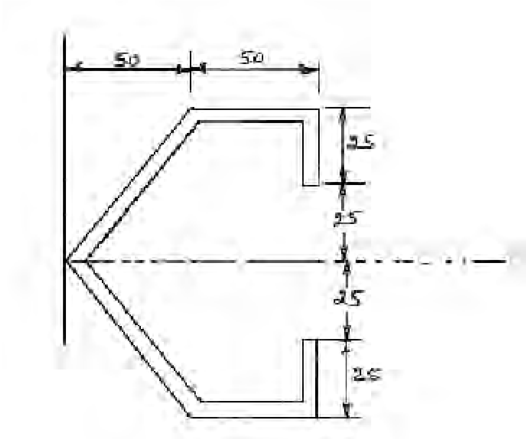

Figure 7:

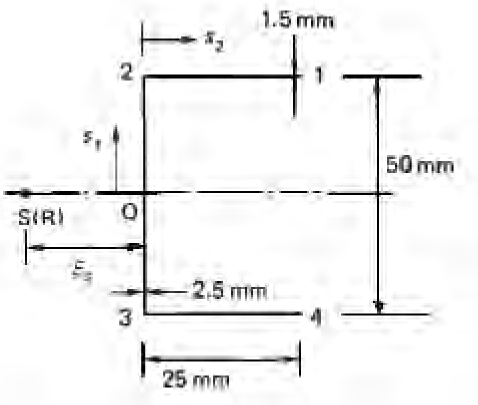

Figure 8:

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

III B.Tech II Semester Examinations,December 2010
AEROSPACE VEHICLES STRUCTURES - II
Aeronautical Engineering

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

Answer any FIVE Questions
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⋆ ⋆ ⋆ ⋆ ⋆

1. Write short notes on the following:
   (a) Aerodynamic loads
   (b) Ground loads. [8+8]
2. 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 3, 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]

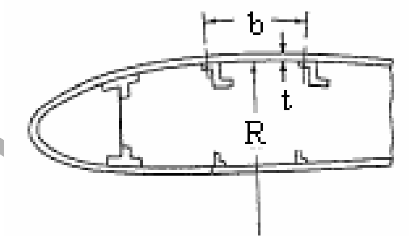

Figure 3:

4. 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]
5. (a) Derive an expression for the angle of diagonal tension.
   (b) Find the shear flow in each web of the beam shown in the figure 5b. 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]

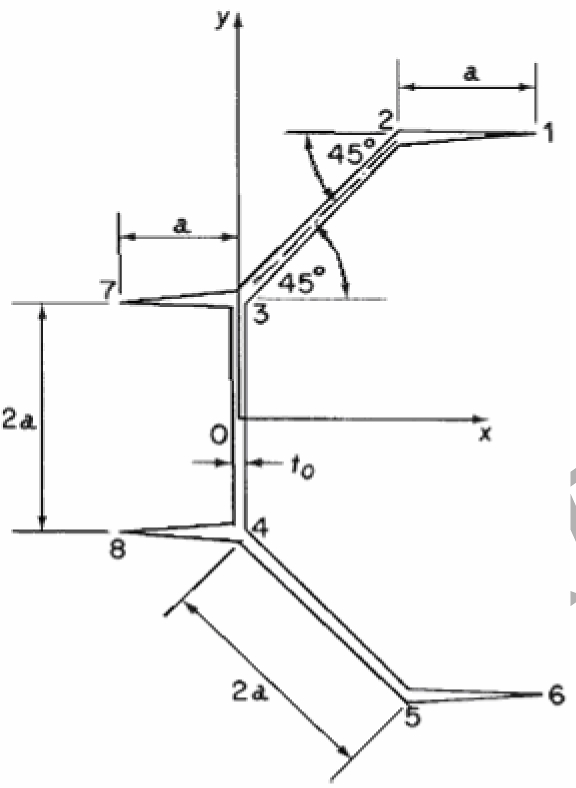

Figure 4:

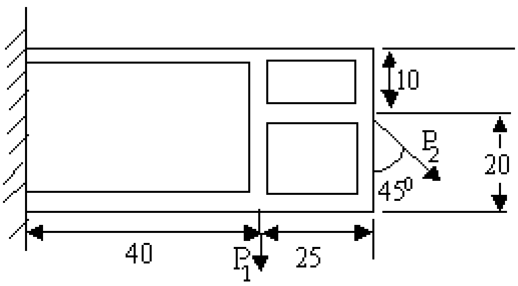

Figure 5b

6. Determine the location of shear centre for the cross-section having uniform thickness shown in figure 6. [16]

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]

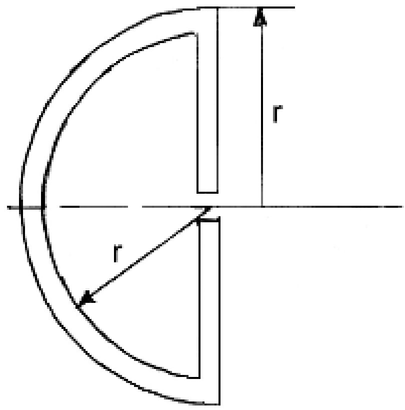

Figure 6:

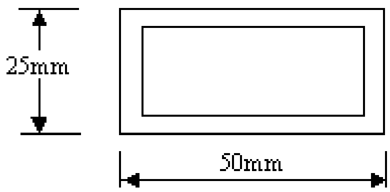

Figure 7b

8. A uniform beam has the point-symmetric cross- section shown in figure 8. 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]

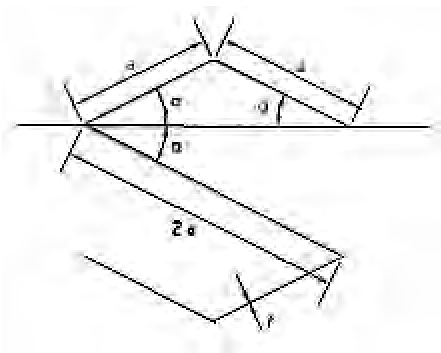

Figure 8:

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

III B.Tech II Semester Examinations,December 2010
AEROSPACE VEHICLES STRUCTURES - II
Aeronautical Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. Explain in detail the stresses in the fuselage components due to air load? [16]

2. How to calculate effective width of the sheet if stringers like angles, hat sections etc. are attached to the sheet for ultimate compressive strength of flat sheet. Derive the equations. [16]

3. The Unlipped extruded beam has the cross section shown in figure 3, determine:

   (a) The location of the shear centre.

   (b) The distribution of shearing stresses caused by a 110 KN vertical shearing force applied at O. [16]

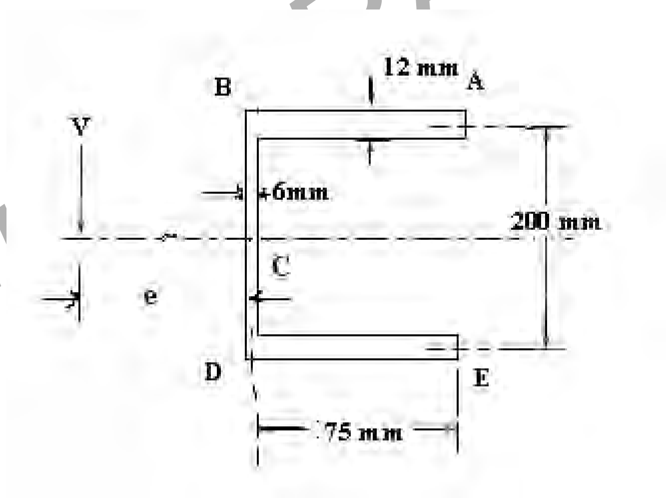

Figure 3:

4. Derive the shear stress equation for rectangular beam of breadth 'b', depth 'd'. Also plot the variation of shear stress. Derive the relation for τ_{max} / τ_{av}. [16]

5. The thin walled section shown in Figure 5 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]

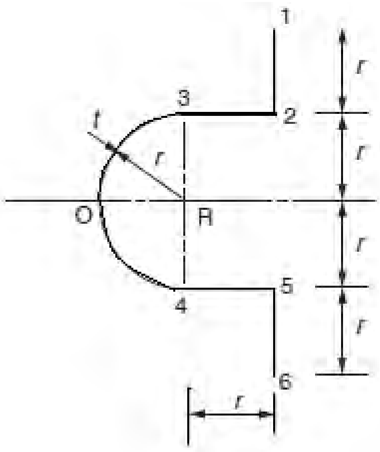

Figure 5:

6. A thin-walled cantilever beam of length L has the cross-section shown in Figure 6 and carries an anticlockwise torque T at its free end. Determine the torsion bending constant for the beam section and derive an expression for the rate of twist along the length of the beam. In a practical case the beam supports a shear load of 150N at its free end applied vertically upwards in the plane of the web. If L =500 mm, a=20 mm, t =1.0mm and G/E =0.3 calculate the value of direct stress at the point 2 including both axial constraint and elementary bending stresses. [16]

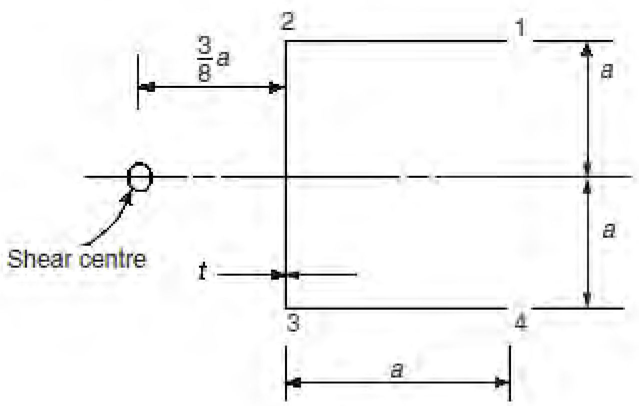

Figure 6:

7. (a) Explain shear buckling stress in curved plates.

   (b) Find the shear flow in each web of the tapered beam shown in the figure 7b. 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]

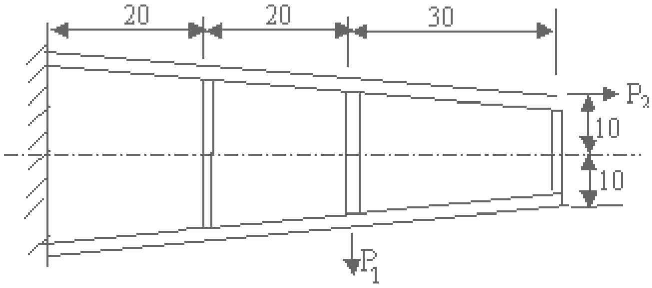

Figure 7b

8. (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 8b. 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]

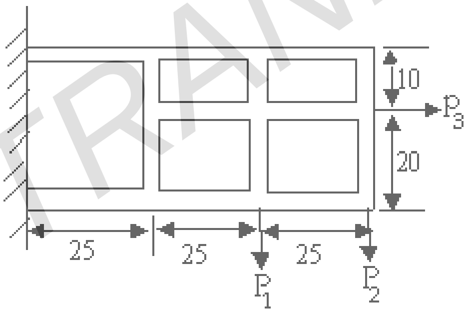

Figure 8b

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