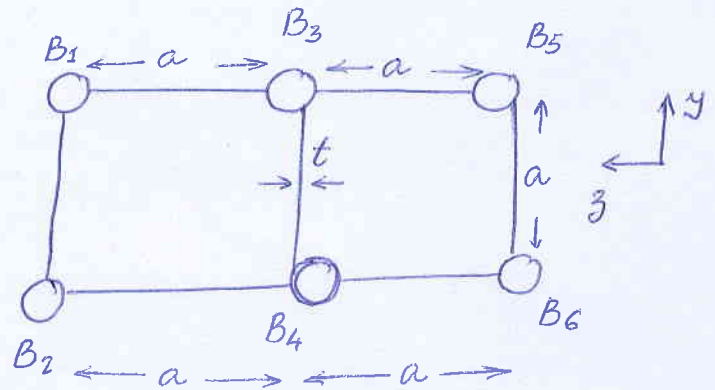# TORSION PROBLEMS

**Q1**   Given the idealized section shown in the figure with booms $B_i = B$, $i = 1, 2, \ldots, 6$. Let the boom and skin material be of aluminium with $E = 70 GPa$, $\nu = 0.3$. The skin has thickness $t$ and each arm is of length $a$. (length and area in metres or $m^2$). Determine the following:

(a) Shear flow in each arm when the beam is subjected to a constant torque $T$.

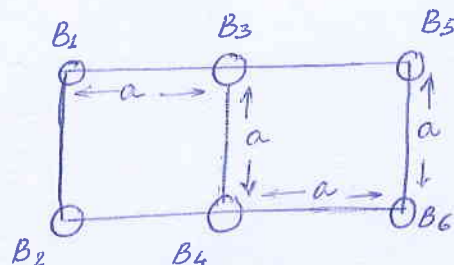(b) The torsional rigidity constant $J$, and rate of twist $\alpha$.

(c) Shear flow in each arm when the beam is subjected to a constant shear force $V_y$ acting through boom $B_5$. Also find the rate of twist $\alpha$.

**Q2**   For the section shown, determine the location of shear cen[tre]

thickness of skin $= t$
Young's modulus $= E$
Shear modulus $= G$

$B_i = iB$
where $B$ is a generic area

* Follow the steps : (a) Find the centroid, (b) Find the jumps across $B_i$ due to shear forces $V_y$, $V_z$ (in terms of $B$, $a$, $t$), (c) Assume $V_y$, $V_z$ is acting through shear centre located at $(y_s, z_s)$ < with $y_s$, $z_s$ unknown >, (d) Set $\alpha_1 = 0$, $\alpha_2 = 0$ to get the shear flows in terms of $V_y$, $V_z$, (e) Take moment about any boom due to shear flows and EQUATE to that for $V_y$, $V_z$; equate coeffs. of $V_y$, $V_z$ to get location of shear centre.