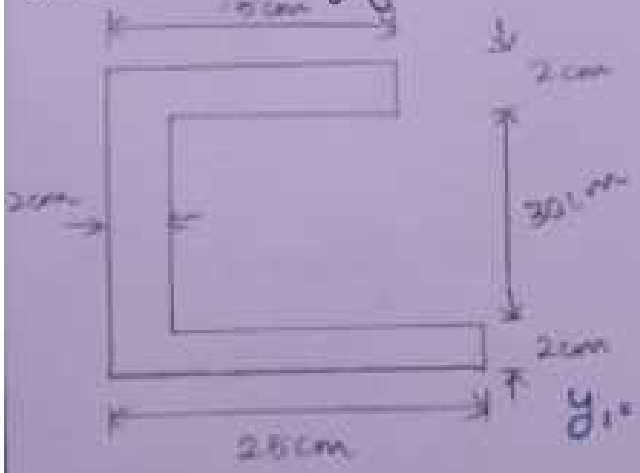
1. Find the moments of inertia of the channel section shown in figure about centroidal axes.



$A_1 = l \times b = 15 \times 2 = 30 cm^2$

$A_2 = l \times b = 30 \times 2 = 60 cm^2$

$A_3 = l \times b = 25 \times 2 = 50 cm^2$

$x_1 = \frac{15}{2} = 7.5 cm$; $x_2 = \frac{2}{2} = 1 cm$; x_3

$y_1 = 32 + \left(\frac{2}{2}\right) = 33 cm$, $y_3 = 2 + \left(\frac{\frac{15}{20}}{2}\right) = 11 cm$

$$\bar{x} = \frac{a_1x_1 + a_2x_2 + a_3x_3}{a_1 + a_2 + a_3} = \frac{910}{140} = 6.5 cm$$

$$\bar{y} = \frac{a_1y_1 + a_2y_2 + a_3y_3}{a_1 + a_2 + a_3} = 14.71 cm$$

To find I_{xx},

$h_1 = (y_1 - \bar{y}) = 18.29 cm$

$h_2 = (y_2 - \bar{y}) = 2.29 cm$

$h_3 = (y_3 - \bar{y}) = 13.71\,cm$

$I_{xx} = I_1 + I_2 + I_3$

$I_1 = I_{g_1} + A_1 h_1^2$

$= \frac{bd^3}{12} + A_1 h_1^2$

$= \frac{18 \times 2^3}{12} + (30 \times 18.29^2)$

$I_1 = 10048.72\,cm^4$

$I_2 = I_{g_2} + A_2 h_2^2$

$= \frac{bd^3}{12} + A_2 h_2^2$

$= \frac{2 \times 30^3}{12} + (60 \times 2.29^2)$

$= 4500 + (60 \times 2.29^2)$

$I_2 = 6814.64\,cm^4$

$I_3 = I_{g_3} + A_3 h_3^2$

$= \frac{bd^3}{12} + A_3 h_3^2$

$= \frac{25 \times 2^3}{12} + (50 \times 13.71^2)$

$I_3 = 9414.87\,cm^4$

$I_{xx} = I_1 + I_2 + I_3$

$\boxed{I_{xx} = 24275.23\,cm^4}$

To find I_{yy}.

$h_1 = (x_1 - \bar{x}) = \_\_\_\_\,cm$

$h_2 = (x_2 - \bar{x}) = 9.9\,cm$

$h_3 = (x_3 - \bar{x}) = 6\,cm$

$I_{yy} = I_1 + I_2 + I_3$

$I_1 = I_{g_1} + A_1 h_1^2$

$= \frac{db^3}{12} + A_1 h_1^2$

$= \frac{2 \times 18^3}{12} + (30 \times 1^2)$

$I_1 = 592.5\,cm^4$

$I_2 = I_{g_2} + A_2 h_2^2$

$= \frac{30 \times 2^3}{12} + (60 \times 5.45^2)$

$I_2 = 1835\,cm^4$

$I_3 = I_{g_3} + A_3 h_3^2$

$= \frac{db^3}{12} + (A_3 h_3^2)$

$= \frac{2 \times 25^3}{12} + (50 \times 6^2)$

$I_3 = 4404.16\,cm^4$

$I_{yy} = I_1 + I_2 + I_3$

$\boxed{I_{yy} = 6831.66\,cm^4}$

Radius of gyration:

$K_{xx} = \sqrt{I_{xx}/A}$

$K_{xx} = 13.16\,cm$

$K_{yy} = \sqrt{I_{yy}/A}$

$K_{yy} = \sqrt{48.799}$

$K_{yy} = 6.98\,cm$

Result:

$I_{xx} = 24275.23\,cm^4$; $I_{yy} = 6831.66\,cm^4$

$K_{xx} = 13.16\,cm$; $K_{yy} = 6.98\,cm$