

$$x_G = \frac{S_y}{A} = \frac{H}{2}$$

$$y_G = \frac{S_x}{A} = B + \frac{h}{2}$$

$H = 10\text{cm}, B = 2\text{cm}$

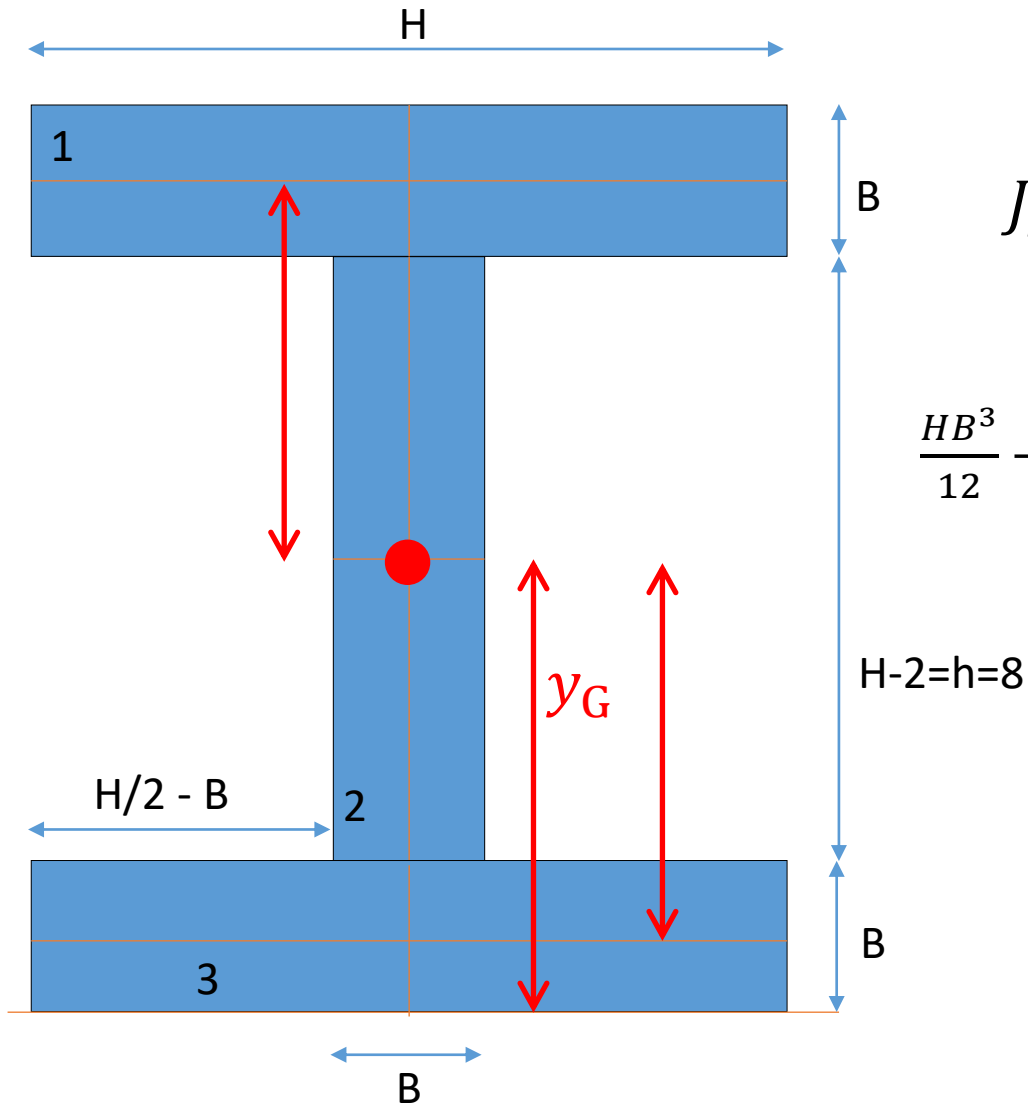
$(H=5B)$

$$x_G = \frac{10}{2} = 5\text{cm}$$

$$y_G = 2 + \frac{10 - 2}{2} = 6\text{cm}$$

A1

$$y_G = 6cm$$



$$J_{x_G} = (J_{x_1} + A_1 d_1^2) + (J_{x_2} + A_2 d_2^2) + (J_{x_3} + A_3 d_3^2)$$

$$\frac{HB^3}{12} + (HB) \left(\frac{h}{2} + \frac{B}{2} \right)^2 = \frac{80}{12} + 500 = 506.67 cm^4$$

$$\frac{Bh^3}{12} + (Bh)(0)^2 = 85.33 cm^4$$

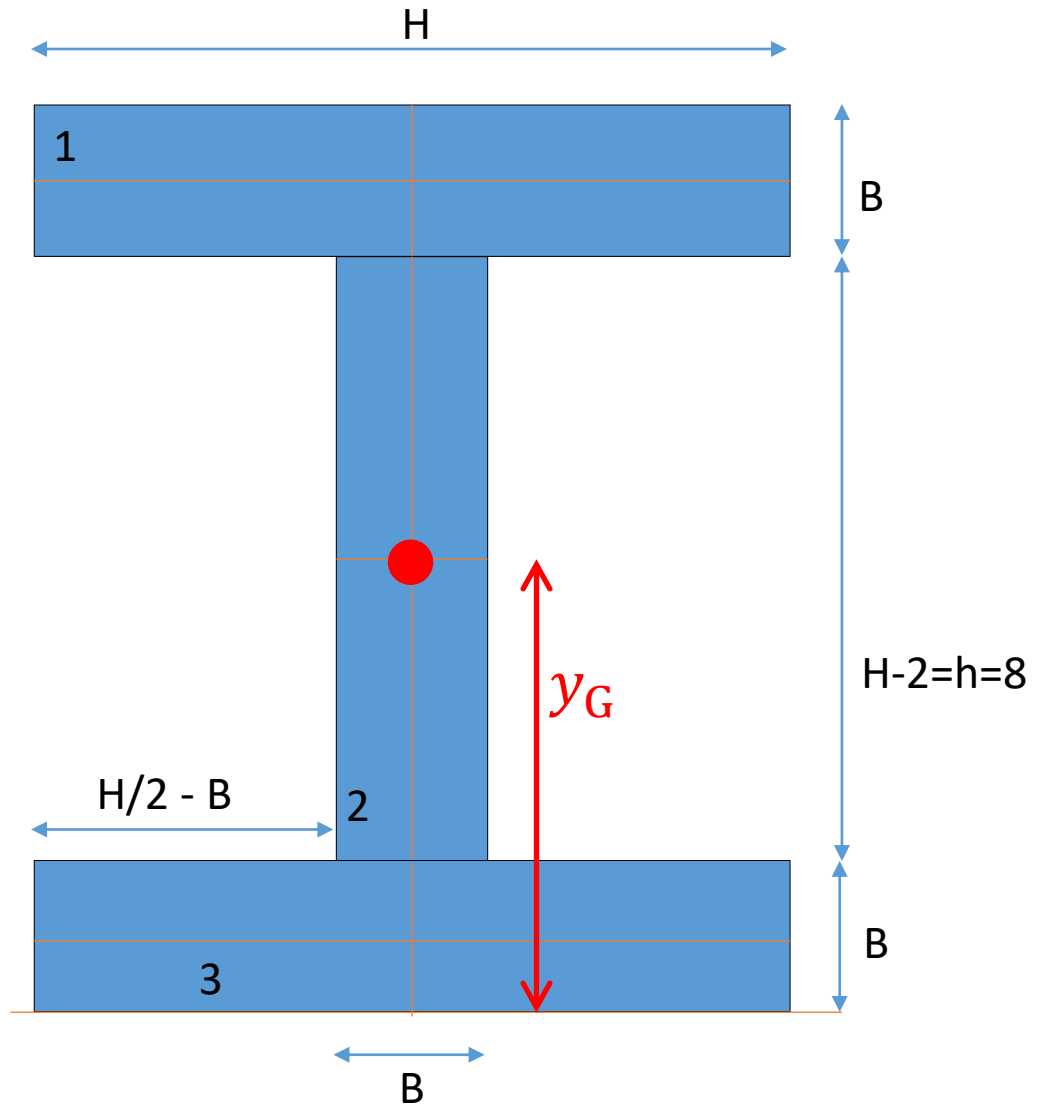
$$\frac{HB^3}{12} + (HB) \left(-\frac{h}{2} - \frac{B}{2} \right)^2 = 506.67 cm^4$$

$$H = 10cm, B = 2cm$$

$$(H=5B)$$

$$J_{x_G} = 506.67 + 85.33 + 506.67 = 1098.67 cm^4$$

(analogamente per il calcolo di J_{y_G})



$$y_G = 6cm$$

$$J_{x_G} = \text{"pieno"} - \text{"vuoto"}$$

$$\frac{H(h+2B)^3}{12} = 1440cm^4$$

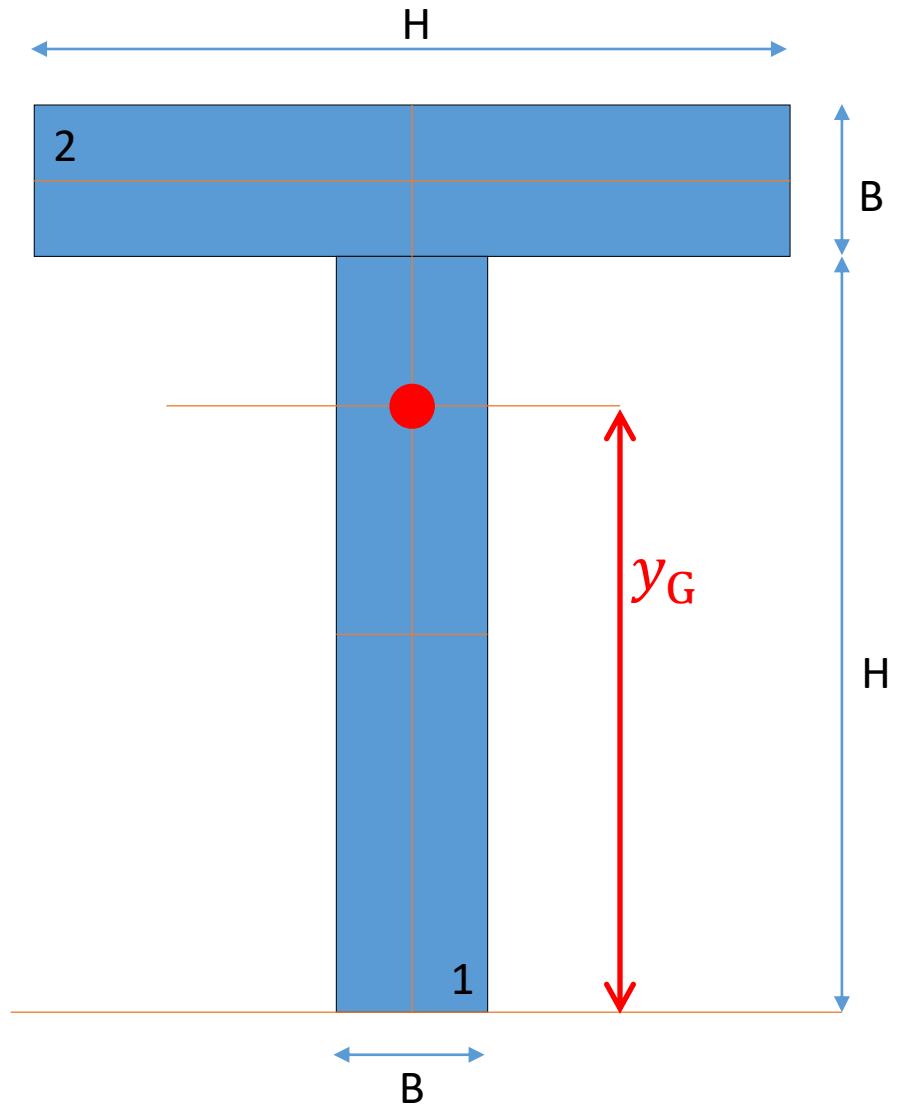
$$2 \frac{\left(\frac{H}{2} - B\right) h^3}{12} = 341cm^4$$

$$H = 10cm, B = 2cm$$

$$(H=5B)$$

$$J_{x_G} = 1440 - 341 = 1099cm^4$$

(analogamente per il calcolo di J_{y_G})



$$y_G = \frac{S_x}{A}$$

$$y_G = \frac{S_x}{A} = \frac{S_{x1} + S_{x2}}{A_1 + A_2}$$

$$A = A_1 + A_2 = (BH) + (BH)$$

$$S_{x1} = (BH)y_1 = (BH)\frac{H}{2}$$

$$S_{x2} = (BH)y_2 = (BH)\left(H + \frac{B}{2}\right)$$

$H = 10\text{cm}, B = 2\text{cm}$

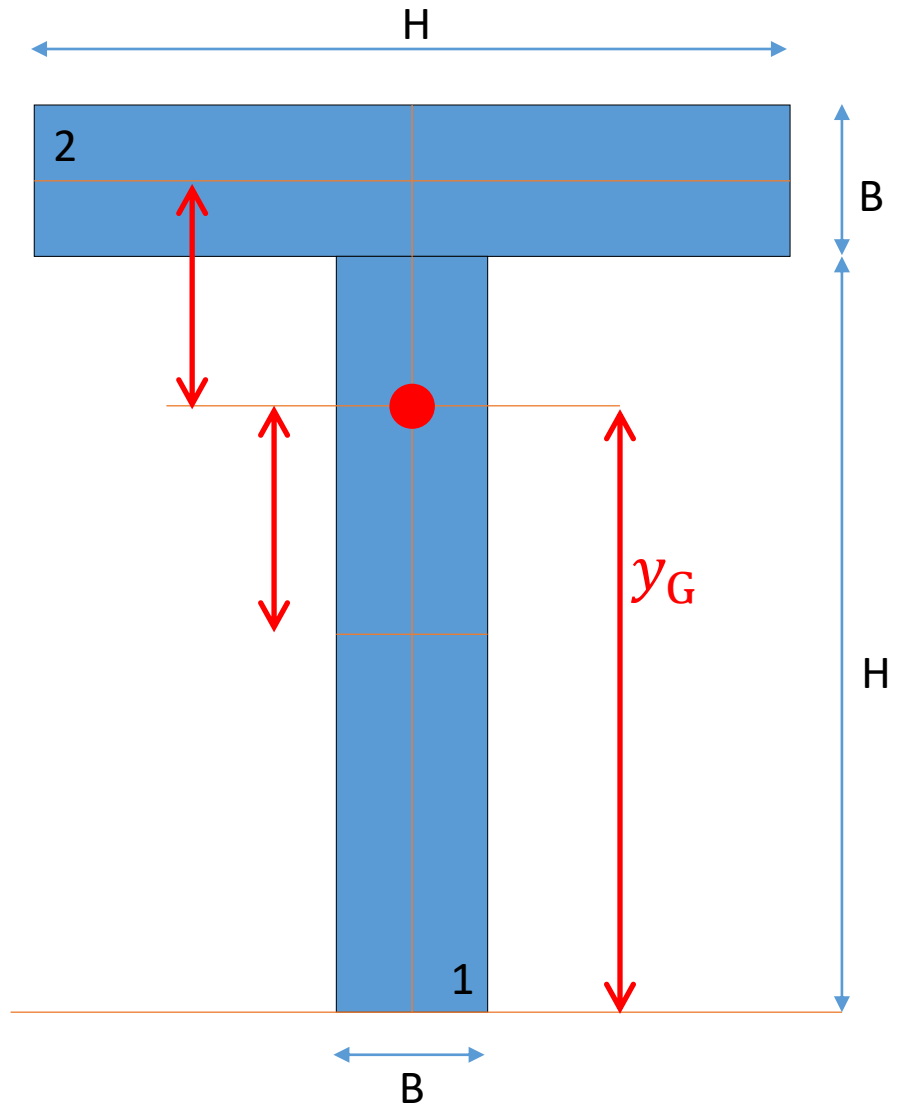
$(H=5B)$

$$y_G = \frac{S_x}{A} = \frac{(2 \cdot 10)(5) + (2 \cdot 10)(10 + 1)}{2 \cdot (2 \cdot 10)}$$

$$= \frac{(20 \cdot 5) + (20 \cdot 11)}{40} = \frac{320}{40} = 8\text{cm}$$

(analogamente per il calcolo di J_{yG})

$$y_G = 8\text{cm}$$



$$J_{x_G} = (J_{x_1} + A_1 d_1^2) + (J_{x_2} + A_2 d_2^2)$$

$$\frac{BH^3}{12} + (BH)(y_G - y_{G1})^2 = 166.67 + 180 = 346.67\text{cm}^4$$

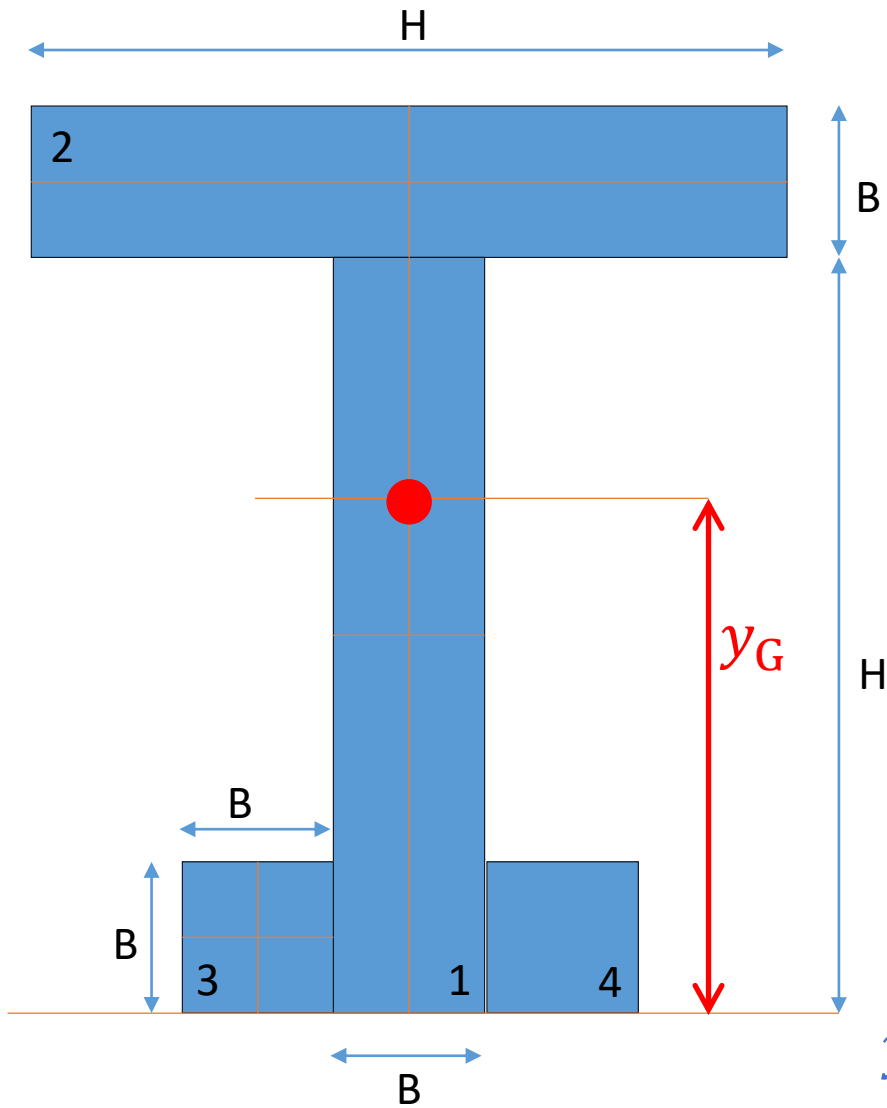
$$\frac{HB^3}{12} + (HB) \left(\frac{B}{2} + (H - y_G) \right)^2 = 6.67 + 180 = 186.67\text{cm}^4$$

$$H = 10\text{cm}, B = 2\text{cm}$$

$$(H=5B)$$

$$J_{x_G} = 346.67 + 186.67 = 533.34\text{cm}^4$$

(analogamente per il calcolo di J_{y_G})



$$H = 10\text{cm}, B = 2\text{cm}$$

$$(H=5B)$$

A3

$$y_G = \frac{S_x}{A}$$

$$y_G = \frac{S_x}{A} = \frac{S_{x1} + S_{x2} + 2S_{x3}}{A_1 + A_2 + 2A_3}$$

$$A = 2A_1 + 2A_3$$

$$S_{x1} = (BH) \frac{H}{2} = 100\text{cm}^3$$

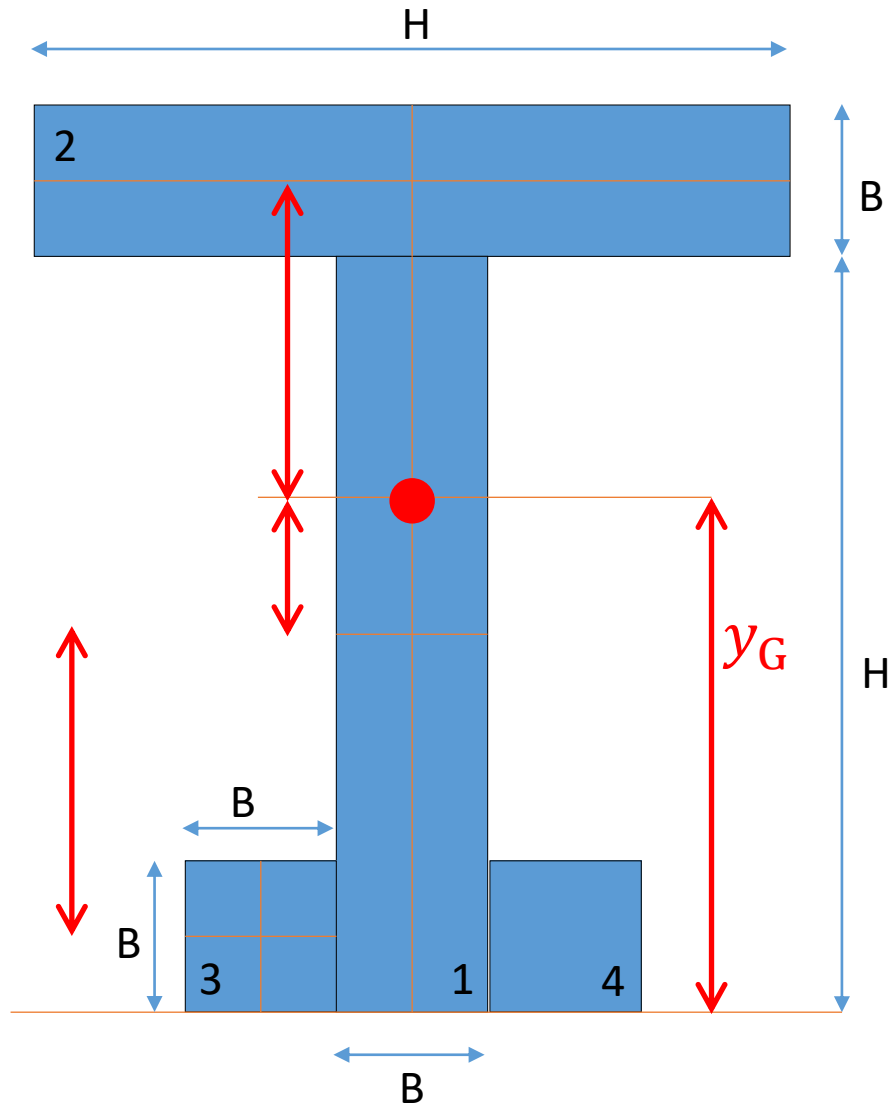
$$S_{x2} = (BH) \left(H + \frac{B}{2} \right) = 220\text{cm}^3$$

$$S_{x3} = (BB)y_3 = (BB) \frac{B}{2} = \frac{B^3}{2} = 4\text{cm}^3$$

$$y_G = \frac{S_x}{A} = \frac{100 + 220 + 2 \cdot (2 \cdot 2)(1)}{40 + 2 \cdot (2 \cdot 2)} = \frac{320 + 8}{40 + 8} = \frac{328}{48} = 6.83\text{cm}$$

A3

$$y_G = 6.83\text{cm}$$



$$H = 10\text{cm}, B = 2\text{cm}$$

$$(H=5B)$$

$$J_{x_G} = (J_{x_1} + A_1 d_1^2) + (J_{x_2} + A_2 d_2^2) + 2(J_{x_3} + A_3 d_3^2)$$

$$\frac{BH^3}{12} + (BH) \left(y_G - \frac{H}{2} \right)^2 = 166.67 + 66.98 = 233.64\text{cm}^4$$

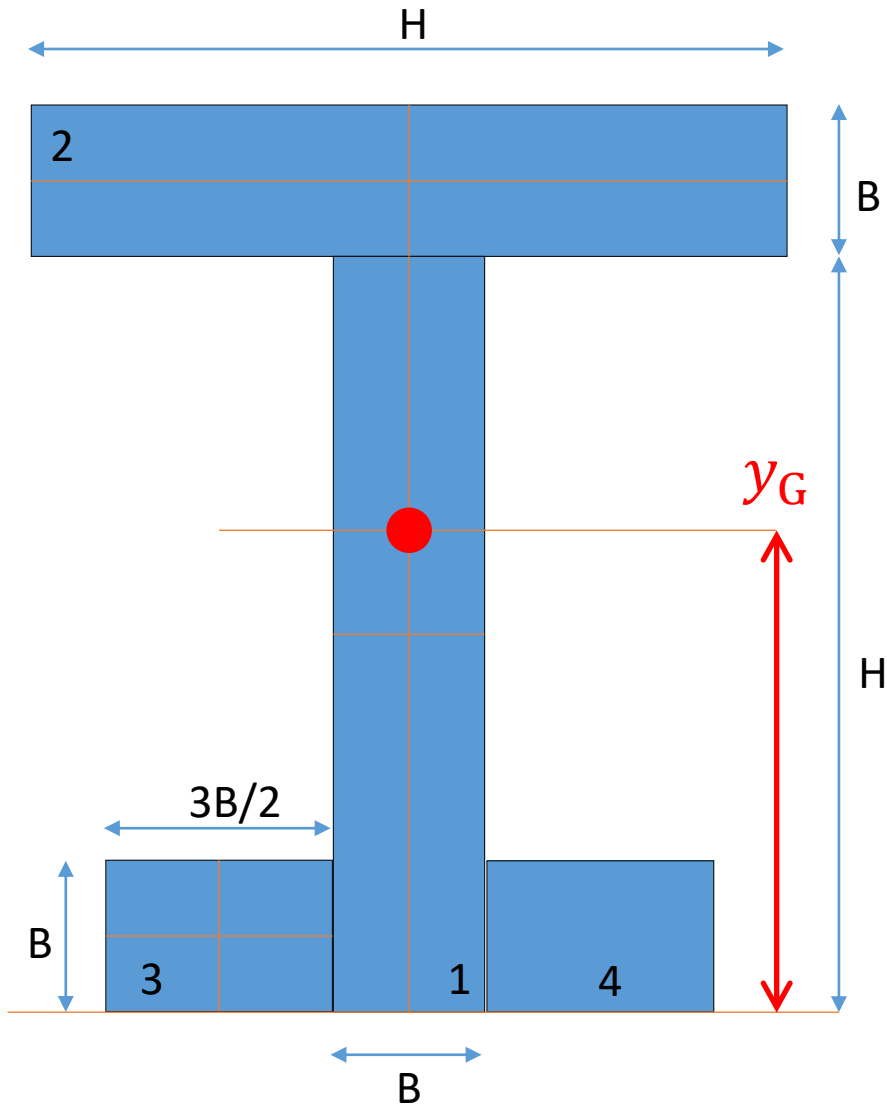
$$\frac{HB^3}{12} + (HB) \left(\frac{B}{2} + (H - y_G) \right)^2 = 6.67 + 347.78 = 354.44\text{cm}^4$$

$$\frac{BB^3}{12} + (BB) \left(y_G - \frac{B}{2} \right)^2 = 1.33 + 135.96 = 137.28\text{cm}^4$$

$$J_{x_G} = 233.64 + 354.44 + 2 \cdot 137.28 = 862.67\text{cm}^4$$

(analogamente per il calcolo di J_{y_G})

A4



$$y_G = \frac{S_x}{A}$$

$$y_G = \frac{S_x}{A} = \frac{S_{x1} + S_{x2} + 2S_{x3}}{A_1 + A_2 + 2A_3}$$

$$A = 2A_1 + 2A_3$$

$$S_{x1} = (BH) \frac{H}{2} = 100 \text{ cm}^3$$

$$S_{x2} = (BH) \left(H + \frac{B}{2} \right) = 220 \text{ cm}^3$$

$$S_{x3} = \left(B \frac{3}{2} B \right) y_3 = \left(\frac{3}{2} B^2 \right) \frac{B}{2} = \frac{3}{4} B^3 = 6 \text{ cm}^3$$

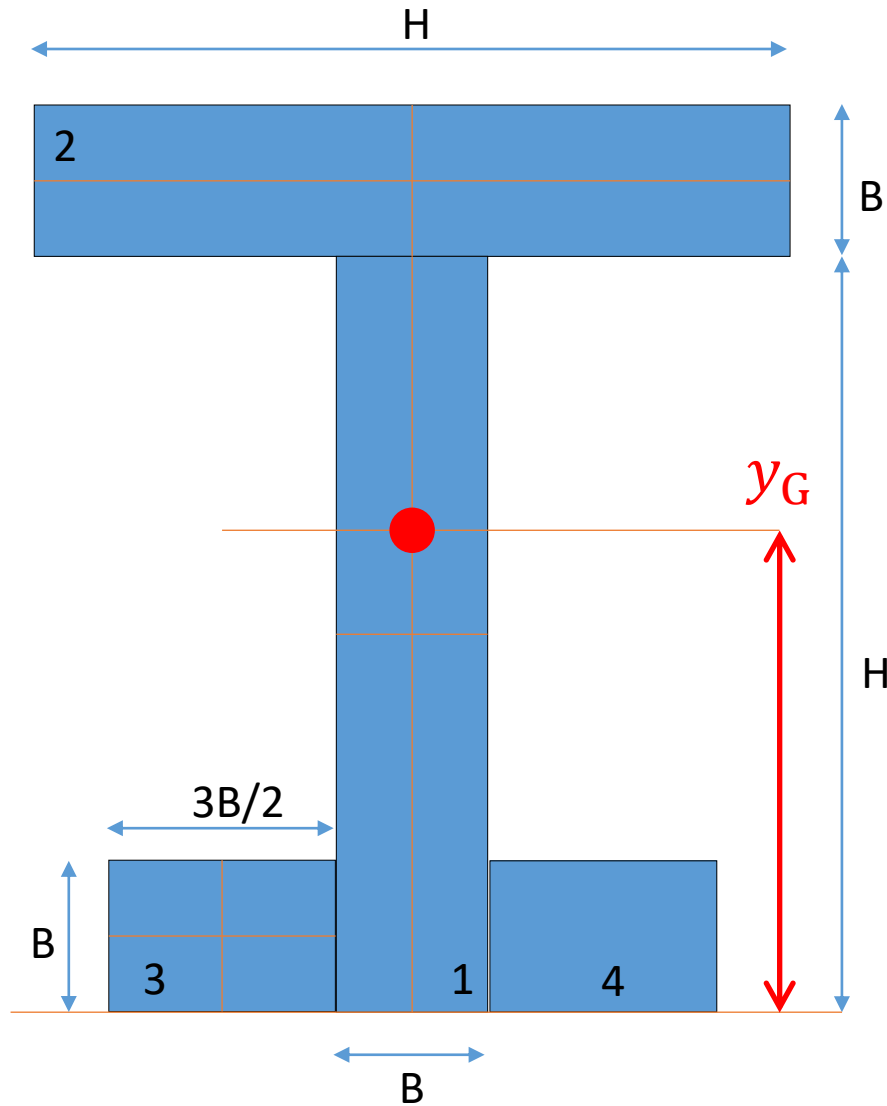
$$y_G = \frac{S_x}{A} = \frac{100 + 220 + 2 \cdot 6}{40 + 2 \cdot (6)} = \frac{320 + 12}{40 + 12} = \frac{332}{52} = 6.38 \text{ cm}$$

$$H = 10 \text{ cm}, B = 2 \text{ cm}$$

$$(H=5B)$$

A4

$$y_G = 6.38\text{cm}$$



$$J_{x_G} = (J_{x_1} + A_1 d_1^2) + (J_{x_2} + A_2 d_2^2) + 2(J_{x_3} + A_3 d_3^2)$$

$$\frac{BH^3}{12} + (BH) \left(y_G - \frac{H}{2} \right)^2 = 166.67 + 38.89 = 204.75\text{cm}^4$$

$$\frac{HB^3}{12} + (HB) \left(\frac{B}{2} + (H - y_G) \right)^2 = 6.67 + 426.89 = 433.55\text{cm}^4$$

$$\frac{\frac{3}{2}BB^3}{12} + \left(\frac{3}{2}BB \right) \left(y_G - \frac{B}{2} \right)^2 = 2 + 173.67 = 175.67\text{cm}^4$$

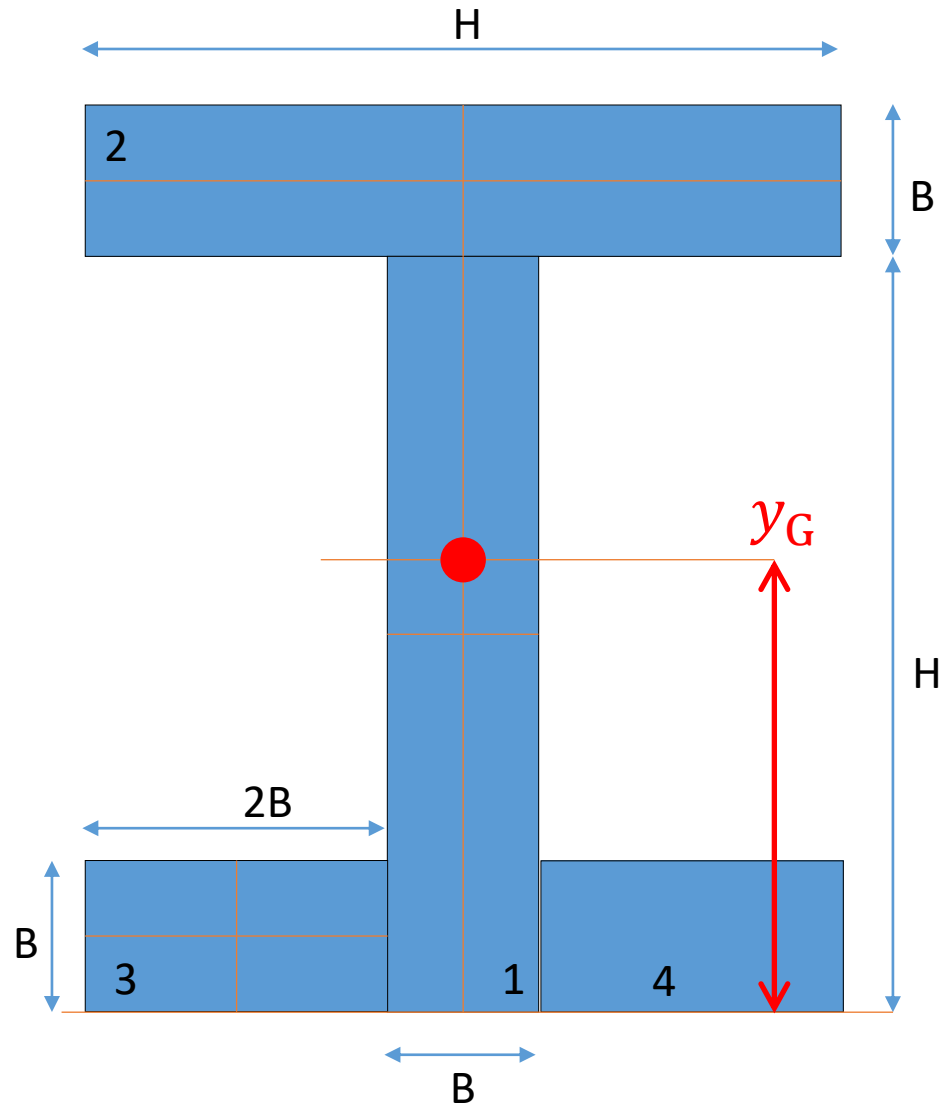
$$H = 10\text{cm}, B = 2\text{cm}$$

$$(H=5B)$$

$$J_{x_G} = 204.75 + 433.55 + 2 \cdot 175.67 = 989.64\text{cm}^4$$

(analogamente per il calcolo di J_{y_G})

A5



$$y_G = \frac{S_x}{A}$$

$$y_G = \frac{S_x}{A} = \frac{S_{x1} + S_{x2} + 2S_{x3}}{A_1 + A_2 + 2A_3}$$

$$A = 2A_1 + 2A_3$$

$$S_{x1} = (BH) \frac{H}{2} = 100 \text{ cm}^3$$

$$S_{x2} = (BH) \left(H + \frac{B}{2} \right) = 220 \text{ cm}^3$$

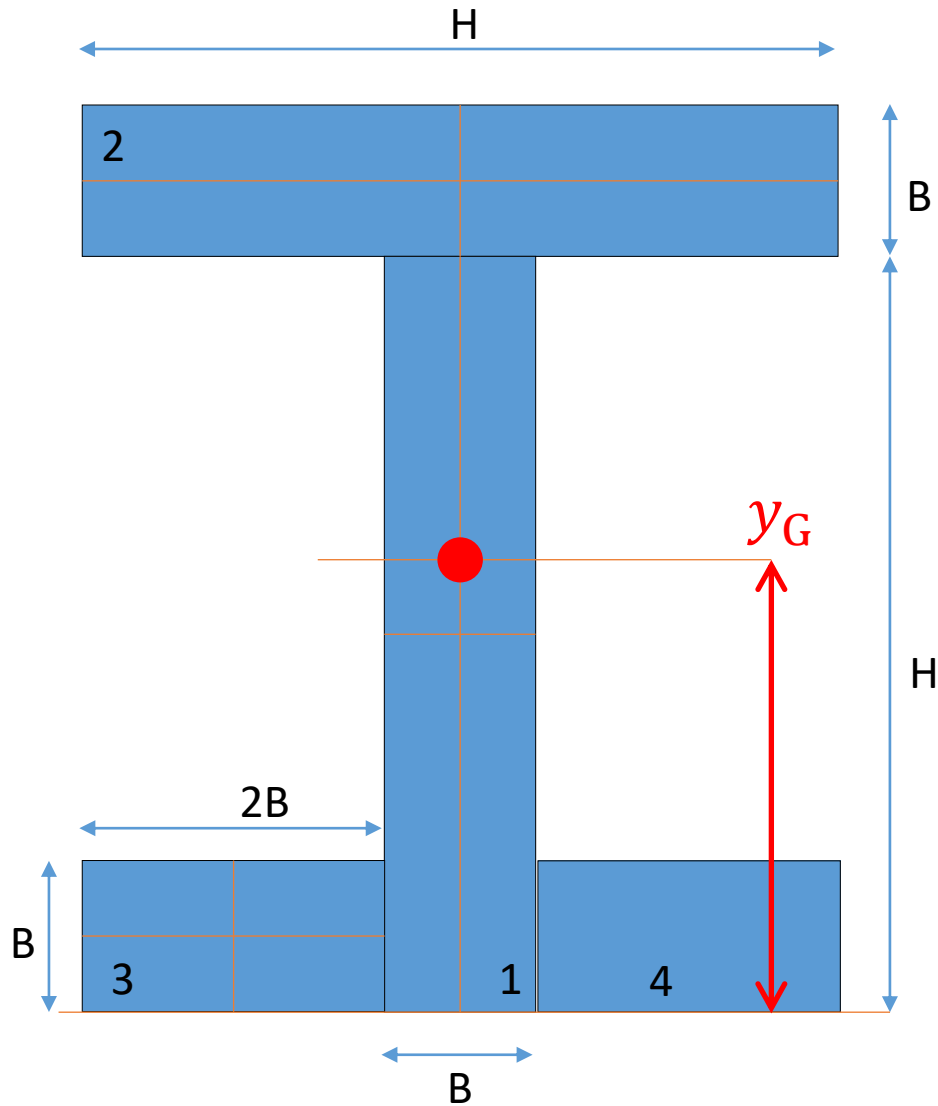
$$S_{x3} = (B \cdot 2B) y_3 = (2B^2) \frac{B}{2} = B^3 = 8 \text{ cm}^3$$

$H = 10 \text{ cm}, B = 2 \text{ cm}$

$(H=5B)$

$$y_G = \frac{S_x}{A} = \frac{100 + 220 + 2 \cdot 8}{40 + 2 \cdot (8)} = \frac{320 + 16}{40 + 16} = \frac{336}{56} = 6 \text{ cm}$$

$$y_G = 6\text{cm}$$



$$H = 10\text{cm}, B = 2\text{cm}$$

$$(H=5B)$$

$$J_{x_G} = (J_{x_1} + A_1 d_1^2) + (J_{x_2} + A_2 d_2^2) + 2(J_{x_3} + A_3 d_3^2)$$

$$\frac{BH^3}{12} + (BH) \left(y_G - \frac{H}{2} \right)^2 = 166.67 + 20 = 186.67\text{cm}^4$$

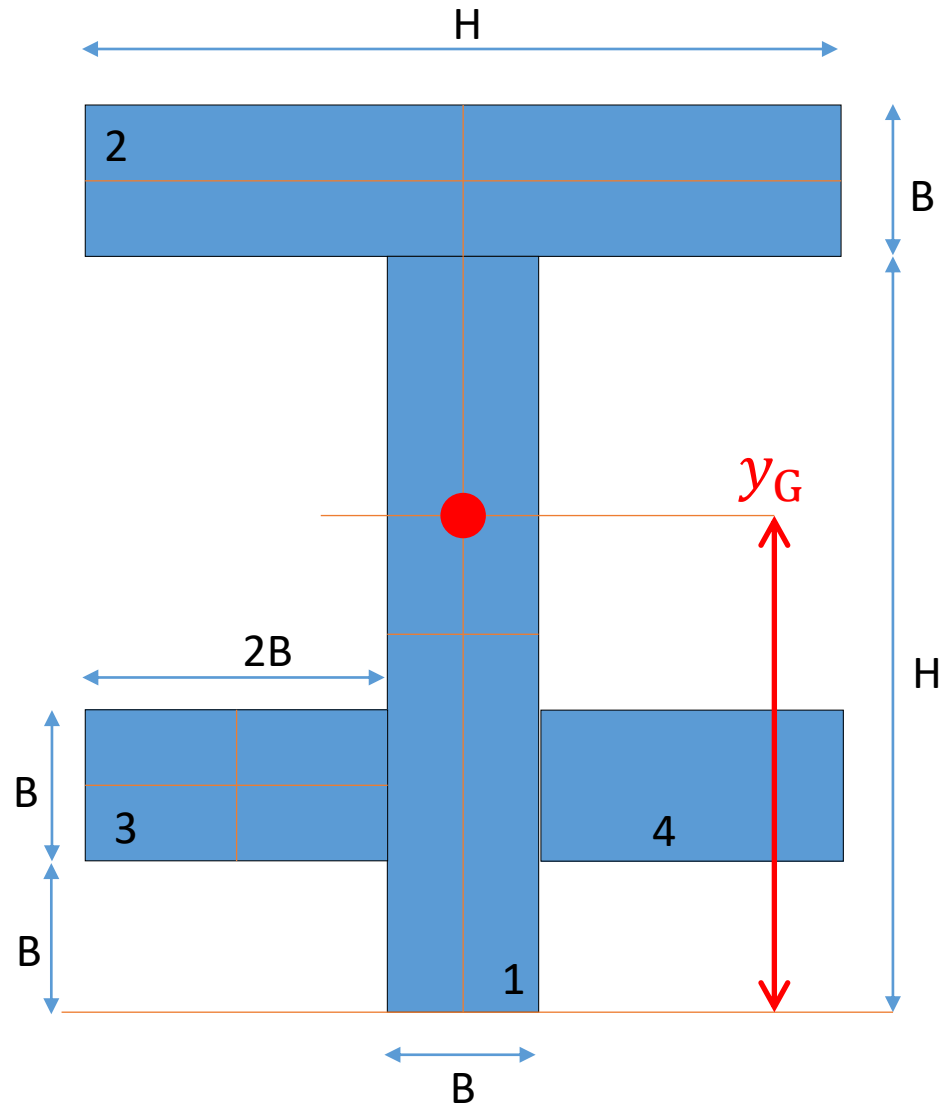
$$\frac{HB^3}{12} + (HB) \left(\frac{B}{2} + (H - y_G) \right)^2 = 6.67 + 500 = 506.67\text{cm}^4$$

$$\frac{2BB^3}{12} + (2BB) \left(y_G - \frac{B}{2} \right)^2 = 2.67 + 200 = 202.67\text{cm}^4$$

$$J_{x_G} = 186.67 + 506.67 + 2 \cdot 202.67 = 1098.68\text{cm}^4$$

(analogamente per il calcolo di J_{y_G})

A6



$H = 10\text{cm}, B = 2\text{cm}$
 $(H=5B)$

$$y_G = \frac{S_x}{A}$$

$$y_G = \frac{S_x}{A} = \frac{S_{x1} + S_{x2} + 2S_{x3}}{A_1 + A_2 + 2A_3}$$

$$A = 2A_1 + 2A_3$$

$$S_{x1} = (BH) \frac{H}{2} = 100\text{cm}^3$$

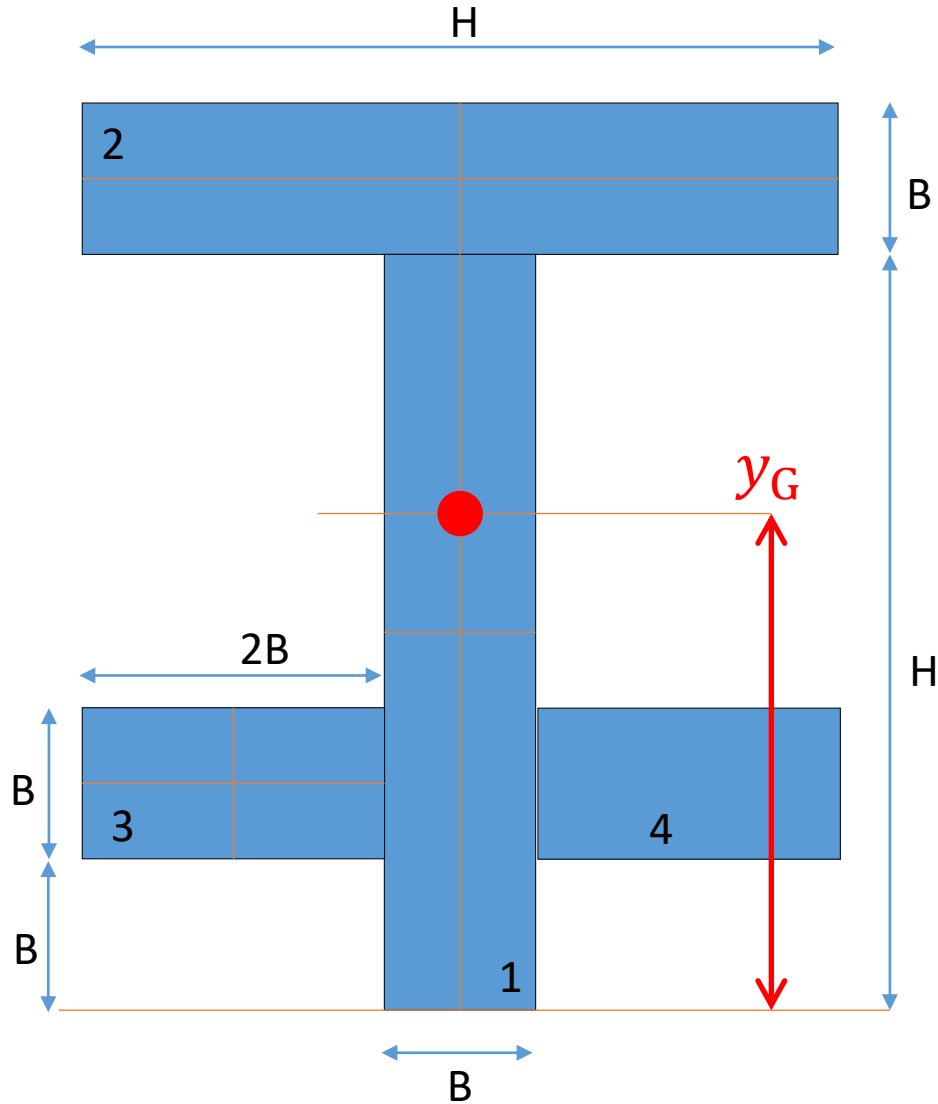
$$S_{x2} = (BH) \left(H + \frac{B}{2} \right) = 220\text{cm}^3$$

$$S_{x3} = (B \cdot 2B) y_3 = (2B^2) \left(B + \frac{B}{2} \right) = 3B^3 = 24\text{cm}^3$$

$$y_G = \frac{S_x}{A} = \frac{100 + 220 + 2 \cdot 24}{40 + 2 \cdot (8)} = \frac{320 + 48}{40 + 16} = \frac{368}{56} = 6.57\text{cm}$$

A6

$$y_G = 6.57 \text{ cm}$$



$$J_{x_G} = (J_{x_1} + A_1 d_1^2) + (J_{x_2} + A_2 d_2^2) + 2(J_{x_3} + A_3 d_3^2)$$

$$\frac{BH^3}{12} + (BH) \left(y_G - \frac{H}{2} \right)^2 = 166.67 + 49.3 = 215.96 \text{ cm}^4$$

$$\frac{HB^3}{12} + (HB) \left(\frac{B}{2} + (H - y_G) \right)^2 = 6.67 + 392.50 = 399.16 \text{ cm}^4$$

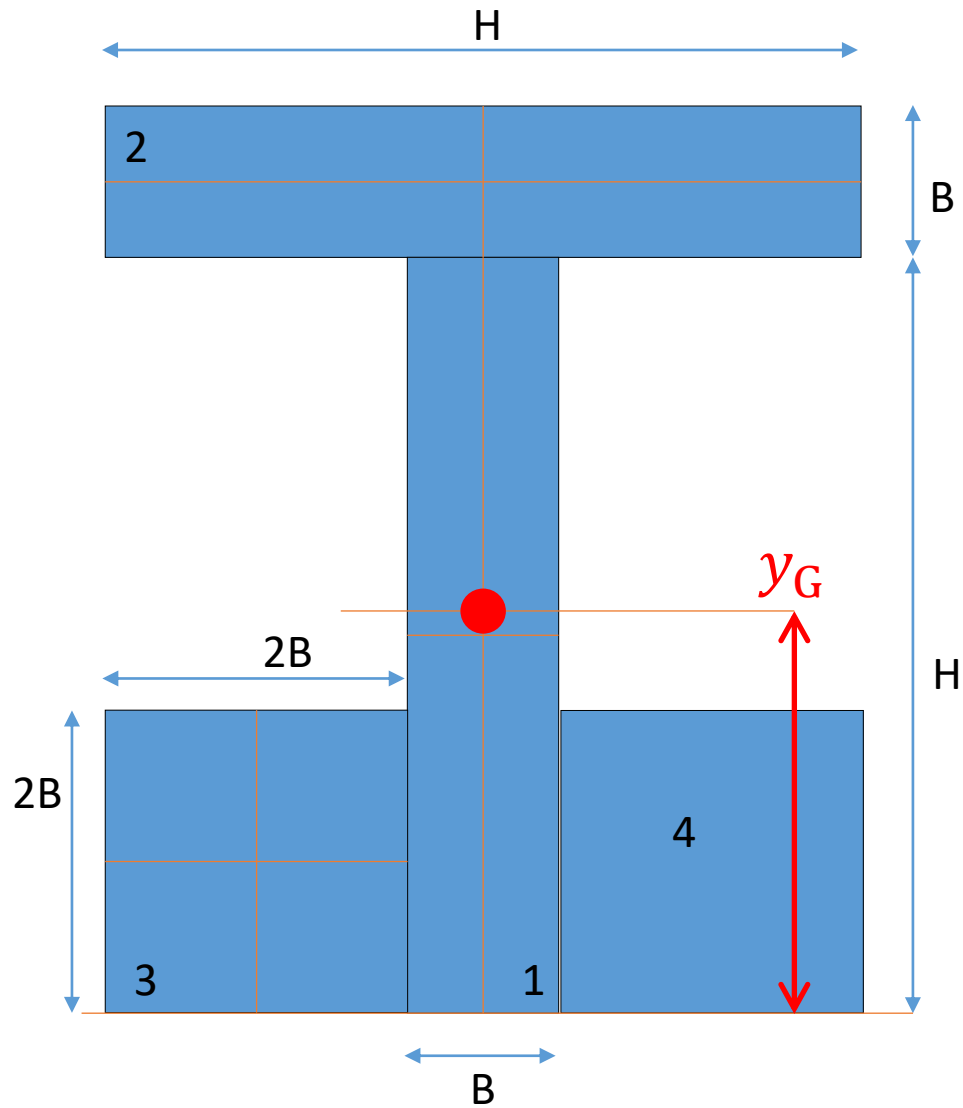
$$\frac{2BB^3}{12} + (2BB) \left(y_G - \left(B + \frac{B}{2} \right) \right)^2 = 2.67 + 101.96 = 104.63 \text{ cm}^4$$

$$H = 10 \text{ cm}, B = 2 \text{ cm}$$

$$(H=5B)$$

$$J_{x_G} = 215.96 + 399.16 + 2 \cdot 104.63 = 760.75 \text{ cm}^4$$

(analogamente per il calcolo di J_{y_G})



$$H = 10\text{cm}, B = 2\text{cm}$$

$$(H=5B)$$

A7

$$y_G = \frac{S_x}{A}$$

$$y_G = \frac{S_x}{A} = \frac{S_{x1} + S_{x2} + 2S_{x3}}{A_1 + A_2 + 2A_3}$$

$$A = 2A_1 + 2A_3$$

$$S_{x1} = (BH) \frac{H}{2} = 100\text{cm}^3$$

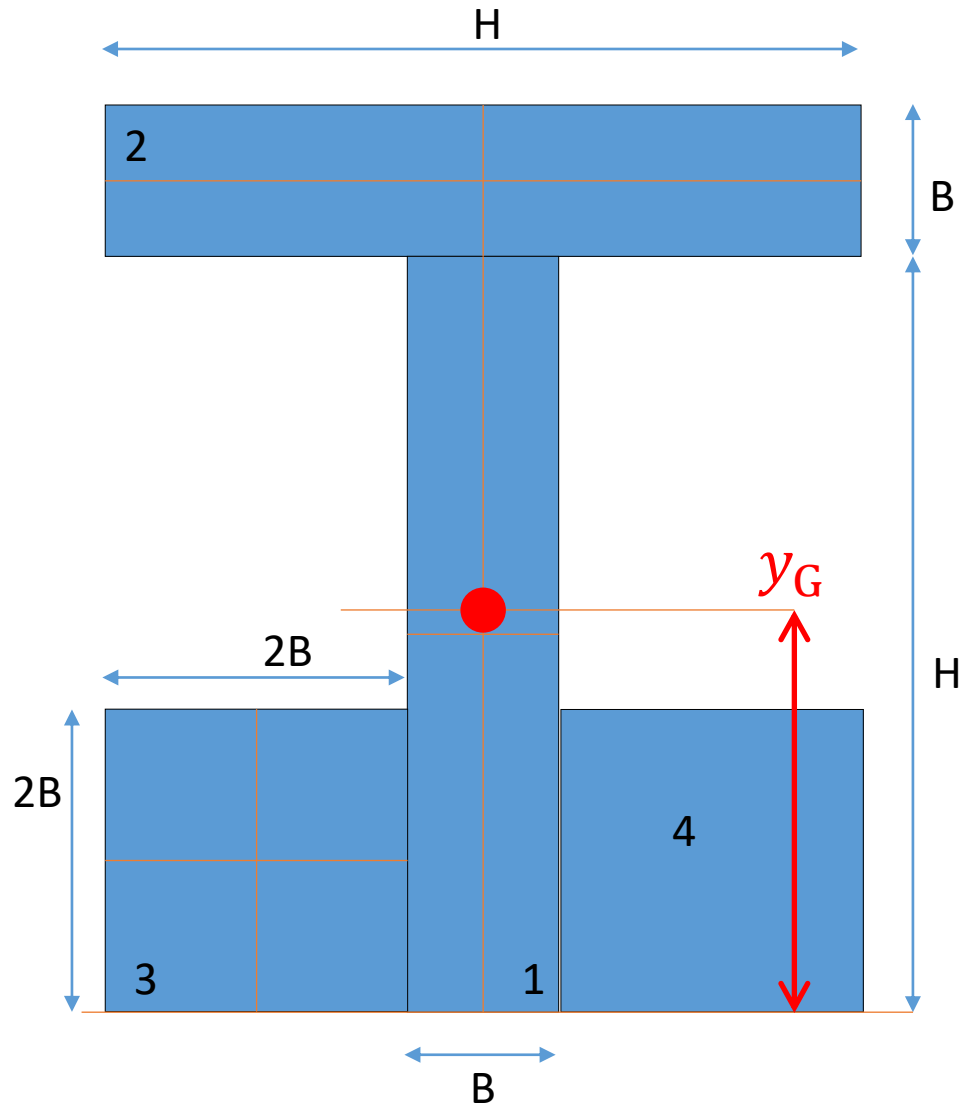
$$S_{x2} = (BH) \left(H + \frac{B}{2} \right) = 220\text{cm}^3$$

$$S_{x3} = (2B \cdot 2B) y_3 = (4B^2)(B) = 4B^3 = 32\text{cm}^3$$

$$y_G = \frac{S_x}{A} = \frac{100 + 220 + 2 \cdot 32}{40 + 2 \cdot 16} = \frac{320 + 64}{40 + 32} = \frac{384}{72} = 5.33\text{cm}$$

$$y_G = 5.33\text{cm}$$

A7



$$H = 10\text{cm}, B = 2\text{cm}$$

$$(H=5B)$$

$$J_{x_G} = (J_{x_1} + A_1 d_1^2) + (J_{x_2} + A_2 d_2^2) + 2(J_{x_3} + A_3 d_3^2)$$

$$\frac{BH^3}{12} + (BH) \left(y_G - \frac{H}{2} \right)^2 = 166.67 + 2.17 = 168.84\text{cm}^4$$

$$\frac{HB^3}{12} + (HB) \left(\frac{B}{2} + (H - y_G) \right)^2 = 6.67 + 642.97 = 649.64\text{cm}^4$$

$$\frac{2B(2B)^3}{12} + (2B2B)(y_G - B)^2 = 21.33 + 177.42 = 198.75\text{cm}^4$$

$$J_{x_G} = 168.84 + 649.64 + 2 \cdot 198.75 = 1216\text{cm}^4$$

(analogamente per il calcolo di J_{y_G})