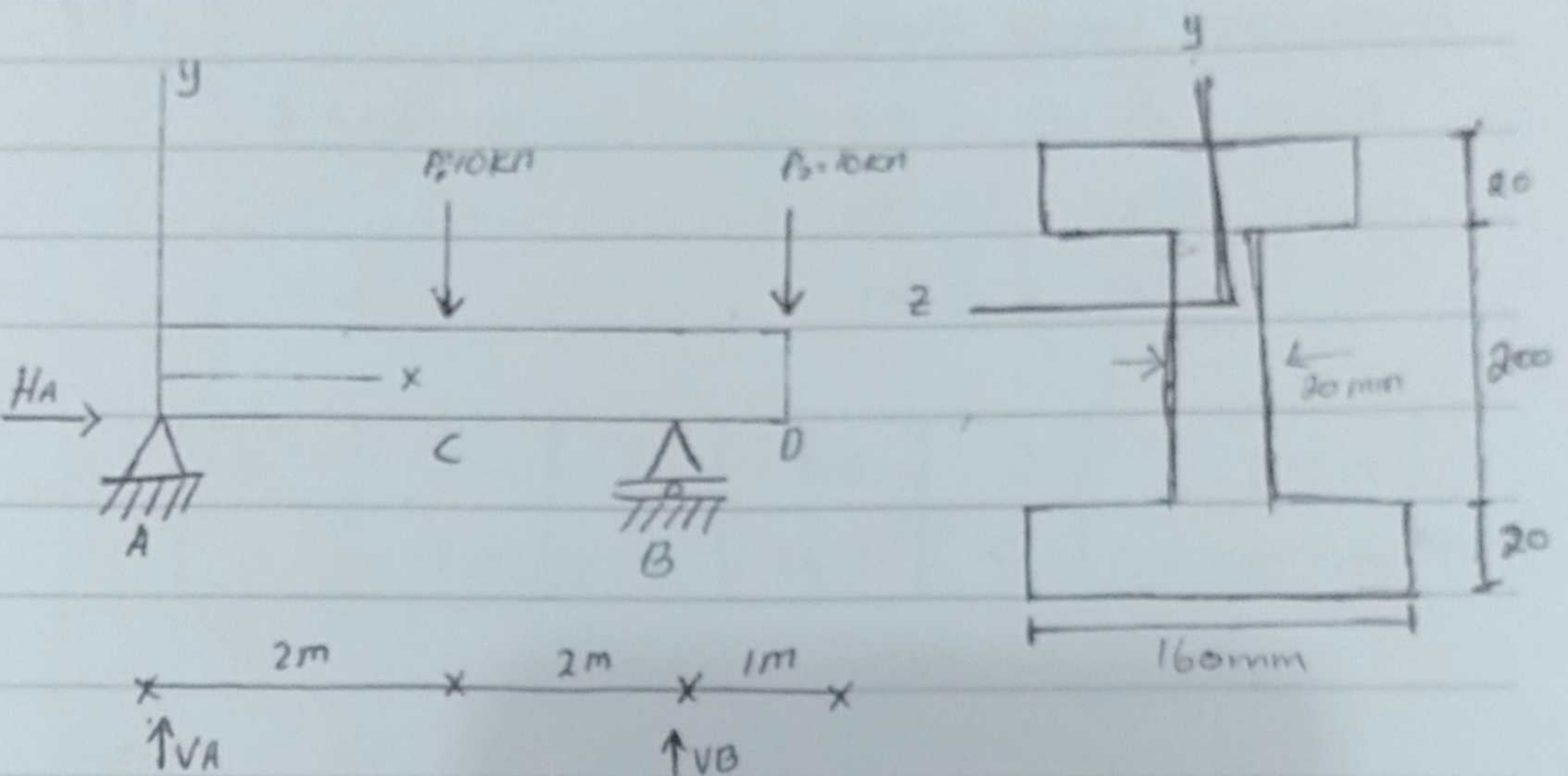


Upload Tugas Pertemuan ke 11

Nama : Ani Oktia Putra

Nim : 102710035

Soal II



Reaksi penelatan

$$\sum M_A = 0$$

$$P_1(2) + P_2(5) - V_B(4) = 0$$

$$10(2) + 10(5) - 4V_B = 0$$

$$V_B = \frac{35}{2} \text{ kN}$$

$$\sum M_B = 0$$

$$V_A(4) - P_1(2) + P_2(1) = 0$$

$$4V_A - 2(10) + 10(1) = 0$$

$$V_A = \frac{5}{2} \text{ kN}$$

$$\text{Verifikasi } \sum V = 0$$

$$(\therefore) V_A + V_B - P_1 - P_2 = 0$$

$$(\therefore) \frac{5}{2} \text{ kN} + \frac{35}{2} \text{ kN} - 10 - 10 = 0$$

$$(\therefore) 20 - 20 = 0$$

0-0 (OK) !!

$$\sum H = 0$$

$$H_A = 0$$

Perhitungan Bidang Momen (M_x)

Botano $AC = 0 \leq x \leq 2m$ diukur dari titik A

$$M_{x1} = V_A \cdot x_1$$

$$m_{x1} = \frac{5}{2} x_1$$

$x_1 (m)$	0	0.5	1	1.5	2
$m_{x1} (KN \cdot m)$	0	1.25	2.5	3.75	5

$$\tau = \frac{V \left(\frac{b}{2} \left(\frac{h^2}{4} - y^2 \right) \right)}{\left(\frac{1}{12} b h^3 \right) b} = \frac{-6V}{b h^3} \left(\frac{h^2}{4} - y^2 \right)$$

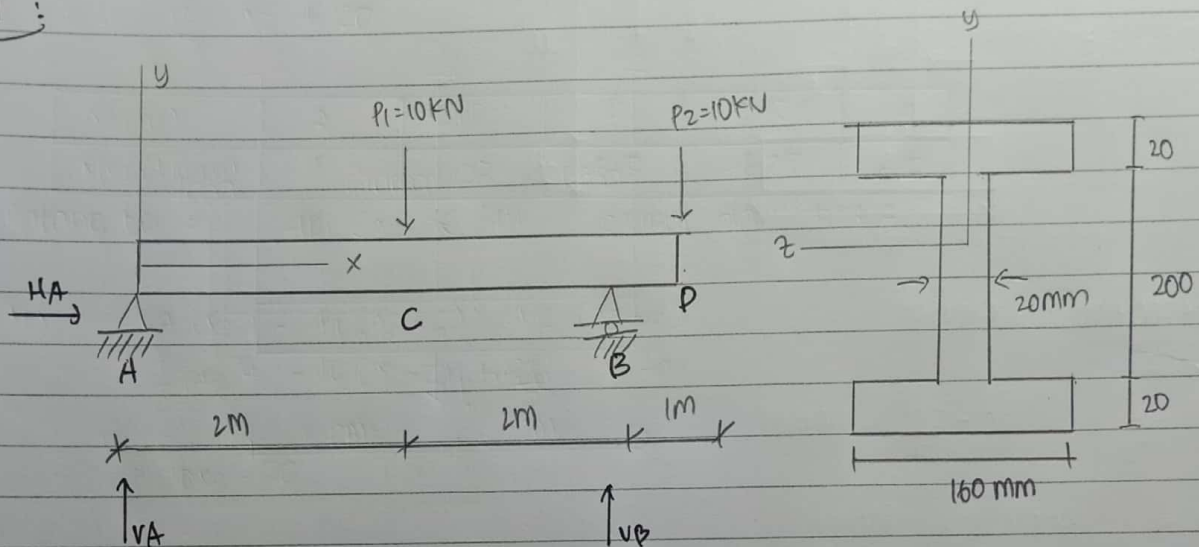
$$\tau = \frac{6(10^4)}{100 \cdot 300^3} \left(\frac{300^2}{4} - y^2 \right)$$

$$= -2.22 \cdot 10^{-5} (22500 - y^2)$$

tegangan utama & geser max.

Nama : Deni Harrison

NPM : 182410027

soal 11 :Reaksi penopangan :

$$\sum M_A = 0$$

$$P_1(2) + P_2(5) - V_B(4) = 0$$

$$10(2) + 10(5) - 4V_B = 0$$

$$V_B = \frac{35}{2} \text{ kN}$$

$$\sum M_B = 0$$

$$V_A(4) - P_1(2) + P_2(1) = 0$$

$$4V_A - 2(10) + 10(1) = 0$$

$$V_A = \frac{5}{2} \text{ kN}$$

Kontrol $\sum V = 0$

$$(\Rightarrow) V_A + V_B - P_1 - P_2 = 0$$

$$(\Rightarrow) \frac{5}{2} \text{ kN} + \frac{35}{2} \text{ kN} - 10 - 10 = 0$$

$$(\Rightarrow) 20 - 20 = 0$$

$$0 = 0 \text{ (OK)!!}$$

$$\sum H = 0$$

$$H_A = 0$$

Perhitungan Bidang Momen (Mx) :Batang AC = 0 $\leq x \leq 2\text{m}$ diukur dari titik A

$$M_{x1} = V_A \cdot x_1$$

$$M_{x1} = \frac{5}{2} x_1$$

$x_1(\text{m})$	0	0,5	1	1,5	2
$M_{x1}(\text{kN}\cdot\text{m})$	0	1,25	2,5	3,75	5

Batang CB = $2m \leq x_2 \leq 4m$ diukur dari titik A

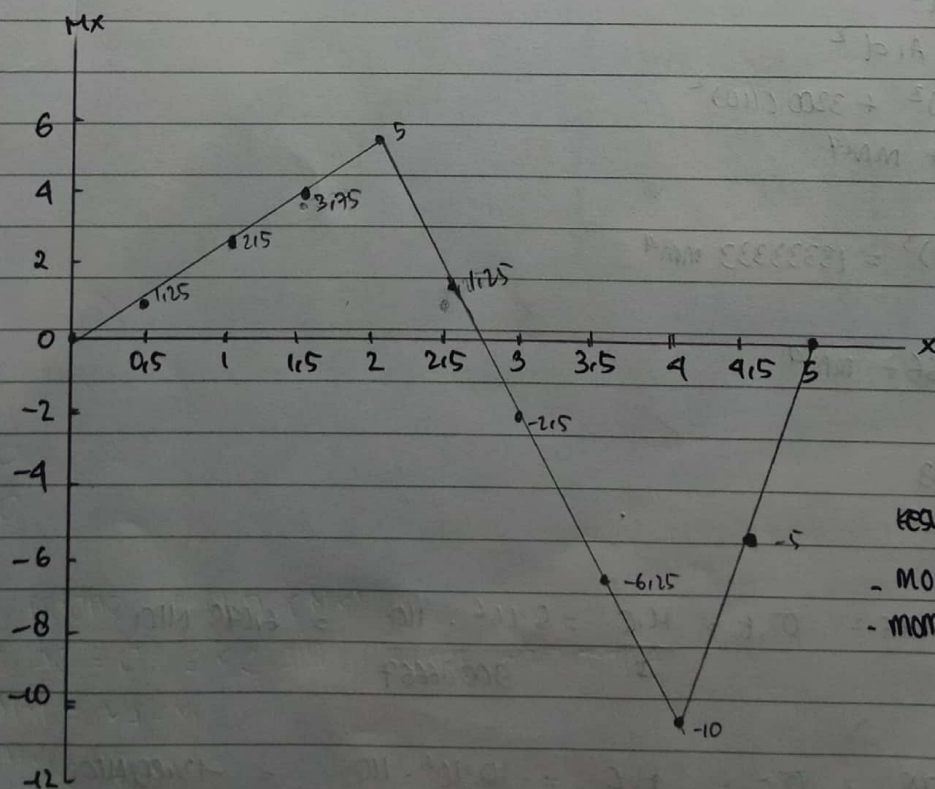
$$\begin{aligned} M_{x_2} &= V_A \cdot x_2 - P_1 (x_2 - 2) \\ &= \frac{5}{2} x_2 - 10(x_2 - 2) \\ &= -\frac{15}{2} x_2 + 20 \end{aligned}$$

$x_2 (cm)$	2	2,5	3	3,5	4
$M_{x_2} (kN-m)$	5	1,25	-2,5	-6,25	-10

Batang BD = $4m \leq x_3 \leq 5m$ diukur dari titik A

$$\begin{aligned} M_{x_3} &= V_A (x_3) - P_1 (x_3 - 2) + V_B (x_3 - 4) \\ &= \frac{5}{2} (x_3) - 10(x_3 - 2) + \frac{35}{2} (x_3 - 4) \\ &= 10x_3 - 50 \end{aligned}$$

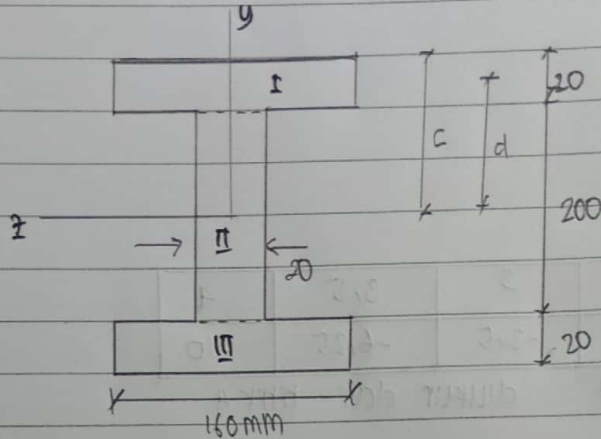
$x_3 (cm)$	4	4,5	5
$M_{x_3} (kN-m)$	-10	-5	0



Kesimpulan:

- Momen (+) max $\rightarrow 5 kNm$
- Momen (-) max $\rightarrow -10 kNm$

Perthitungan momen Inersia:



$$c = \frac{20 + 200 + 20}{2} = 120 \text{ mm}$$

$$d = c - \frac{t}{2} = 120 - \frac{20}{2} = 110 \text{ mm}$$

$$A_1 = b \cdot t = 160(20) = 3200 \text{ mm}^2$$

$$A_2 = h \cdot t = 200(20) = 4000 \text{ mm}^2$$

$$A_3 = b \cdot t = 160(20) = 3200 \text{ mm}^2$$

$$\begin{aligned} I_{z1} &= I_{zc} + A_1 d^2 \\ &= \frac{1}{12} b t^3 + A_1 d^2 \\ &= \frac{1}{12} 160 (20)^3 + 3200 (110)^2 \\ &= 38826667 \text{ mm}^4 \end{aligned}$$

$$I_{z2} = \frac{1}{12} (20) (200)^3 = 13333333 \text{ mm}^4$$

$$I_{z3} = I_{z1} = 38826667 \text{ mm}^4$$

$$\begin{aligned} I_z &= I_{z1} + I_{z2} + I_{z3} \\ &= 90986667 \text{ mm}^4 \end{aligned}$$

$$\text{tegangan tarik Max} = \sigma_t = \frac{M c}{I} = \frac{5 \cdot 10^6 \cdot 110}{90986667} = 6.095 \text{ MPa}$$

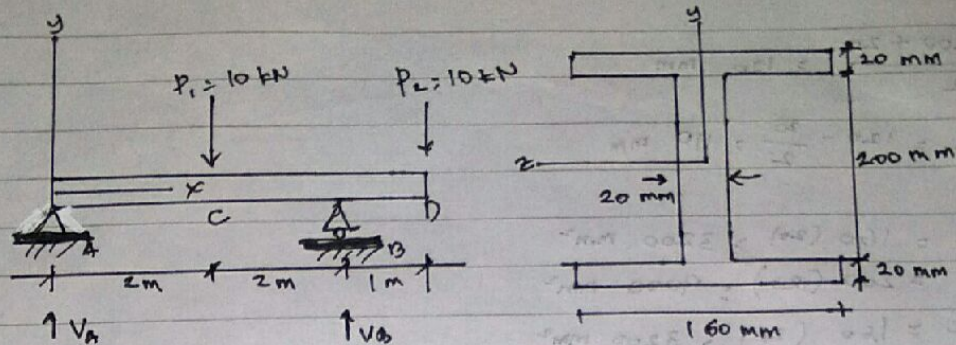
$$\text{tegangan tekan max} = \sigma_c = \frac{M c}{I} = \frac{-10 \cdot 10^6 \cdot 110}{90986667} = -12.09 \text{ MPa}$$

NAMA : DESMARITA

NIM : 182710025

TUGAS II

SEBUAH BALOK DENGAN BEBAN P_1 DAN P_2 SEPERTI TERLAMBAR. PENAMPANG BALOK ADALAH PROFIL IWF DENGAN $b = 160 \text{ mm}$ dan $h = 240 \text{ mm}$ (BERAT SENDIRI DIABAIKAN). HITUNG LAH TEGANGAN TARIK DAN TEKAN MAKSIMUM AKIBAT BEBAN TERSEBUT.



Reaksi Perletakan :

$$\begin{aligned}\sum M_A &= 0 \\ P_1(2) + P_2(5) - V_B(4) &= 0 \\ 10(2) + 10(5) - 4V_B &= 0 \\ V_B &= \frac{35}{2} \text{ kN}\end{aligned}$$

$$\begin{aligned}\sum M_B &= 0 \\ V_A(4) - P_1(2) + P_2(1) &= 0 \\ 4V_A - 2(10) + 10(1) &= 0 \\ V_A &= \frac{5}{2} \text{ kN}\end{aligned}$$

Kontrol $\sum V = 0$

$$(\sum) V_A + V_B - P_1 - P_2 = 0$$

$$\begin{aligned}\frac{5}{2} \text{ kN} + \frac{35}{2} \text{ kN} - 10 - 10 &= 0 \\ 20 - 20 &= 0 \\ 0 - 0 (\text{OK})!\end{aligned}$$

$$\sum H = 0$$

$$H_A = 0$$

Perhitungan Bidang Momen (M_x) :

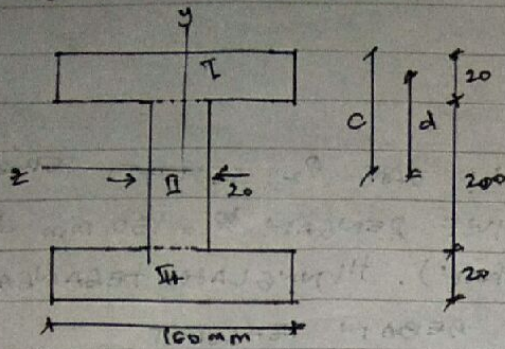
BATANG AC $0 \leq x \leq 2 \text{ m}$ DI UJUK DARI TITIK A

$$M_{x1} = V_A \cdot x$$

$$M_{x1} = \frac{5}{2} x$$

$x_i \text{ (m)}$	0	0,5	1	1,5	2
$M_{x_i} \text{ (kN.m)}$	0	1,25	2,5	3,75	5

Perhitungan momen Inersia :



$$c = \frac{20 + 200 + 20}{2} = 120 \text{ mm}$$

$$d = c - \frac{t}{2} = 120 - \frac{20}{2} = 110 \text{ mm}$$

$$A_1 = b \cdot t = 160 (20) = 3200 \text{ mm}^2$$

$$A_2 = h \cdot t = 200 (20) = 4000 \text{ mm}^2$$

$$A_3 = b \cdot t = 160 (20) = 3200 \text{ mm}^2$$

$$\begin{aligned} I_{z_1} &= I_{zc} + A_1 d^2 \\ &= \frac{1}{12} b t^3 + A_1 d^2 \\ &= \frac{1}{12} 60 (20)^3 + 3200 (110)^2 \\ &= 38826667 \text{ mm}^4 \end{aligned}$$

$$I_{z_2} = \frac{1}{12} (20) (200)^3 = 13333333 \text{ mm}^4$$

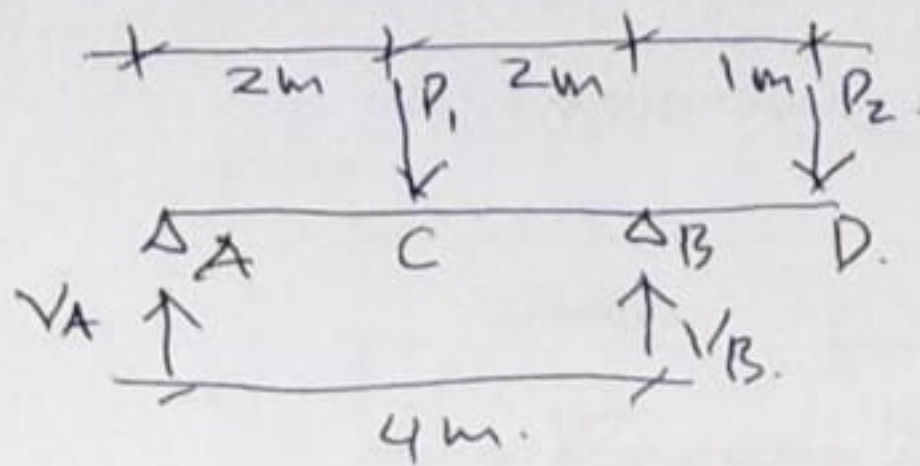
$$I_{z_3} = I_{z_1} = 38826667 \text{ mm}^4$$

$$I_z = I_{z_1} + I_{z_2} + I_{z_3} = 90986667 \text{ mm}^4$$

$$\text{Tegangan Tarik max} = \sigma_t = \frac{M \cdot c}{I} = \frac{5 \cdot 10^6 \cdot 110}{90986667} = 6,045 \text{ MPa}$$

$$\text{Tegangan Tekan max} = \sigma_c = \frac{M \cdot c}{I} = \frac{-10 \cdot 10^6 \cdot 110}{90986667} = -12,09 \text{ MPa}$$

Tugas Pertemuan II



$$\sum V = 0$$

$$= V_A + V_B - P_1 - P_2 = 0$$

$$V_B = P_1 + P_2 - V_A$$

$$= 10 + 10 - 2,5$$

$$= 17,5 \text{ KN}$$

- Batang AC: $0 \leq x_1 \leq 2 \Rightarrow M_x = V_A \cdot x_1$
 $= 2,5 x_1$

$$x_1 = 0 \Rightarrow M_x = 0$$

$$x_1 = 2 \Rightarrow M_x = 5 \text{ KNm}$$

- Batang CB: $2 \leq x_2 \leq 4 \Rightarrow M_x = V_A \cdot x_2 - P_1(x_2 - 2)$

$$= 2,5 x_2 - 10 x_2 + 20$$

$$x_2 = 2 \Rightarrow M_x = 5$$

$$x_2 = 4 \Rightarrow M_x = -10$$

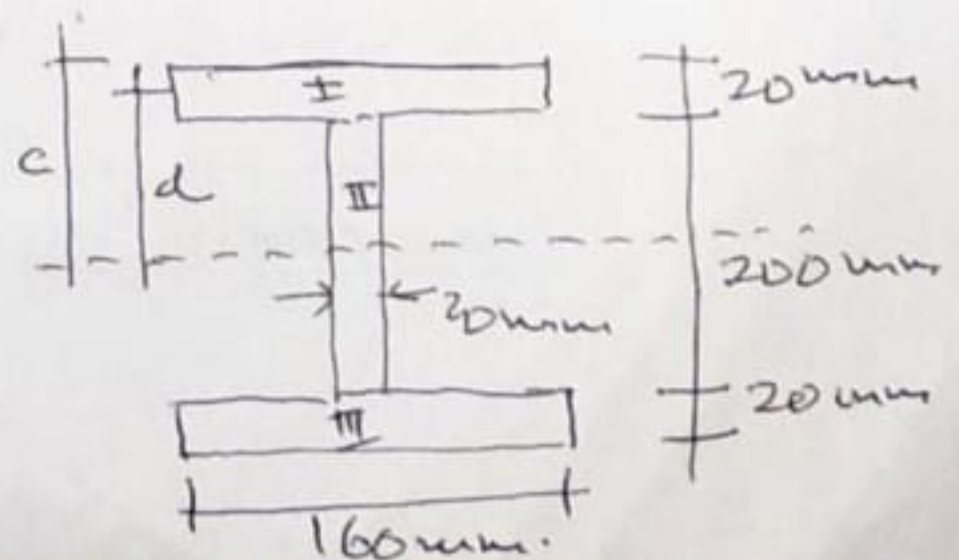
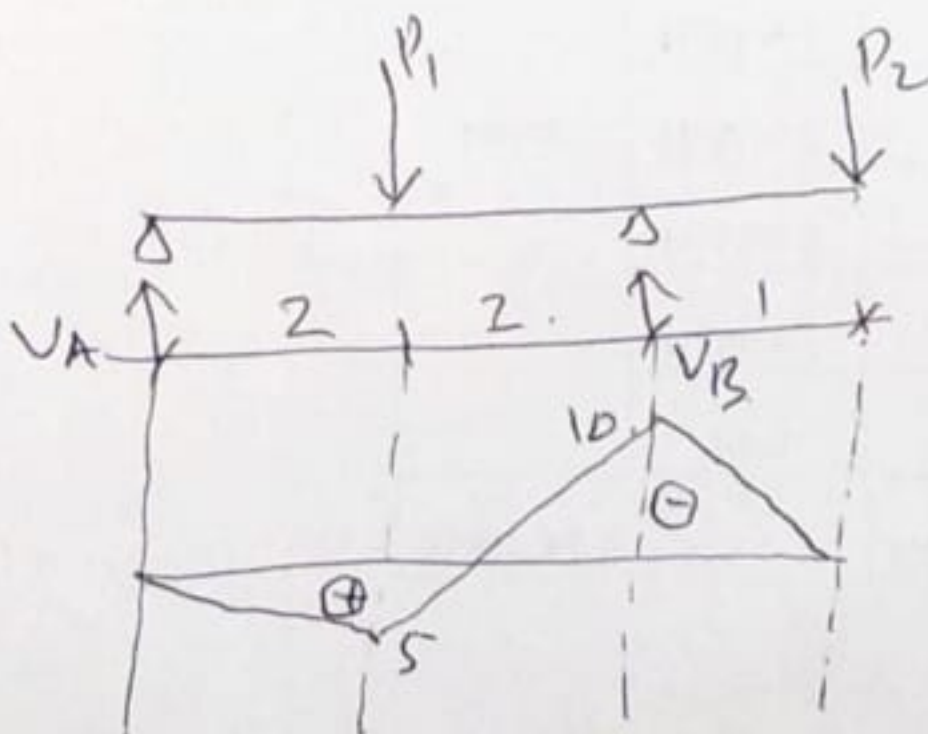
- Batang BD: $4 \leq x_3 \leq 5 \text{ atau } 0 \leq x_1 \leq 1$

$$\Rightarrow M_x = V_A \cdot x_3 - P_1(x_3 - 2) + V_B(x_3 - 4)$$

$$= 2,5 \cdot x_3 - 10(x_3 - 2) + 17,5(x_3 - 4)$$

$$x_3 = 4 \Rightarrow M_x = -10$$

$$x_3 = 5 \Rightarrow M_x = 0$$



$$d = 120 - 10 = 110 \text{ mm.}$$

$$C = 120 \text{ mm.}$$

$$A_1 = 20 \cdot 160 = 3200$$

$$I_1 = \frac{1}{12} \cdot 160 \cdot 20^3 + 3200 \cdot 110^2 = 38826667 \text{ mm}^4.$$

$$A_2 = 20 \cdot 200 = 4000 \text{ mm}$$

$$I_2 = \frac{1}{12} \cdot 20 \cdot 200^3 = 13333333 \text{ mm}^4.$$

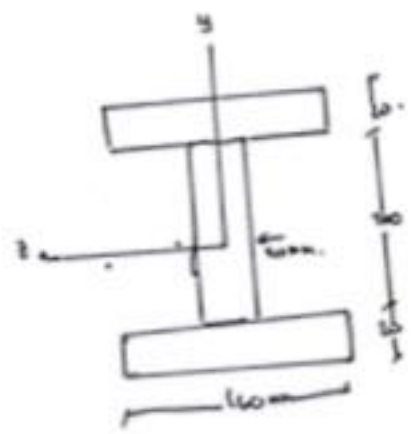
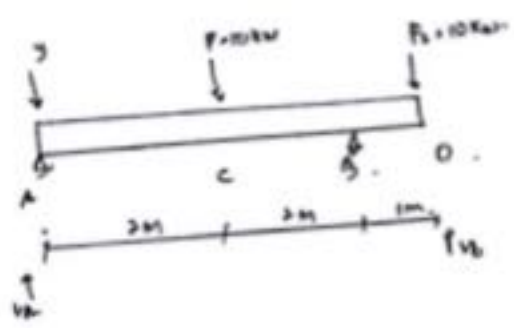
$$\begin{aligned} I_{\text{TOTAL}} &= 2 \cdot I_1 + I_2 \\ &= 2 \cdot 38826667 + 13333333 \\ &= 90986667. \end{aligned}$$

Jadi: Tegangan Tarik Maksimum:

$$\sigma_{\text{max}} = \frac{M \cdot c}{I} = \frac{5 \cdot 10^6 \cdot 110}{90986667} = 6,045 \text{ MPa} = 6,045 \text{ N/mm}^2$$

$$\sigma_{\text{max}} = \frac{M \cdot c}{I} = \frac{-10 \cdot 10^6 \cdot 110}{90986667} = 12,09 \text{ MPa} = 12,09 \text{ N/mm}^2$$

11



Reaksi Relestatikan.

$\sum M_A = 0$
 $P_1 (2) + P_2 (6) - V_D (4) = 0$
 $10 (2) + 10 (6) - 4 V_D = 0$
 $V_D = \frac{35}{1} \text{ kN}$

$\sum M_D = 0$
 $V_A (4) - P_1 (2) + P_2 (2) = 0$
 $4 V_A - 20 + 20 = 0$
 $V_A = \frac{0}{4} \text{ kN}$

Kontrol: $\sum V = 0$
 $V_A + V_D - P_1 - P_2 = 0$
 $\frac{0}{4} + 35 - 10 - 10 = 0$
 $15 = 15$
 $0 = 0$ ok!

$\sum H = 0$
 $H_A = 0$

1. Pendekatan dengan Momen (Mx):

- Momen $0 \leq x \leq 2 \text{ m}$ (dikawat $0 \leq x \leq 2$)
 $M_{x1} = V_A \cdot x$
 $M_{x1} = \frac{0}{4} \cdot x$

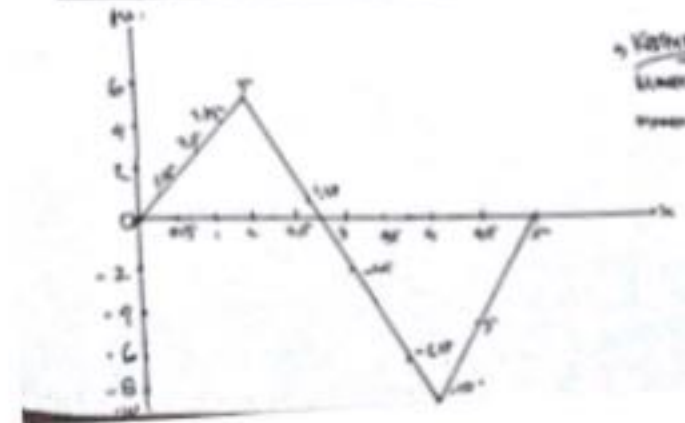
x	0	0.5	1	1.5	2
M_{x1}	0	0.125	0.25	0.375	0.5

- Momen $2 \text{ m} \leq x \leq 4 \text{ m}$ (dikawat $2 \leq x \leq 4$)
 $M_{x2} = V_A \cdot x - P_1 (x - 2)$
 $= \frac{0}{4} x - 10 (x - 2)$
 $= -\frac{10}{4} x + 20$

x	2	2.5	3	3.5	4
M_{x2}	0	-1.25	-2.5	-3.75	-5

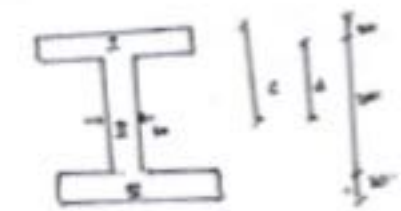
- Momen $4 \text{ m} \leq x \leq 6 \text{ m}$ (dikawat $4 \leq x \leq 6$)
 $M_{x3} = V_A (x) - P_1 (x - 2) + P_2 (x - 4)$
 $= \frac{0}{4} (x) - 10 (x - 2) + \frac{35}{4} (x - 4)$
 $= 10 V_D - 10$

x	4	4.5	5
M_{x3}	0	-1.25	-2.5



• Keterangan:
 Kiri = 10 kN → 10 kN
 Kanan = 10 kN → 10 kN

2. Pendekatan dengan Momen (Mx):



$C = \frac{b \cdot h + h \cdot b}{2} = 160 \text{ mm}$

$d = C - \frac{t}{2} = 160 - \frac{10}{2} = 155 \text{ mm}$

$A_1 = b \cdot t = 160 (10) = 1600 \text{ mm}^2$

$A_2 = h \cdot t = 160 (10) = 1600 \text{ mm}^2$

$A_3 = b \cdot t = 160 (10) = 1600 \text{ mm}^2$

$I_{x1} = I_{x2} = A_1 d^2$

$= \frac{1}{12} b t^3 + A_1 d^2$

$= \frac{1}{12} 160 (10)^3 + 1600 (155)^2$

$= 38000000 \text{ mm}^4$

$I_{x2} = \frac{1}{12} (160) (160)^3 = 10666666.67 \text{ mm}^4$

$I_{x3} = I_{x1} = 38000000 \text{ mm}^4$

$I_x = I_{x1} + I_{x2} + I_{x3} = 86666666.67 \text{ mm}^4$

Tegangan Tarik Max $= \sigma_t = \frac{M \cdot c}{I} = \frac{0.10^3 \cdot 10}{86666666.67} = 6.045 \text{ MPa}$

Tegangan Tekan Max $= \sigma_c = \frac{M \cdot c}{I} = \frac{-0.10^3 \cdot 10}{86666666.67} = -6.045 \text{ MPa}$

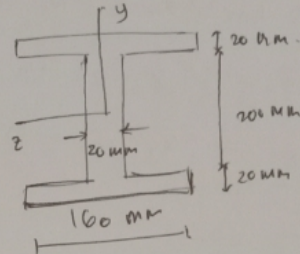
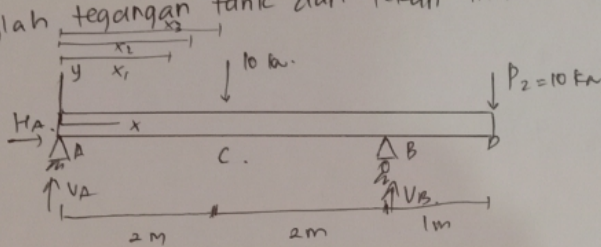
Tugas II

Nama : Muhammad Reza Niscathy

NIM : 102 710037

Soal

Sebuah balok dengan beban P_1 dan P_2 seperti tergambar. penampang balok adalah profil IWF dengan $b = 160 \text{ mm}$ dan $h = 240 \text{ mm}$ (berat sendiri diabaikan). Hitunglah tegangan tarik dan tekan maksimum akibat beban tersebut.



Jawab :

Syarat : Reaksi perletakan :

$$\sum M = 0$$

$$\sum V = 0$$

$$\sum H = 0$$

Reaksi perletakan

$$\sum M_A = 0$$

$$P_1 \cdot 2 + P_2 \cdot 4 - V_B \cdot 4 = 0$$

$$10 \cdot 2 + 10 \cdot 4 - V_B \cdot 4 = 0$$

$$V_B = \frac{35}{2} \text{ kN}$$

$$\sum M_B = 0$$

$$V_A \cdot 4 - P_1 \cdot 2 + P_2 \cdot 1 = 0$$

$$V_A \cdot 4 - 10 \cdot 2 + 10 \cdot 1 = 0$$

$$V_A = \frac{5}{2} \text{ kN}$$

Kontrol : $\sum V = 0$

$$V_A + V_B - P_1 - P_2 = 0$$

$$\frac{5}{2} \text{ kN} + \frac{35}{2} \text{ kN} - 10 \text{ kN} - 10 \text{ kN} = 0$$

$$0 = 0 \rightarrow \text{OK!}$$

$$\sum H = 0$$

$$H_A = 0$$

Perhitungan Bidang momen (M_x)

Batang AC : $0 \leq x_1 \leq 2 \text{ m}$ diukur dari titik A

$$M_{x_1} = V_A x_1$$

$$M_{x_1} = \frac{5}{2} \cdot x_1$$

$x_1 \text{ (m)}$	0	0,5	1	1,5	2
$M_{x_1} \text{ (kN-m)}$	0	1,25	2,5	3,75	5

Batang CB : $2 \text{ m} \leq x_2 \leq 4 \text{ m}$ diukur dari titik A

$$M_{x_2} = V_A \cdot x_2 - P_1 (x_2 - 2)$$

$$M_{x_2} = \frac{5}{2} x_2 - 10 (x_2 - 2)$$

$$M_{x_2} = -\frac{15}{2} x_2 + 20$$

x_2 (m)	2	2,5	3	3,5	4
M_{x_2} (kN.m)	5	1,25	-2,5	-6,25	-10

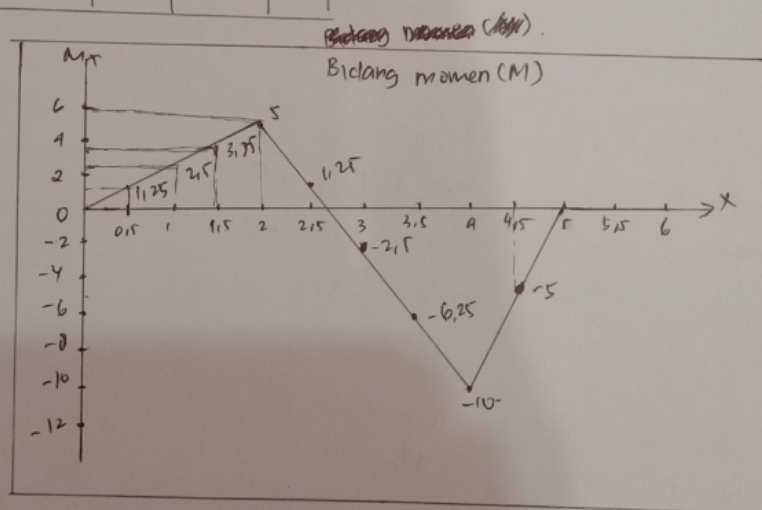
Batang BD : $4\text{ m} \leq x_3 \leq 5\text{ m}$ diukur dari titik A

$$M_{x_3} = V_A \cdot x_3 - P_1 (x_3 - 2) + V_B (x_3 - 4)$$

$$M_{x_3} = \frac{5}{2} x_3 - 10 (x_3 - 2) + \frac{35}{2} (x_3 - 4)$$

$$M_{x_3} = 10 x_3 - 50$$

x_3 (m)	4	4,5	5
M_{x_3} (kN.m)	-10	-5	0



Berdasarkan perhitungan diatas dapat disimpulkan bahwa momen positif maksimum dan negatif maksimum masing-masing adalah 5 kN.m dan 10 kN.m.

Perhitungan Momen Inersia

$$C = \frac{20 + 200 + 20}{2} = 120 \text{ mm}$$

$$d = C - \frac{t}{2} = 120 - \frac{20}{2} = 110 \text{ mm}$$

$$A_1 = b \cdot t = 160 \cdot 20 = 3200 \text{ mm}^2$$

$$A_2 = h \cdot t = 200 \cdot 20 = 4000 \text{ mm}^2$$

$$A_3 = b \cdot t = 160 \cdot 20 = 3200 \text{ mm}^2$$

$$I_{z1} = I_{2c} + A_1 \cdot d^2$$

$$I_{z1} = \frac{1}{12} \cdot b t^3 + A_1 \cdot d^2$$

$$I_{z1} = \frac{1}{12} \cdot 160 \cdot 20^3 + 3200 \cdot 110^2 = 38026667 \text{ mm}^4$$

$$I_{z2} = \frac{1}{12} t h^3$$

$$I_{z2} = \frac{1}{12} \cdot 20 \cdot 200^3 = 13333333 \text{ mm}^4$$

$$I_{z3} = I_{z1} = 38026667 \text{ mm}^4$$

$$I_z = I_{z1} + I_{z2} + I_{z3} = 90906667 \text{ mm}^4$$

Tegangan tarik dan tekan maksimum

Tegangan tarik maximum : $\sigma_t = \frac{M \cdot c}{I}$

$$\sigma_t = \frac{5 \times 10^6 \cdot 110}{90906667} = \underline{\underline{6,045 \text{ MPa}}}$$

Tegangan Tekan maximum = $\sigma_c = \frac{M \cdot c}{I}$

$$\sigma_c = \frac{-10 \cdot 10^6 \cdot 110}{90906667} = \underline{\underline{-12,09 \text{ MPa}}}$$

Perhitungan Bidang Momen (M_x):

- Batang AC: $0 \leq x \leq 2 \text{ m}$. (diukur titik A).

$$M_{x1} = V_A \cdot x_1$$

$$M_{x1} = 5/2 \cdot x_1$$

x_1	0	0.5	1	1.5	2
M_{x1}	0	1.25	2.5	3.75	5

- Batang CD: $2 \text{ m} \leq x_2 \leq 4 \text{ m}$ (diukur titik A)

$$M_{x2} = V_A \cdot x_2 - P_1 (x_2 - 2)$$

$$= 5/2 x_2 - 10 (x_2 - 2)$$

$$= -15/2 x_2 + 20$$

x_2	2	2.5	3	3.5	4
M_{x2}	5	1.25	-2.5	-6.25	-10

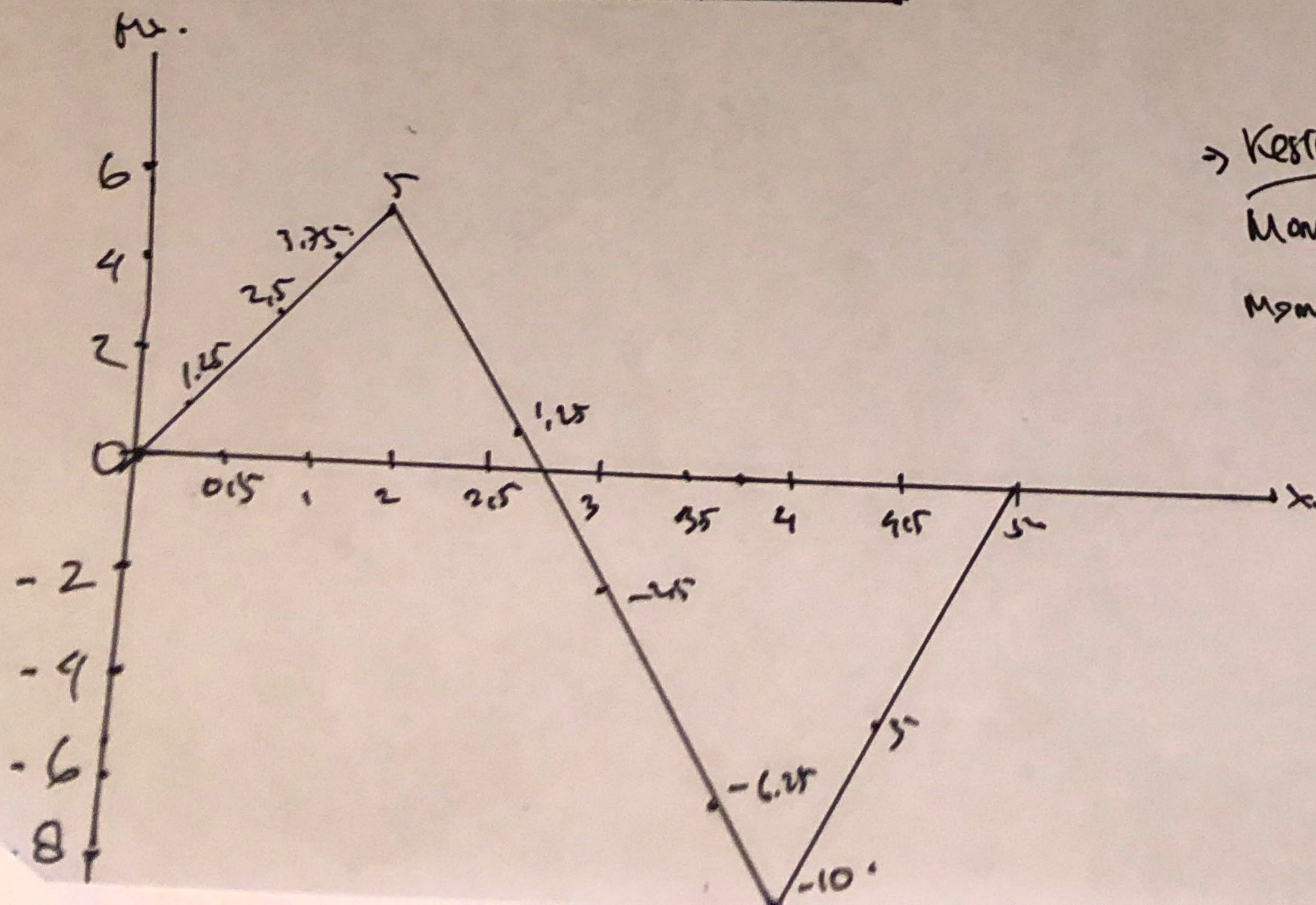
- Batang BD: $4 \text{ m} \leq x_3 \leq 5 \text{ m}$ (diukur titik A)

$$M_{x3} = V_A (x_3) - P_1 (x_3 - 2) + V_B (x_3 - 4)$$

$$= 5/2 (x_3) - 10 (x_3 - 2) + \frac{35}{2} (x_3 - 4)$$

$$= 10x_3 - 50$$

x_3	4	4.5	5
M_{x3}	-10	-5	0

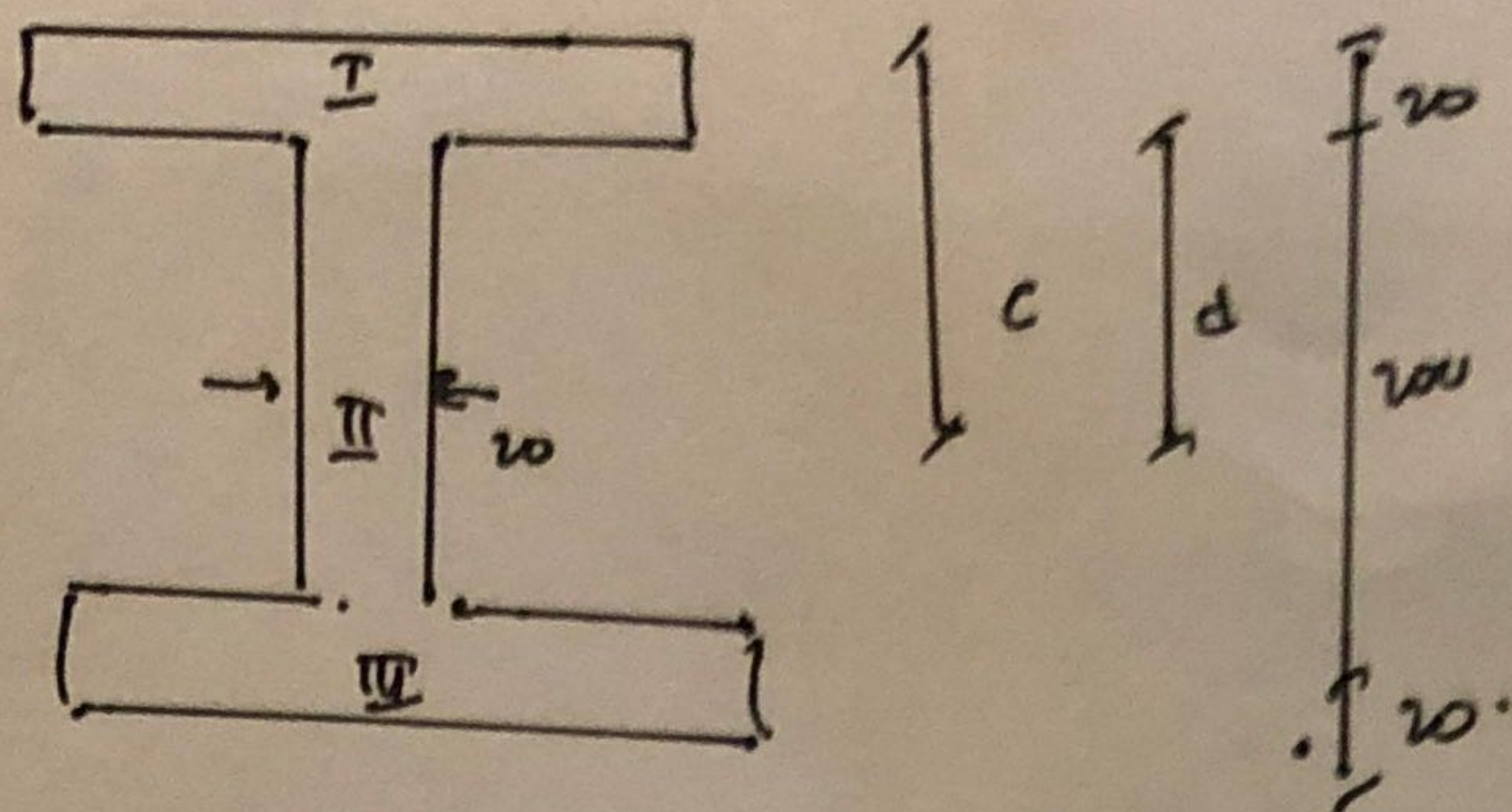


→ Kesimpulan:

Momen + Max → 5 kNm.

Momen - Max → -10 kNm.

Perhitungan Momen Inersia:



$$c = \frac{20 + 200 + 20}{2} = 120 \text{ mm.}$$

$$d = c - \frac{t}{2} = 120 - \frac{20}{2} = 110 \text{ mm.}$$

$$A_1 = b \cdot t = 160 (20) = 3200 \text{ mm}^2$$

$$A_2 = h \cdot t = 200 (20) = 4000 \text{ mm}^2$$

$$A_3 = b \cdot t = 160 (20) = 3200 \text{ mm}^2$$

$$I_{z1} = I_{zc} + A_1 d^2$$

$$= \frac{1}{12} b t^3 + A_1 d^2$$

$$= \frac{1}{12} 160 (20)^3 + 3200 (110)^2$$

$$= \underline{38026667 \text{ mm}^4}$$

$$I_{z2} = \frac{1}{12} (20) (200)^3 = 133777777 \text{ mm}^4$$

$$I_{z3} = I_{z1} = 38026667 \text{ mm}^4$$

$$I_z = I_{z1} + I_{z2} + I_{z3} = \underline{90906667 \text{ mm}^4}$$

$$\text{Tegangan Tarik Max} = \sigma_t = \frac{M \cdot c}{I} = \frac{5 \cdot 10^6 \cdot 110}{90906667} = \underline{6.045 \text{ mpa.}}$$

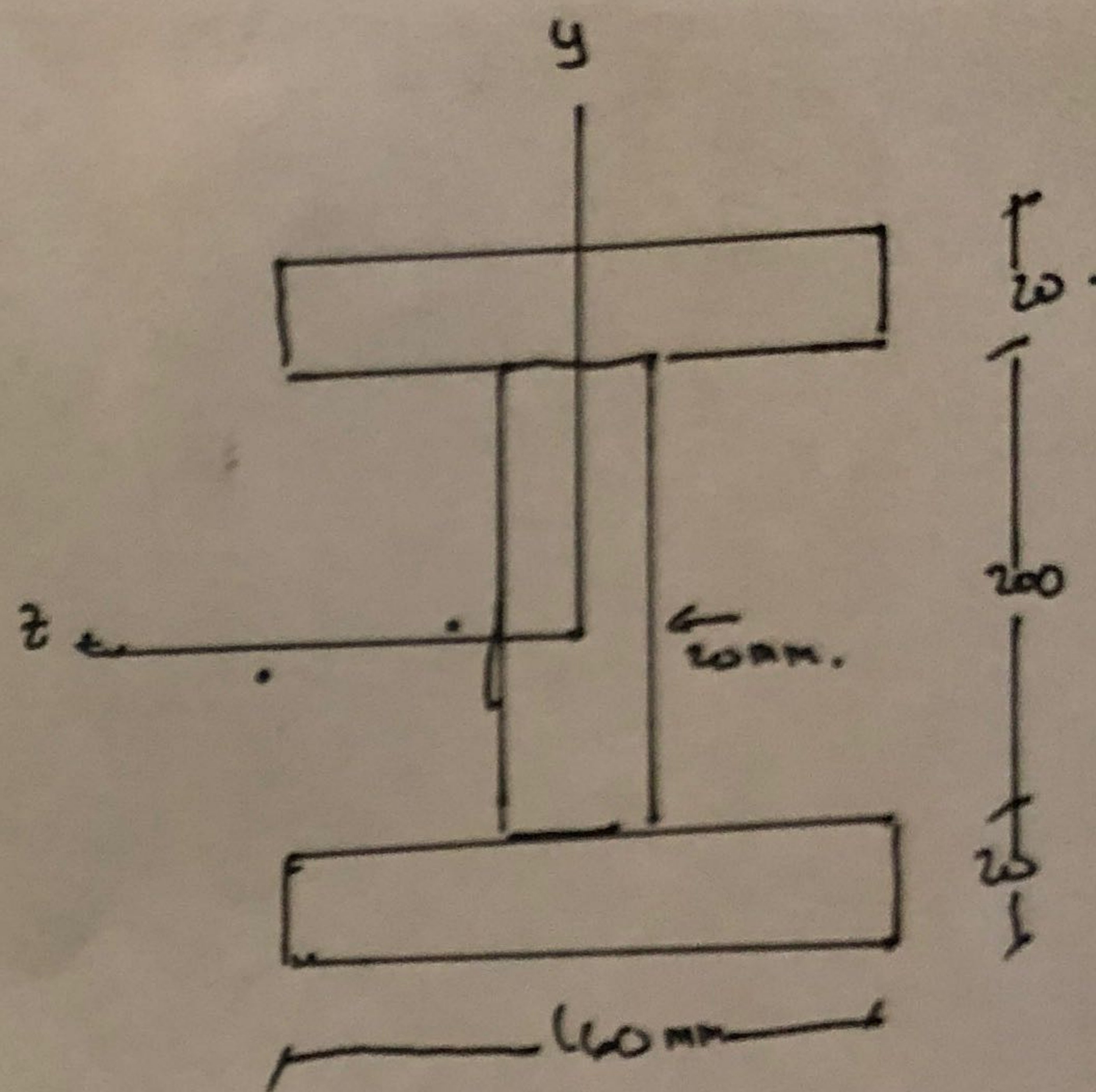
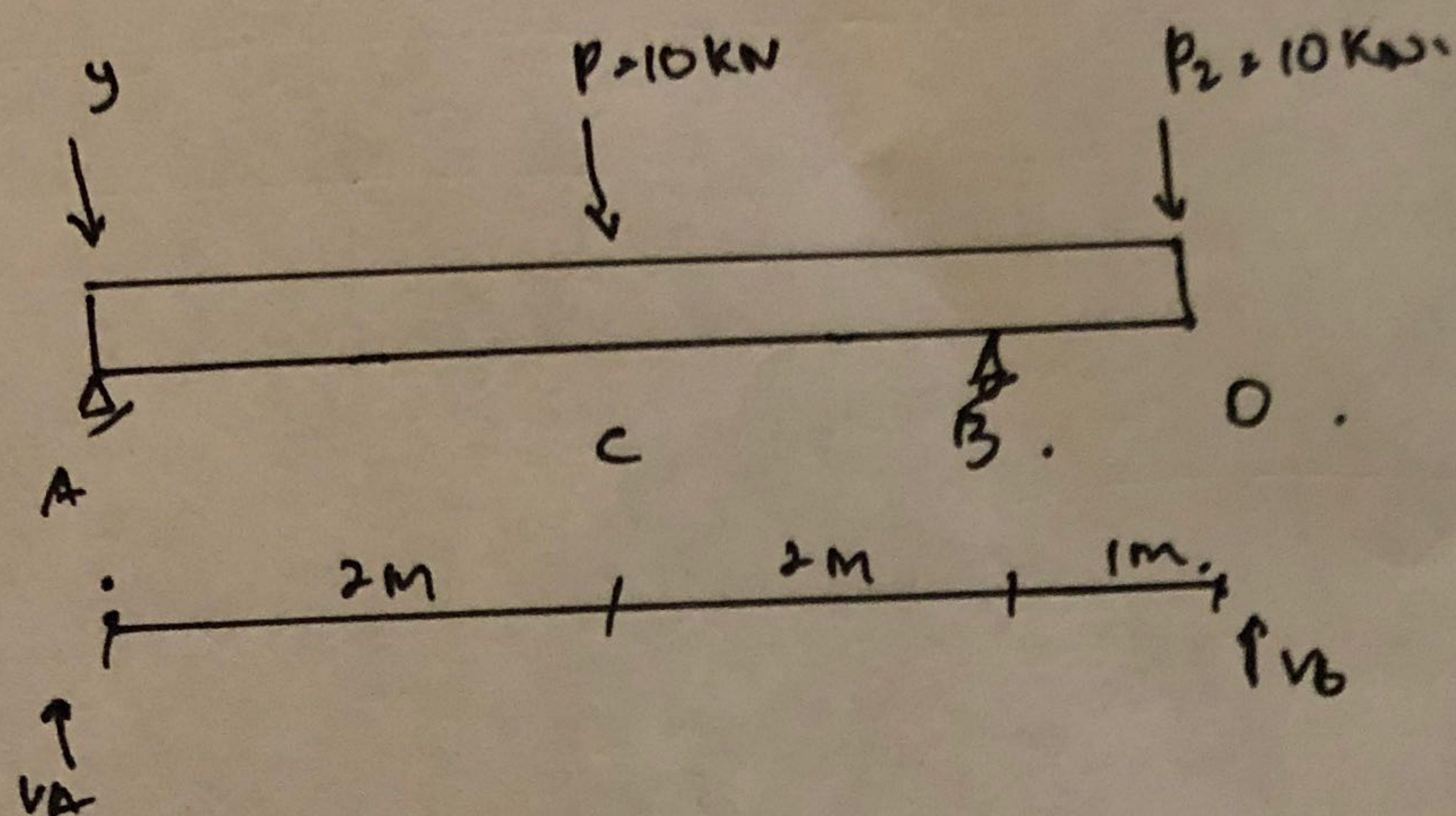
$$\text{Tegangan Tekan max} = \sigma_c = \frac{M \cdot c}{I} = \frac{-10 \cdot 10^6 \cdot 110}{90906667} = \underline{-12.09 \text{ mpa.}}$$

NAMA: RICO ANDRO BELLI

NIM : 182110043.

M. KUL : MATEMATIKA TERAPAN.

Soal. 11



Reaksi Perletakan.

$$\sum M_A = 0$$

$$P_1(2) + P_2(5) - V_B(4) = 0$$

$$10(2) + 10(5) - 4 V_B = 0$$

$$V_B = \frac{35}{2} \text{ kN.}$$

$$\sum M_B = 0$$

$$V_A(4) - P_1(2) + P_2(1) = 0$$

$$4V_A - 2(10) + 10(1) = 0$$

$$V_A = \frac{5}{2} \text{ kN}$$

Kontrol: $\sum V = 0$

$$V_A + V_B - P_1 - P_2 = 0$$

$$\frac{5}{2} \text{ kN} + \frac{35}{2} \text{ kN} - 10 - 10 = 0.$$

$$20 - 20 = 0$$

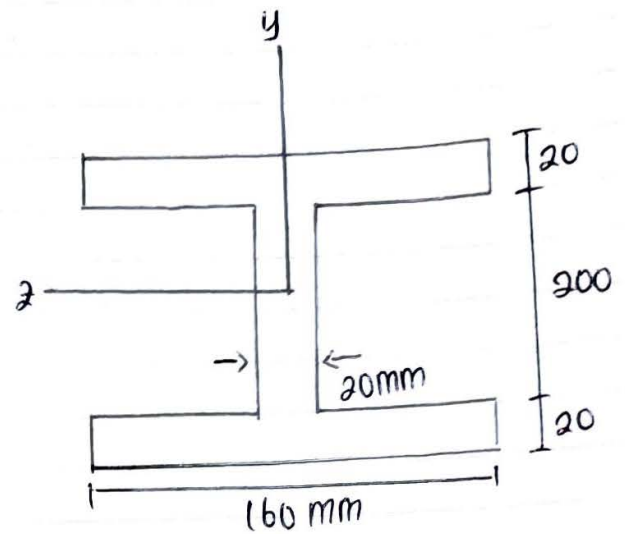
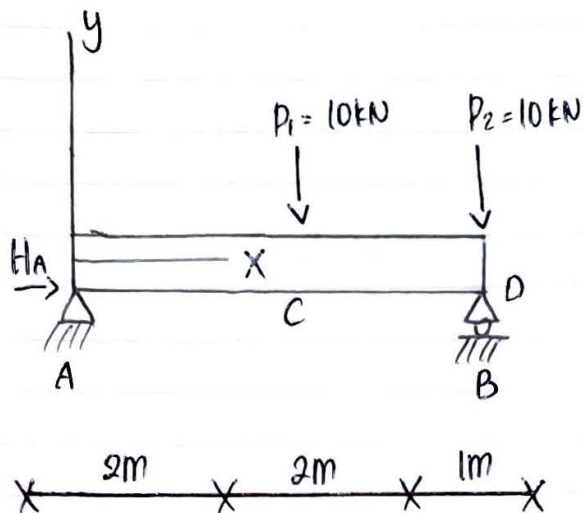
$0 = 0, \dots \text{ok!}$

$$\sum H = 0$$

$$H_A = 0.$$

Nama : Shafta Adynato
NIM : 182710038

Solusi II



Reaksi Penetakan:

$$\sum M_A = 0$$

$$P_1(2) + P_2(5) - V_B(4) = 0$$

$$10(2) + 10(5) - 4V_B = 0$$

$$V_B = \frac{35}{2} \text{ kN}$$

$$\sum M_B = 0$$

$$V_A(4) - P_1(2) - P_2(1) = 0$$

$$4V_A - 10(2) - 10(1) = 0$$

$$V_A = \frac{5}{2} \text{ kN}$$

Kontrol $\sum V = 0$

$$(\Rightarrow) V_A + V_B - P_1 - P_2 = 0$$

$$(\Rightarrow) \frac{5}{2} \text{ kN} + \frac{35}{2} \text{ kN} - 10 - 10 = 0$$

$$(\Rightarrow) 20 - 20 = 0$$

$$0 = 0 \text{ (OK)!}$$

$$\sum H = 0$$

$$H_A = 0$$

Perhitungan Bidang Momen (M_x):

Batang AC = $0 \leq x \leq 2\text{m}$ diukur dari titik A

$$M_{x1} = V_A \cdot x_1$$

$$M_{x1} = \frac{5}{2} x_1$$

$x_1(\text{m})$	0	0,5	1	1,5	2
$M_{x1} (\text{kN} \cdot \text{m})$	0	1,25	2,5	3,75	5

Batang CB = $2\text{m} \leq x_2 \leq 4\text{m}$ diukur dari titik A

$$M_{x2} = V_A \cdot x_2 - P_1 (x_2 - 2)$$

$$= \frac{5}{2} x_2 - 10 (x_2 - 2)$$

$$= -\frac{15}{2} x_2 + 20$$

$x_2(\text{m})$	2	2,5	3	3,5	4
$M_{x2} (\text{kN} \cdot \text{m})$	5	1,25	-2,5	-6,25	-10

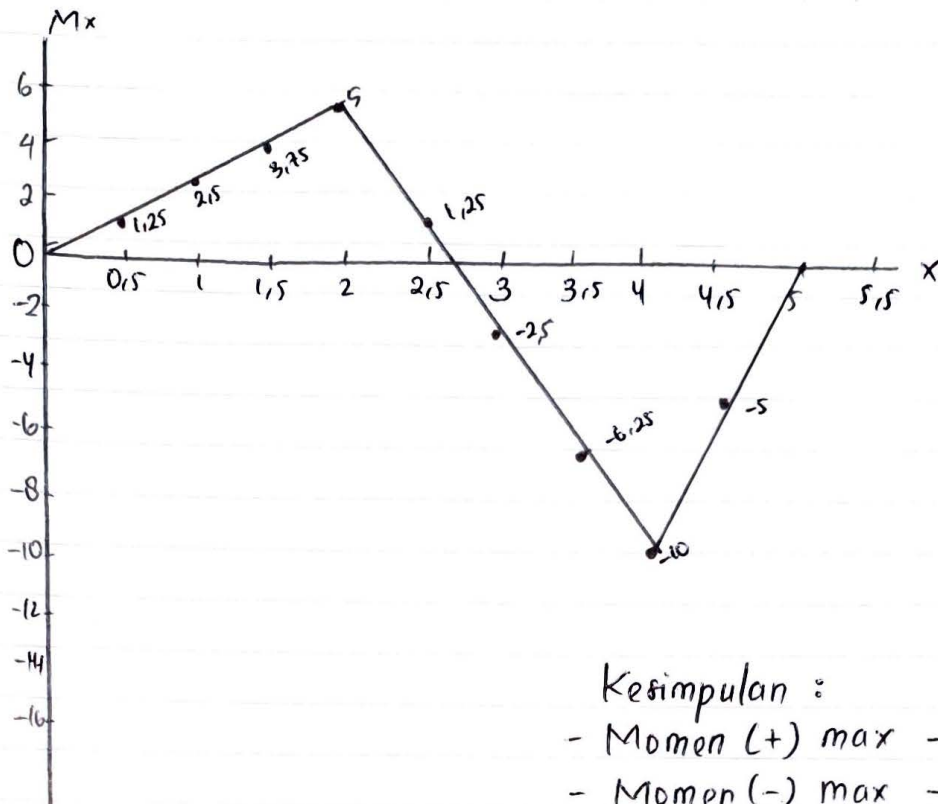
Batang BD = $4\text{m} \leq x_3 \leq 5\text{m}$ diukur dari titik A

$$M_{x3} = V_A (x_3) - P_1 (x_3 - 2) + V_B (x_3 - 4)$$

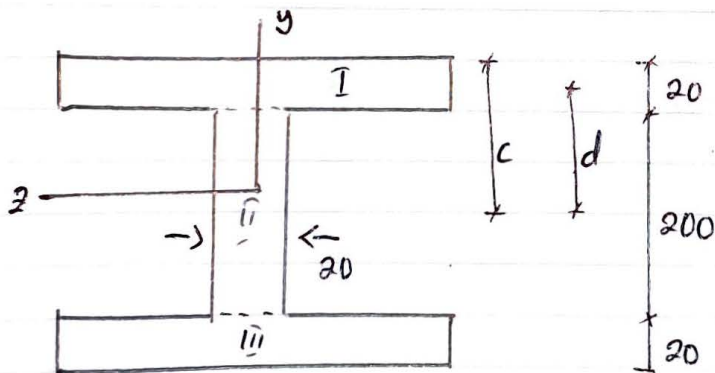
$$= \frac{5}{2} (x_3) - 10 (x_3 - 2) + \frac{35}{2} (x_3 - 4)$$

$$= 10 x_3 - 50$$

$x_3(\text{m})$	4	4,5	5
$M_{x3} (\text{kN} \cdot \text{m})$	-10	-5	0



Perhitungan Momen Inertia



$$c = \frac{20 + 200 + 20}{2} = 120 \text{ mm}$$

$$d = c - \frac{t}{2} = 120 - \frac{20}{2} = 110 \text{ mm}$$

$$A_1 = b \cdot t = 160 (20) = 3.200 \text{ mm}^2$$

$$A_2 = h \cdot t = 200 (20) = 4.000 \text{ mm}^2$$

$$A_3 = b \cdot t = 160 (20) = 3.200 \text{ mm}^2$$

$$\begin{aligned}
 I_{21} &= I_{2c} + A_1 d^2 \\
 &= \frac{1}{12} b t^3 + A_1 d^2 \\
 &= \frac{1}{12} 160 (20)^3 + 3 \cdot 200 (110)^2 \\
 &= 38.826.667 \text{ mm}^4
 \end{aligned}$$

$$\begin{aligned}
 I_{22} &= \frac{1}{12} (20) (200)^3 \\
 &= 13.333.333 \text{ mm}^4
 \end{aligned}$$

$$I_{23} = I_{21} = 38.826.667 \text{ mm}^4$$

$$\begin{aligned}
 I_2 &= I_{21} + I_{22} + I_{23} \\
 &= 38.826.667 + 13.333.333 + 38.826.667 \\
 &= 90.986.667 \text{ mm}^4
 \end{aligned}$$

$$\text{Tegang tarik max: } \sigma_t = \frac{M \cdot c}{I} = \frac{5 \cdot 10^6 \cdot 110}{90.986.667} = 6,045 \text{ MPa}$$

$$\text{Regangan tekan max: } \sigma_c = \frac{M \cdot c}{I} = \frac{-10 \cdot 10^6 \cdot 110}{90.986.667} = -12,09 \text{ MPa}$$

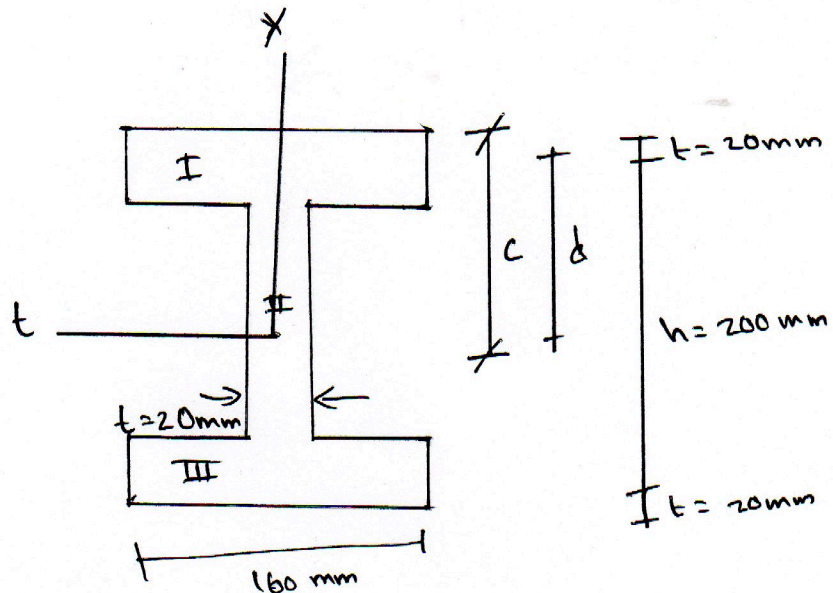
Nama : Wahid Sapta

Mata Kuliah : Mekanika Terapan

NIM : 182710033

Dosen : Dr. Firdaus, MT

Tugas no. 11



$$C = \frac{20 + 200 + 20}{2} = 120 \text{ mm}$$

$$d = c - \frac{t}{2} = 120 - 10 = 110 \text{ mm}$$

$$A_1 = 160 \cdot 20 = 3200 \text{ mm}^2$$

$$A_2 = 100 \cdot 20 = 4000 \text{ mm}^2$$

$$A_3 = 160 \cdot 20 = 3200 \text{ mm}^2$$

$$\begin{aligned} I_{z_1} &= I_{z_c} + A_1 \cdot d^2 = \frac{1}{12} \cdot 160 \cdot 20^3 + 3200 \cdot 110^2 \\ &= 106.666,6 + 38.720.000 \\ &= 38.826.666,67 \text{ mm}^4 \end{aligned}$$

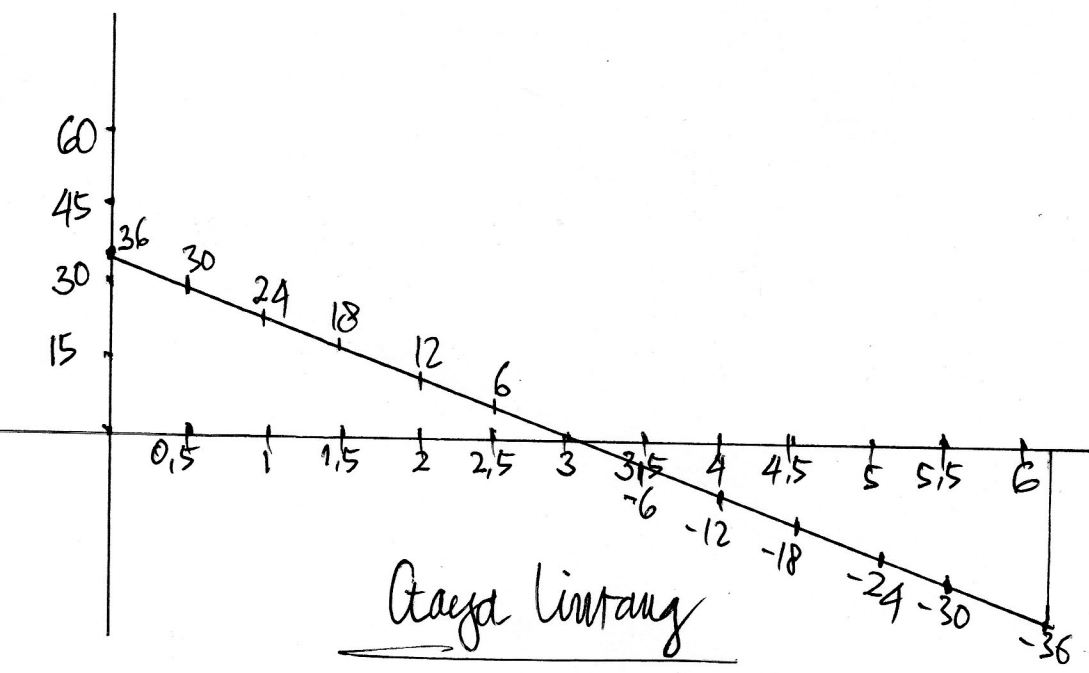
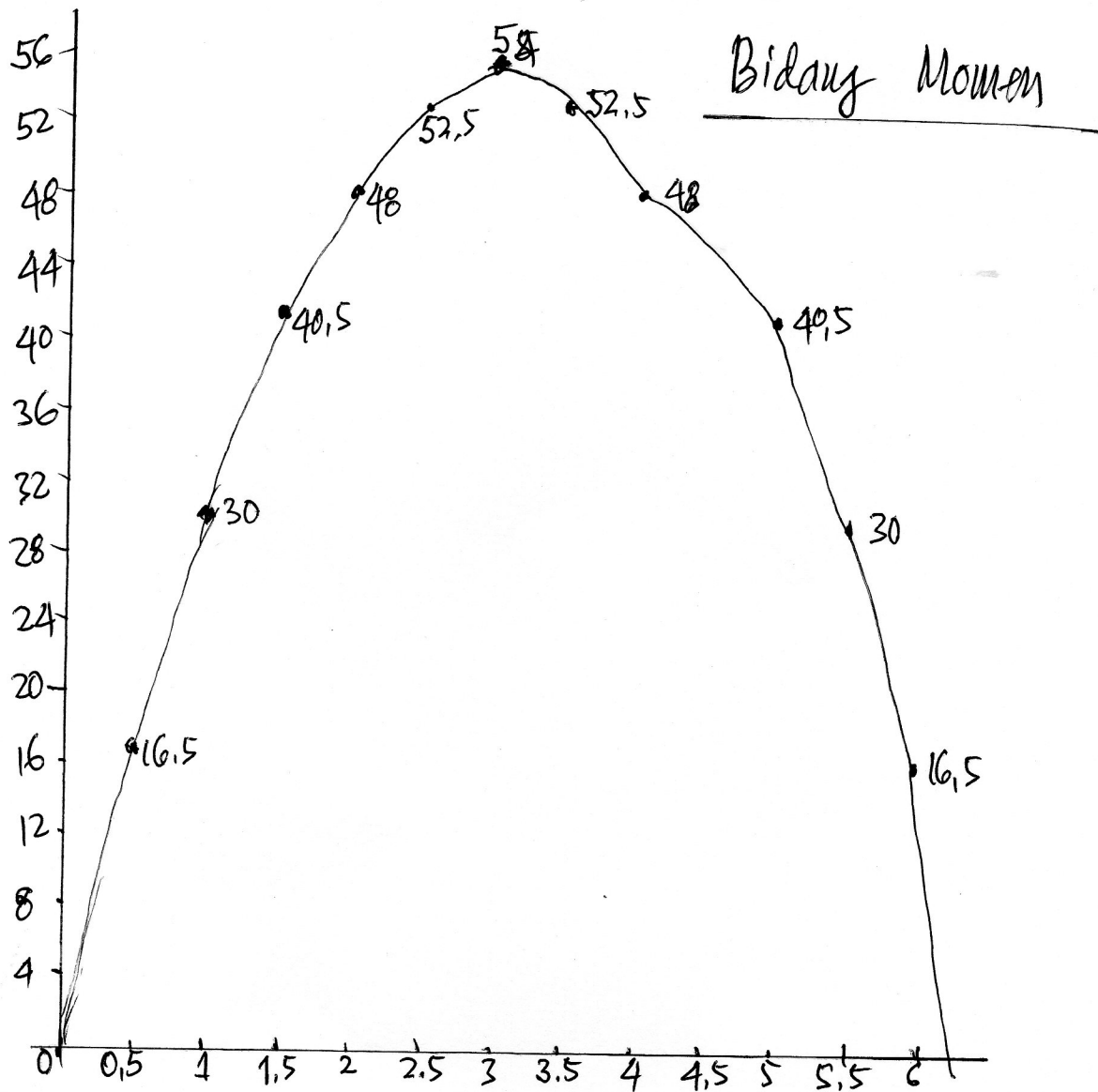
$$I_{z_2} = \frac{1}{12} \cdot 20 \cdot 200^3 = 13.333.333,33 \text{ mm}^4$$

$$I_{z_3} = \frac{1}{12} \cdot 160 \cdot 20^3 + 320 \cdot 110^2 = 38.826.666,67 \text{ mm}^4$$

$$I_z = I_{z_1} + I_{z_2} + I_{z_3} = 90.986.666,67 \text{ mm}^4$$

$$\begin{aligned} \text{Tegang Tarik Maksimum: } \sigma_t &= \frac{M \cdot c}{I} = \frac{5 \cdot 10^6 \cdot 120}{90.986.666,67} \\ \sigma_t &= 6,594 \text{ Mpa} \end{aligned}$$

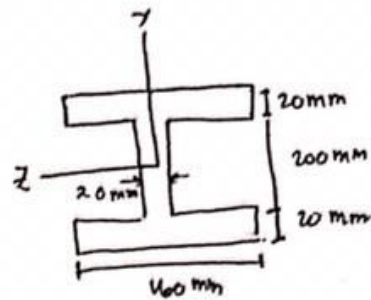
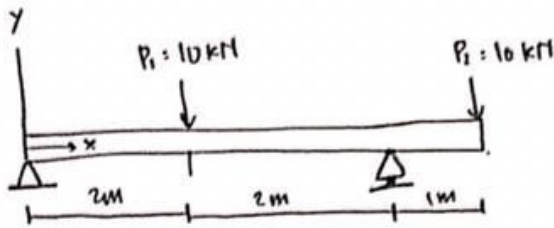
$$\begin{aligned} \text{Tegang Tarik minimum: } \sigma_t &= \frac{-M \cdot c}{I} = \frac{-10 \cdot 10^6 \cdot 120}{90.986.666,67} \\ \sigma_t &= -13,188 \text{ Mpa} \end{aligned}$$



Zul Aslam / 182710039

Tugas 11.

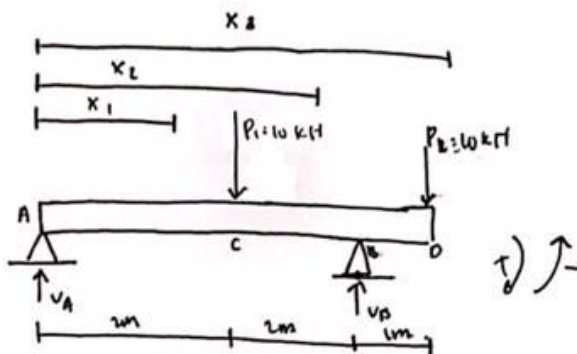
Diket: Gambar
Balok Iwf



Tanya: a. Hit. Tegangan Tarik
b. Hit Tekanan Max.

Jawab:

1. Reaksi Perletakan



$$\sum M_a = 0$$

$$P_1 \cdot 2 + P_2 \cdot 5 - V_B \cdot 4 = 0$$

$$10 \cdot 2 + 10 \cdot 5 - 4V_B = 0$$

$$V_B = \frac{35}{2} \text{ kN} = 17,5 \text{ kN}$$

$$\sum M_b = 0$$

$$V_a \cdot 4 - P_1 \cdot 2 + P_2 \cdot 1 = 0$$

$$4V_a - 10 \cdot 2 + 10 \cdot 1 = 0$$

$$V_a = \frac{30}{4} = \frac{5}{2} \text{ kN}$$

$$\sum V = 0$$

$$V_a + V_B - P_1 - P_2 = 0$$

$$\frac{5}{2} + \frac{35}{2} - 10 - 10 = 0$$

$$20 - 20 = 0$$

$$\sum H_a = 0$$

Hitung (M_x)

⇒ Batang A-C

$$0 \leq x_1 \leq 2 \text{ dan hkf A}$$

$$m_{x_1} = V_a \cdot x_1$$

$$= \frac{5}{2} \cdot x_1$$

Tabel

x_1	0	0,5	1,0	1,5	2,0
m_{x_1}	0	1,25	2,5	3,75	5

⇒ Batang e-B . $2 \leq x_2 \leq 4$ dan hkf A

$$m_{x_2} = V_a \cdot x_2 - P(x_2 - 2)$$

$$= \frac{5}{2} \cdot x_2 - 10(x_2 - 2)$$

$$= \frac{15}{2} x_2 + 20$$

Tabel

x_2	2	2,5	3	3,5	4
m_{x_2}	5	1,25	-2,5	-6,25	-10

⇒ Batang B-D

$4 \leq x_3 \leq 5$ dan hkf A

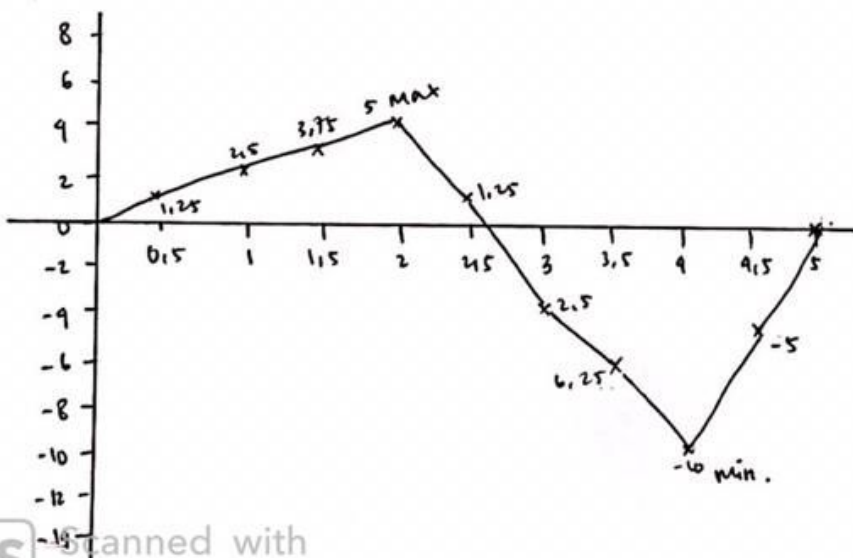
$$m_{x_3} = V_a \cdot x_3 - P_1(x_3 - 2) + V_b(x_3 - 4)$$

$$= \frac{5}{2} x_3 - 10(x_3 - 2) + \frac{35}{2}(x_3 - 4)$$

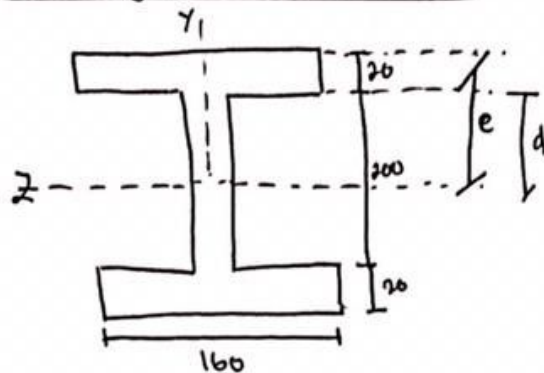
$$= 10x_3 - 50.$$

Tabel

x_3	4	4,5	5
m_{x_3}	-10	-5	0



Perhitungan Inersia IWF



$$e = \frac{20 + 200 + 20}{2} = 120 \text{ mm}$$

$$d = e - \frac{t}{2} = 120 - \frac{20}{2} = 110 \text{ mm}$$

- Was I : $A_1 = 160 \cdot 20 = 3200 \text{ mm}^2$

- Was $\hat{ij}$: $A_2 = 200 \cdot 20 = 4000 \text{ mm}^2$

- Was $\hat{ij}$: $A_3 = 160 \cdot 20 = 3200 \text{ mm}^2$

$$\begin{aligned} \text{Inertia } I_{z1} &= I_{z2} + A_1 \cdot d^2 \\ &= \frac{1}{12} b t^3 + A_1 \cdot d^2 \\ &= \frac{1}{12} \cdot 160 \cdot 20^3 + 3200 \\ &= 38.826.667 \text{ mm}^4 \end{aligned}$$

$$\begin{aligned} \text{Inertia } I_{z2} &= \frac{1}{12} \cdot t \cdot h^3 \\ &= \frac{1}{12} \cdot 20 \cdot 200^3 \\ &= 13.333.333 \text{ mm}^4 \end{aligned}$$

$$\text{Inertia } I_{z3} = I_{z1}$$

$$\begin{aligned} \text{total Inertia } I &= I_{z1} + I_{z2} + I_{z3} \\ &= 90.986.667 \text{ mm}^4 \end{aligned}$$

a. Teg Tarik max

$$\sigma_t = \frac{M \cdot e}{I} = \frac{5 \cdot 10^6 \cdot 110}{90.986.667} = 6,10 \text{ mpa}$$

b. Teg Tekan max

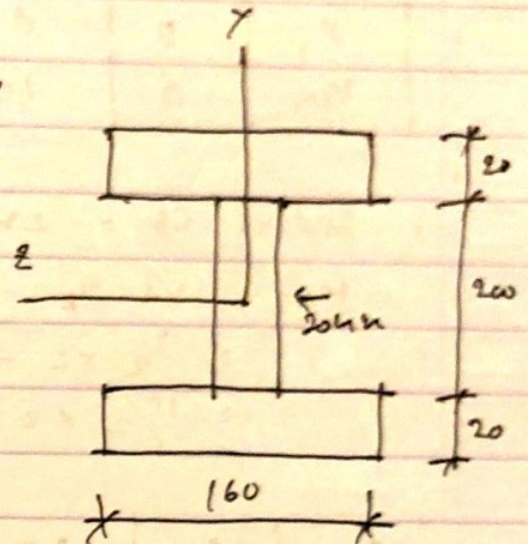
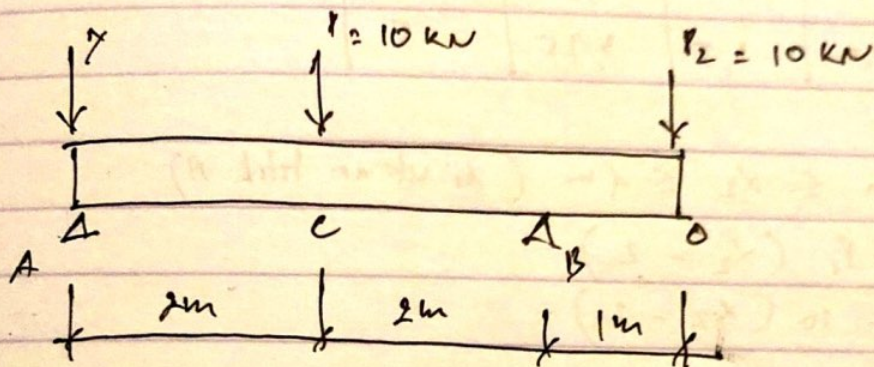
$$\sigma_e = \frac{M \cdot e}{I} = \frac{-10 \cdot 10^6 \cdot 110}{90.986.667} = -12,09 \text{ mpa}$$

Nama : Akhirudin

NIM : 182710045

M. Kuliah : Mekanika Terapan

Soal II



1) Reaksi Perletakan

$$\sum M_A = 0$$

$$P_1(2) + P_2(5) - V_B(4) = 0$$

$$10(2) + 10(5) - 4 V_B = 0$$

$$V_B = \frac{75}{2} \text{ kN}$$

$$\sum M_B = 0$$

$$V_A(4) - P_1(2) + P_2(1) = 0$$

$$4 V_A - 2(10) + 10(1) = 0$$

$$V_A = \frac{5}{2} \text{ kN}$$

Kontrol $\sum V = 0$

$$V_A + V_B - P_1 - P_2 = 0$$

$$\frac{5}{2} \text{ kN} + \frac{75}{2} \text{ kN} - 10 - 10 = 0$$

$$20 - 20 = 0$$

$$0 = 0 \text{ ok!}$$

Perhitungan Bidang Momen (M_x)
 a) Bidang AC : $0 \leq x \leq 2 \text{ m}$ (diukur titik A)

$$M_{x2} = V_A \cdot x_1$$

$$M_{x1} = \frac{5}{2} \cdot x_1$$

x_1	0	0,5	1	1,5	2
M_{x1}	0	1,25	2,5	3,75	5

b) Bidang CB : $2 \text{ m} \leq x_2 \leq 4 \text{ m}$ (diukur titik A)

$$M_{x2} = V_A \cdot x_2 - P_1 (x_2 - 2)$$

$$= \frac{5}{2} x_2 - 10 (x_2 - 2)$$

$$= \frac{15}{2} x_2 + 20$$

x_2	2	2,5	3	3,5	4
M_{x2}	5	1,25	-2,5	-6,25	-10

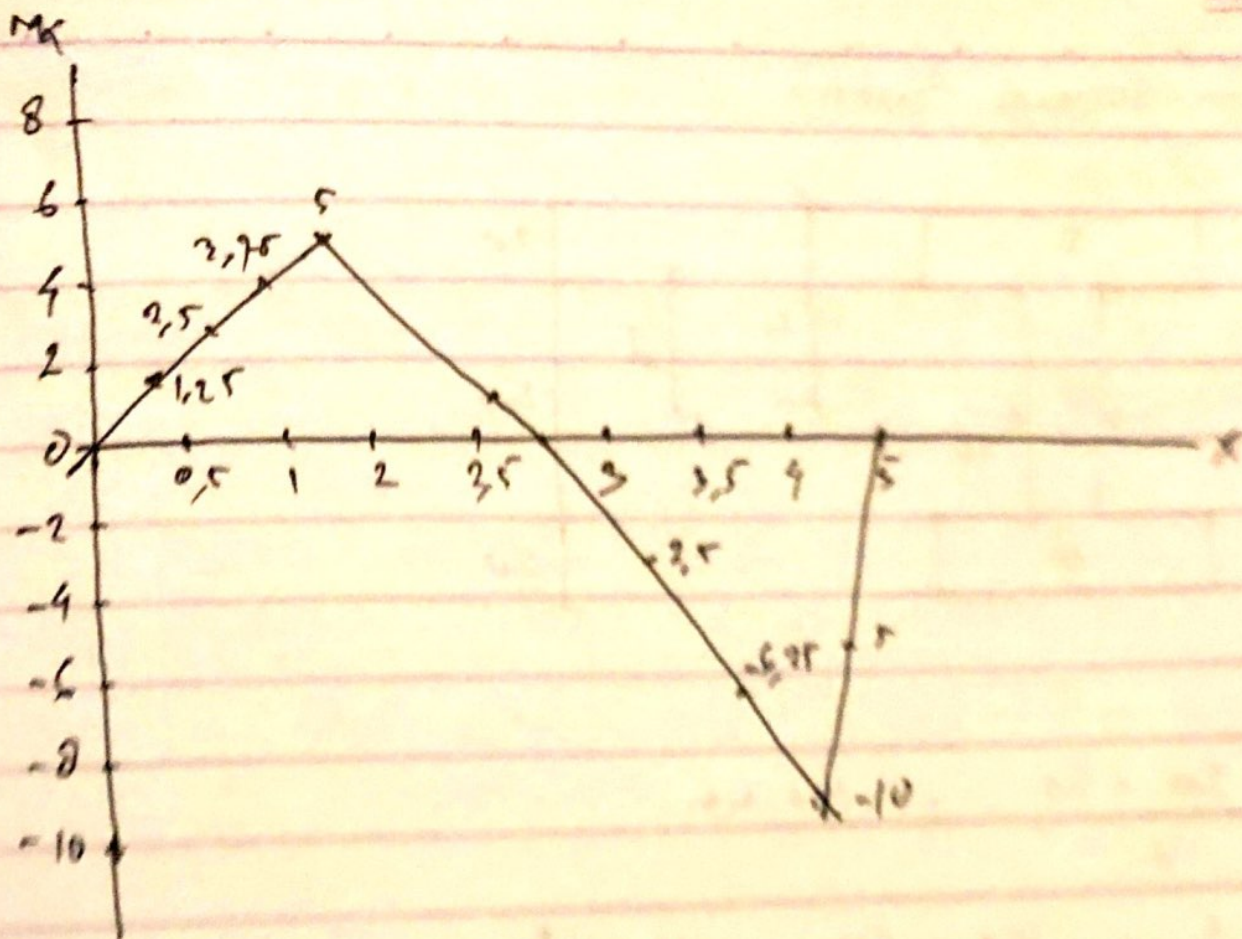
c) Bidang BD : $4 \text{ m} \leq x_3 \leq 5 \text{ m}$ (diukur titik A)

$$M_{x3} = V_A (x_3) - P_1 (x_3 - 2) + V_B (x_3 - 4)$$

$$= \frac{5}{2} (x_3) - P_1 (x_3 - 2) + \frac{35}{2} (x_3 - 4)$$

$$= 10 x_3 - 50$$

x_3	4	4,5	5
M_{x3}	-10	-5	0



Vertikalan :

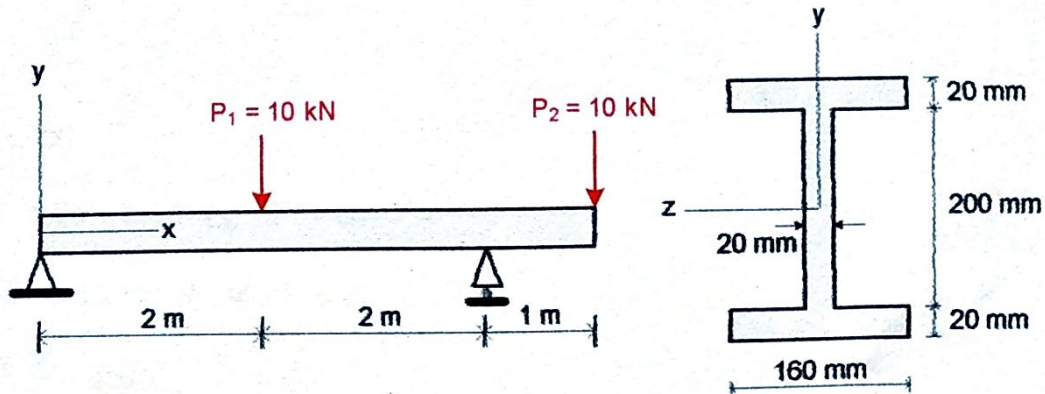
Momen + MAX $\rightarrow$ 5 kNm

Momen - MAX $\rightarrow$ -10 kNm

NAMA : ALDIFI
 NIM : 182710040
 MK : MEKANIKA TERAPAN
 DOSEN : DR. FIRDAUS MT

Soal

1. Sebuah balok dengan beban P_1 dan P_2 seperti tergambar. Penampang balok adalah profil IWF dengan $b = 160$ mm dan $h = 240$ mm (berat sendiri diabaikan). Hitunglah tegangan tarik dan tekan maksimum akibat beban tersebut.



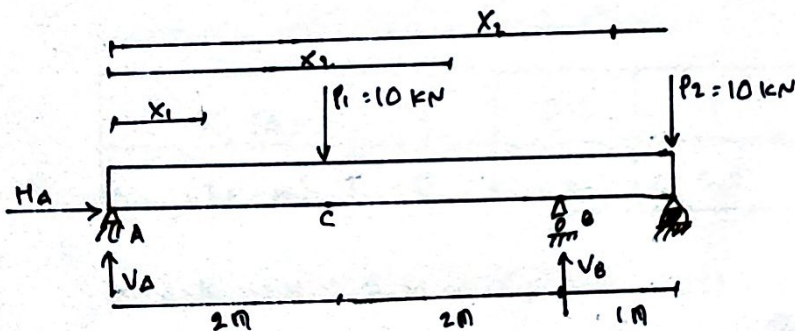
JAWABAN

SYARAT :

$$\sum M = 0$$

$$\sum V = 0$$

$$\sum H = 0$$



REAKSI PERLETAKAN :

$$\sum M_A = 0$$

$$P_1 \cdot 2 + P_2 \cdot 5 - V_B \cdot 4 = 0$$

$$10 \cdot 2 + 10 \cdot 5 - 4 V_B = 0$$

$$V_B = \frac{35}{2} \text{ kN}$$

$$\text{KONTROL : } \sum V = 0$$

$$V_A + V_B - P_1 - P_2 = 0$$

$$\frac{5 \text{ KN}}{2} + \frac{35}{2} - 10 \text{ KN} - 10 \text{ KN} = 0$$

$$0 = 0 \rightarrow \text{OK}$$

$$\sum H = 0$$

$$H_A = 0$$

$$\sum M_B = 0$$

$$V_A \cdot 4 - P_1 \cdot 2 + P_2 \cdot 1 = 0$$

$$V_A \cdot 4 - 10 \cdot 2 + 10 \cdot 1 = 0$$

$$V_A = \frac{5}{2} \text{ KN}$$

a PERHITUNGAN BIDANG MOMEN

BATANG AC : $0 \leq x_1 \leq 2 \text{ m}$ DIUKUR DARI TITIK A

$$M_{x_1} = V_A \cdot x_1$$

$$M_{x_1} = \frac{5}{2} \cdot x_1$$

$x_1 \text{ (m)}$	0	0,5	1	1,5	2
$M_{x_1} \text{ (KN-M)}$	0	1,25	2,5	3,75	5

BATANG CB : $2 \text{ m} \leq x_2 \leq 4$ DIUKUR DARI TITIK A

$$M_{x_2} = V_A \cdot x_2 - P_1 (x_2 - 2)$$

$$M_{x_2} = \frac{5}{2} \cdot x_2 - 10 (x_2 - 2)$$

$$M_{x_2} = -\frac{15}{2} x_2 + 20$$

$x_2 \text{ (m)}$	2	2,5	3	3,5	4
$M_{x_2} \text{ (KN-M)}$	5	1,25	-2,5	-6,25	-10

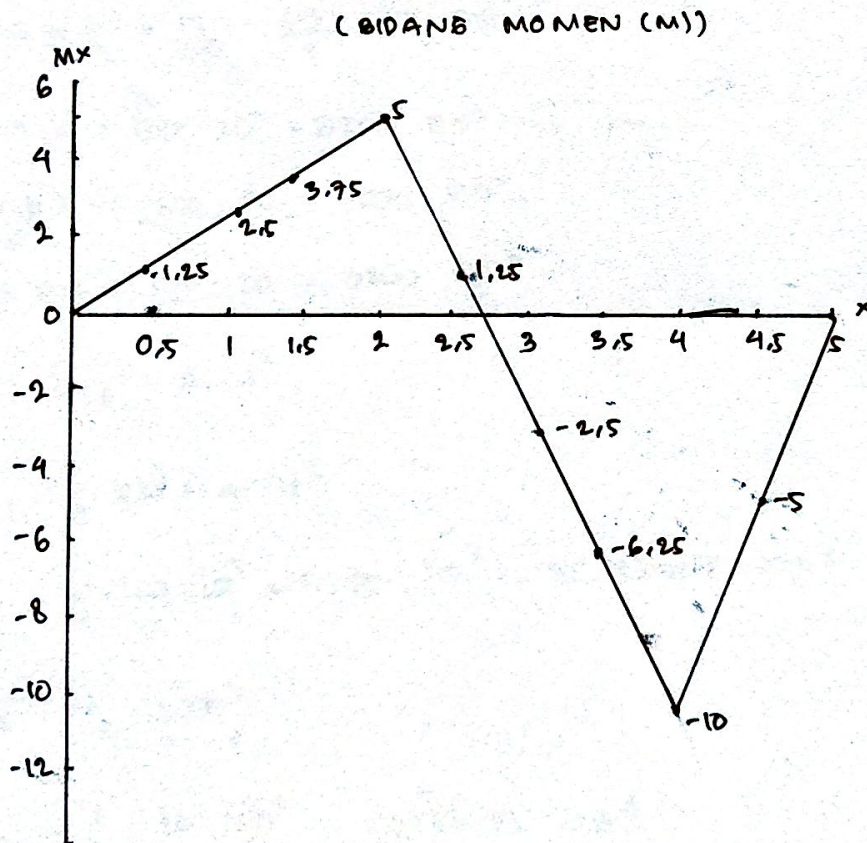
⦿ BATANG BD : $4 \text{ m} \leq x_3 \leq 5 \text{ m}$ DIUKUR DARI TITIK A

$$M_{x_3} = V_A \cdot x_3 - P_1 (x_3 - 2) + V_B (x_3 - 4)$$

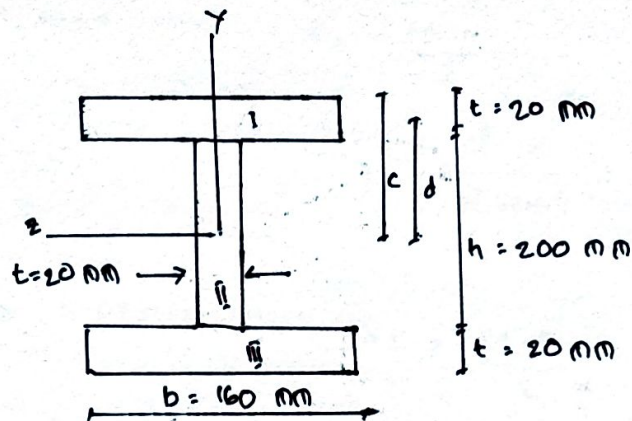
$$M_{x_3} = \frac{5}{2} \cdot x_3 - 10(x_3 - 2) + \frac{35}{2} (x_3 - 4)$$

$$M_{x_3} = 10 \cdot x_3 - 50$$

$x_3 \text{ (m)}$	4	4,5	5
$M_{x_3} \text{ (kN-m)}$	-10	-5	0



⦿ BERDASARKAN PERHITUNGAN DIATAS DAPAT DISIMPULKAN BAHWA MOMEN POSITIF MAKSIMUM DAN NEGATIF MAKSIMAL Masing-masing ADALAH 5 kN-m DAN -10 kN-m



PERHITUNGAN MOMEN INERSIA PROFIL WF

$$c = \frac{20 + 200 + 20}{2} = 120 \text{ mm}$$

$$d = c - \frac{t}{2} = 120 - \frac{20}{2} = 110 \text{ mm}$$

$$A_1 = b \cdot t = 160 \cdot 20 = 3200 \text{ mm}^2$$

$$A_2 = h \cdot t = 200 \cdot 20 = 4000 \text{ mm}^2$$

$$A_3 = b \cdot t = 160 \cdot 20 = 3200 \text{ mm}^2$$

$$I_{21} = I_{22} + A_1 \cdot d^2$$

$$I_{21} = \frac{1}{12} b t^3 + A_1 \cdot d^2$$

$$I_{21} = \frac{1}{12} \cdot 160 \cdot 20^3 + 3200 \cdot 110^2 = 38826667 \text{ mm}^4$$

$$I_{22} = \frac{1}{12} \cdot t \cdot h^3$$

$$I_{22} = \frac{1}{12} \cdot 20 \cdot 200^3 = 13333333 \text{ mm}^4$$

$$I_{23} = I_{21} = 38826667 \text{ mm}^4$$

$$I_2 = I_{21} + I_{22} + I_{23} = 90986667 \text{ mm}^4$$

TEGANGAN TARIK DAN TEKAN MAKSIMUM

a) TEGANGAN TARIK MAKSIMUM : $\sigma_t = \frac{M \cdot c}{I}$

$$\sigma_t = \frac{5 \cdot 10^6 \cdot 110}{90986667} = 6,045 \text{ MPa}$$

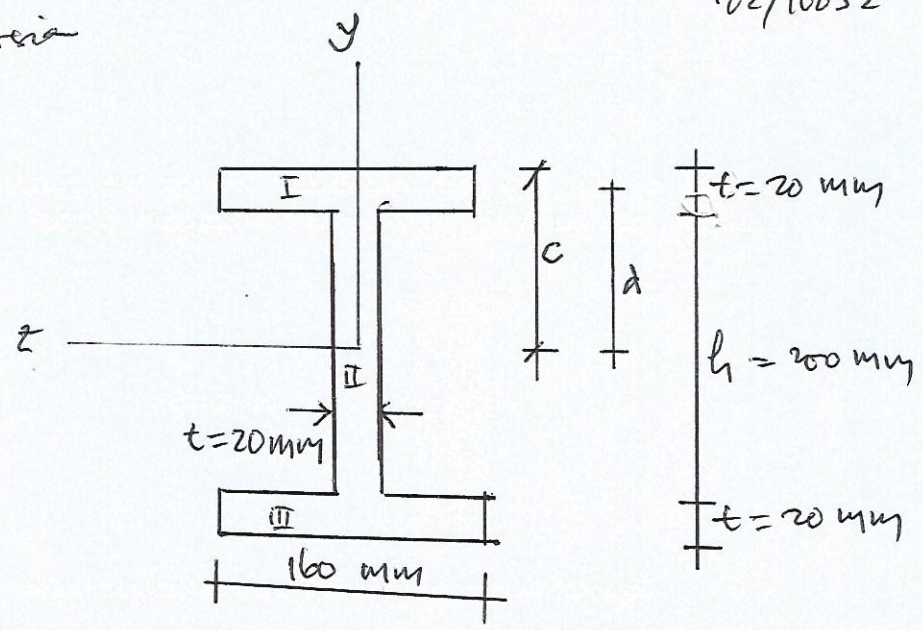
a) TEGANGAN TEKAN MAKSIMUM : $\sigma_c = \frac{M \cdot c}{I}$

$$\sigma_c = \frac{-10 \cdot 10^6 \cdot 110}{90986667}$$

$$= -12,09 \text{ MPa}$$

Arifin
182710032

Momen Inertia



$$c = \frac{20 + 200 + 20}{2} = 120 \text{ mm}$$
$$d = c - \frac{t}{2} = 120 - 10 = 110 \text{ mm}$$
$$A_1 = 160 \cdot 20 = 3200 \text{ mm}^2$$
$$A_2 = 200 \cdot 20 = 4000 \text{ mm}^2$$
$$A_3 = 160 \cdot 20 = 3200 \text{ mm}^2$$

$$I_{z_1} = I_{z_c} + A_1 \cdot d^2 = \frac{1}{12} \cdot 160 \cdot 20^3 + 3200 \cdot 110^2$$
$$= 106.666,67 + 38.720.000 = 38.826.666,67 \text{ mm}^4$$

$$I_{z_2} = \frac{1}{12} \cdot 20 \cdot 200^3 = 13.333.333,33 \text{ mm}^4$$

$$I_{z_3} = \frac{1}{12} \cdot 160 \cdot 20^3 + 320 \cdot 110^2 = 38.826.666,67 \text{ mm}^4$$

$$I_z = I_{z_1} + I_{z_2} + I_{z_3} = 90.986.666,67 \text{ mm}^4$$

Tegangan tarik maksimum = $\sigma_t = \frac{M \cdot c}{I} = \frac{5 \cdot 10^6 \cdot 120}{90.986.666,67}$

$$\sigma_t = 6,594 \text{ MPa}$$

Tegangan tarik minimum = $\sigma_t = \frac{-M \cdot c}{I} = \frac{-10 \cdot 10^6 \cdot 120}{90.986.666,67}$

$$\sigma_t = -13,188 \text{ MPa}$$

BATANG CB $2m \leq x_2 \leq 4m$

$$M_{x_2} = V_A \cdot x_2 - P_1 (x_2 - 2) = \frac{5}{2} x_2 - 10(x_2 - 2)$$

$$M_{x_2} = -\frac{15}{2} x_2 + 20$$

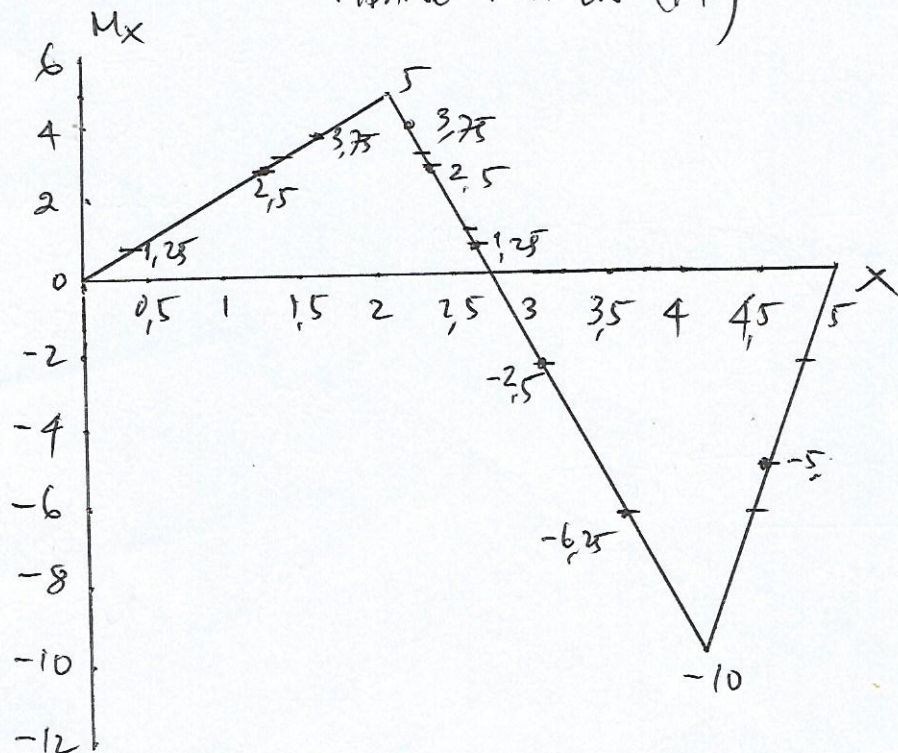
$x_2 (m)$	2	2,5	3	3,5	4
$M_{x_2} (kN-m)$	5	1,25	-2,5	-6,25	-10

BATANG BD : $4m \leq x_3 \leq 5m$

$$\begin{aligned} M_{x_3} &= V_A \cdot x_3 - P_1 (x_3 - 2) + V_B \cdot (x_3 - 4) \\ &= \frac{5}{2} x_3 - 10(x_3 - 2) + \frac{35}{2} (x_3 - 4) \\ &= 10x_3 - 50 \end{aligned}$$

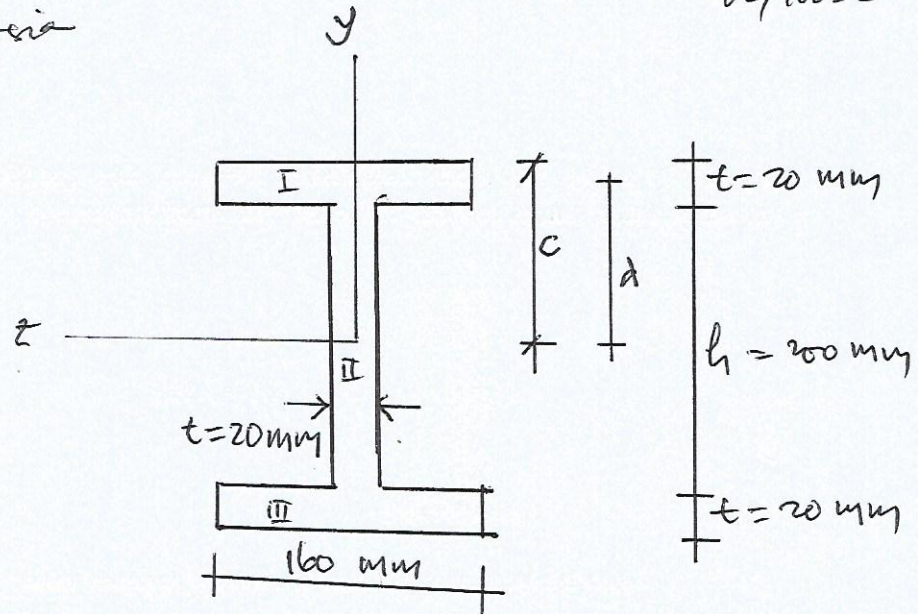
$x_3 (m)$	4	4,5	5
$M_{x_3} (kN-m)$	-10	-5	0

BIDANG MOMEN (kN)



Arifin
182710032

Momen Inertia



$$c = \frac{20 + 200 + 20}{2} = 120 \text{ mm}$$

$$A_1 = 160 \cdot 20 = 3200 \text{ mm}^2$$

$$A_2 = 200 \cdot 20 = 4000 \text{ mm}^2$$

$$A_3 = 160 \cdot 20 = 3200 \text{ mm}^2$$

$$d = c - \frac{t}{2} = 120 - 10 = 110 \text{ mm}$$

$$I_{z_1} = I_{z_c} + A_1 \cdot d^2 = \frac{1}{12} \cdot 160 \cdot 20^3 + 3200 \cdot 110^2 = 106.666,67 + 38.720.000 = 38.826.666,67 \text{ mm}^4$$

$$I_{z_2} = \frac{1}{12} \cdot 20 \cdot 200^3 = 13.333.333,33 \text{ mm}^4$$

$$I_{z_3} = \frac{1}{12} \cdot 160 \cdot 20^3 + 3200 \cdot 110^2 = 38.826.666,67 \text{ mm}^4$$

$$I_z = I_{z_1} + I_{z_2} + I_{z_3} = 90.986.666,67 \text{ mm}^4$$

$$\text{Tegangan tarik maksimum} = \sigma_t = \frac{M \cdot c}{I} = \frac{5 \cdot 10^6 \cdot 120}{90.986.666,67}$$

$$\sigma_t = 6,594 \text{ MPa}$$

$$\text{Tegangan tarik minimum} = \sigma_t = \frac{-M \cdot c}{I} = \frac{-10 \cdot 10^6 \cdot 120}{90.986.666,67}$$

$$\sigma_t = -13,188 \text{ MPa}$$