

## Upload Tugas

# TUGAS 10

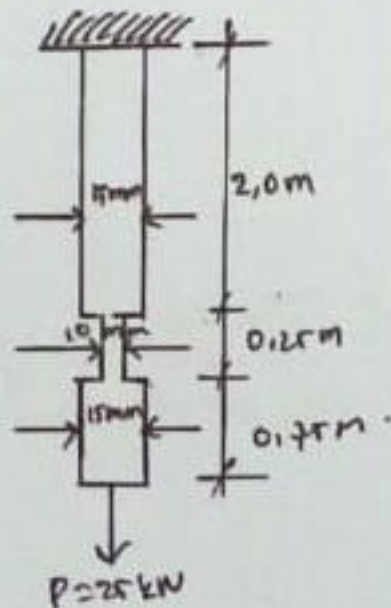
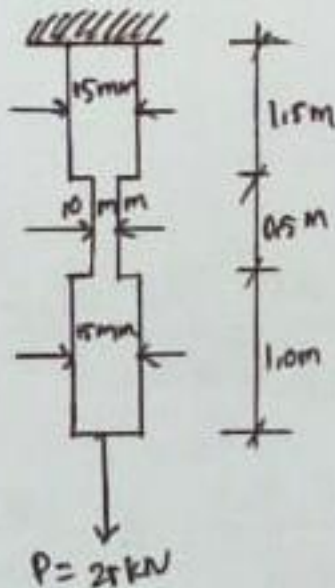
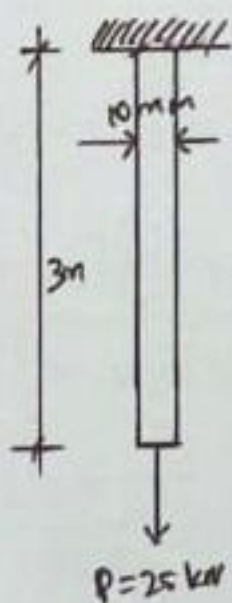
NAMA : EKO SETYAWAN

NIM : 202710037

MATA KULIAH : MEKANIKA TERAPAN

## Soal :

Tiga batang mempunyai panjang yang sama, tetapi bentuk yang berbeda seperti Gambar ketiga batang ini mengalami beban aksial  $P$  yang sama. Hitunglah besarnya energi tegangan yang di simpan pada masing-masing batang, dengan menganggap perilaku elastis linear.



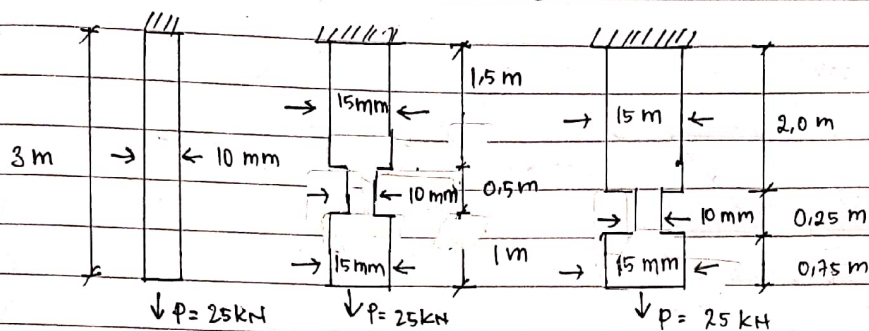
## Penyelesaian

$$\begin{aligned} U_1 &= \frac{P^2 \cdot L}{2E \cdot A} \times \\ &= \frac{(25 \cdot 10^3)^2 \cdot 3 \cdot 1000}{2(200 \cdot 10^9) \left(\frac{1}{4} \pi (10)^2\right)} \\ &= \frac{1.875 \cdot 10^9}{400.785} \\ &= 59.713,3 \text{ N} \cdot \text{mm} \end{aligned}$$

$$\begin{aligned}
 U_2 &= \sum_{i=1}^n \frac{N_i^2 \cdot L_i}{2E_i \cdot A} \\
 &= \frac{(25 \cdot 10^3)^2 \cdot 1500}{2(200 \cdot 10^3) \left(\frac{1}{4} \pi (15^2)\right)} + \frac{(25 \cdot 10^3)^2 \cdot 500}{2(200 \cdot 10^3) \left(\frac{1}{4} \pi (10^2)\right)} + \frac{(25 \cdot 10^3)^2 \cdot 1000}{2(200 \cdot 10^3) \left(\frac{1}{4} \pi (15^2)\right)} \\
 &= \frac{937.500}{70.650} + \frac{312.500}{31.400} + \frac{625.000}{70.650} \\
 &= 13,2696 + 9,9522 + 8,8464 \\
 &= 32,068,3 \text{ N} \cdot \text{mm}
 \end{aligned}$$

$$\begin{aligned}
 U_3 &= \sum_{i=1}^n \frac{N_i^2 \cdot L_i}{2E_i \cdot A} \\
 &= \frac{(25 \cdot 10^3)^2 \cdot 2000}{2(200 \cdot 10^3) \left(\frac{1}{4} \pi (15^2)\right)} + \frac{(25 \cdot 10^3)^2 \cdot 200}{2(200 \cdot 10^3) \left(\frac{1}{4} \pi (10^2)\right)} + \frac{(25 \cdot 10^3)^2 \cdot 700}{2(200 \cdot 10^3) \left(\frac{1}{4} \pi (15^2)\right)} \\
 &= \frac{1.250 \cdot 10^3}{70.650} + \frac{156.250}{31.400} + \frac{468.750}{70.650} \\
 &= 17,6928 + 4,9761 + 6,6348 \\
 &= 29,303,7 \text{ N} \cdot \text{mm}
 \end{aligned}$$

Tiga batang mempunyai panjang yang sama, tetapi bentuk yang berbeda seperti tergambar. Ketiga batang ini mengalami beban aksial  $P$  yang sama. Hitunglah besarnya energi regangan yang disimpan pada masing-masing batang, dengan menganggap perilaku elastis linear.



### Penyelesaian

$$V_1 = \frac{P_2 \cdot L}{2E \cdot A} = \frac{(25 \cdot 10^3)^2 \cdot 3000}{2 \cdot (200 \cdot 10^9) \cdot \left(\frac{1}{4} \pi (10^2)\right)} = \frac{1.875 \cdot 10^3}{400 \cdot 785} = 59.713,3 \text{ N} \cdot \text{mm}$$

$$V_2 = \sum_{i=1}^n \frac{N_i^2 \cdot L_i}{2E_i \cdot A}$$

$$= \frac{(25 \cdot 10^3)^2 \cdot 1500}{2(200 \cdot 10^9) \left(\frac{1}{4} \pi (15^2)\right)} + \frac{(25 \cdot 10^3)^2 \cdot 500}{2(200 \cdot 10^9) \left(\frac{1}{4} \pi (10^2)\right)} + \frac{(25 \cdot 10^3)^2 \cdot 1000}{2(200 \cdot 10^9) \left(\frac{1}{4} \pi (15^2)\right)}$$

$$= \frac{937.500}{70.650} + \frac{312.500}{31.400} + \frac{625.000}{70.650}$$

$$= 13,2696 + 9,9522 + 8,8464$$

$$= 32,068,3 \text{ N} \cdot \text{mm}$$

$$V_3 = \sum_{i=1}^n \frac{N_i^2 \cdot L_i}{2E_i \cdot A}$$

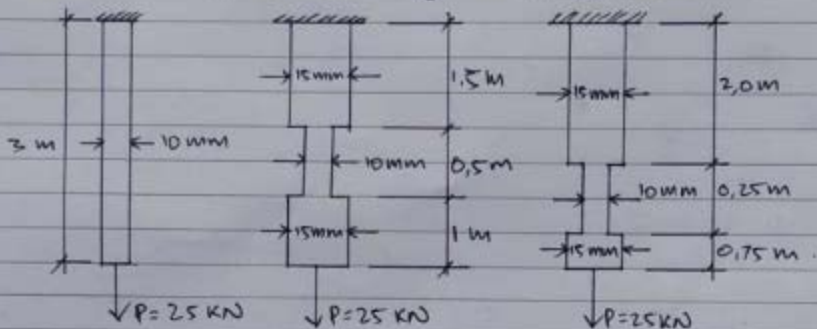
$$= \frac{(25 \cdot 10^3)^2 \cdot 2000}{2(200 \cdot 10^9) \left(\frac{1}{4} \pi (15^2)\right)} + \frac{(25 \cdot 10^3)^2 \cdot 250}{2(200 \cdot 10^9) \left(\frac{1}{4} \pi (10^2)\right)} + \frac{(25 \cdot 10^3)^2 \cdot 750}{2(200 \cdot 10^9) \left(\frac{1}{4} \pi (15^2)\right)}$$

$$= \frac{1.250 \cdot 10^3}{70.650} + \frac{156.250}{31.400} + \frac{468.750}{70.650}$$

$$= 17,6928 + 4,9761 + 6,6348$$

$$= 29.303,7 \text{ N} \cdot \text{mm}$$

TIGA Batang mempunyai panjang yang sama, tetapi bentuk yang berbeda seperti tergambar. Ketiga batang ini mengalami beban aksial P yang sama. Hitunglah besarnya energi regangan yang di simpan pada masing-masing batang, dengan menganggap perilaku elastis linear.



Pemecahannya:

$$U_1 = \frac{P^2 \cdot L}{2E \cdot A} = \frac{(25 \cdot 10^3)^2 \cdot 3000}{2(200 \cdot 10^3) \left(\frac{1}{4} \pi (10^2)\right)} = \frac{1.875 \cdot 10^3}{400 \cdot 78,5}$$

$$= 59.713,3 \text{ N-mm}$$

$$U_2 = \sum_{i=1}^n \frac{N_i^2 L_i}{2E_i \cdot A}$$

$$= \frac{(25 \cdot 10^3)^2 \cdot 1500}{2(200 \cdot 10^3) \left(\frac{1}{4} \pi (15^2)\right)} + \frac{(25 \cdot 10^3)^2 \cdot 500}{2(200 \cdot 10^3) \left(\frac{1}{4} \pi (10^2)\right)} + \frac{(25 \cdot 10^3)^2 \cdot 1000}{2(200 \cdot 10^3) \left(\frac{1}{4} \pi (15^2)\right)}$$

$$= \frac{937.500}{70.650} + \frac{312.500}{31.400} + \frac{625.000}{70.650}$$

$$= 13,2696 + 9,9522 + 8,8464$$

$$= 32.068,3 \text{ N-mm}$$

$$U_2 = \sum_{i=1}^n \frac{N_i^2 \cdot L_i}{2E_i \cdot A}$$

$$= \frac{(25 \cdot 10^3)^2 \cdot 2000}{2(200 \cdot 10^3) \left( \frac{1}{4} \pi (15^2) \right)} + \frac{(25 \cdot 10^3)^2 \cdot 250}{2(200 \cdot 10^3) \left( \frac{1}{4} \pi (10^2) \right)} + \frac{(25 \cdot 10^3)^2 \cdot 750}{2(200 \cdot 10^3) \left( \frac{1}{4} \pi (15^2) \right)}$$

$$= \frac{1.250 \cdot 10^3}{70.650} + \frac{156.250}{31.400} + \frac{468.750}{70.650}$$

$$= 17,6928 + 4,9761 + 6,6398$$

$$= 29.303,7 \text{ N-mm} //$$

**TUGAS MATA KULIAH  
MEKANIKA TERAPAN**

**Dosen : Dr. Firdaus, ST., M.T**



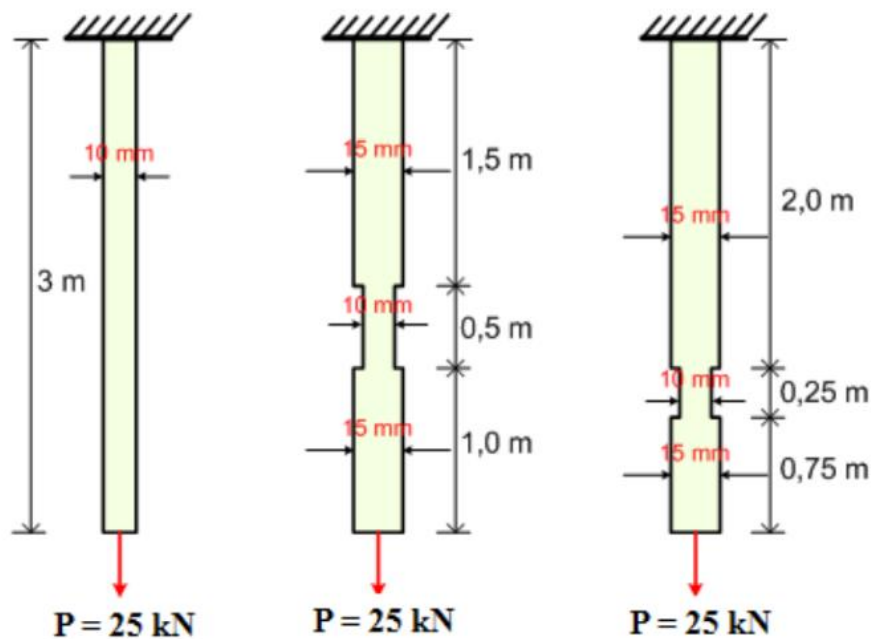
**NAMA : S U J O N O**

**NIM : 202710020**

**MAGISTER TEKNIK SIPIL PROGRAM PASCA SARJANA  
UNIVERSITAS BINA DARMA PALEMBANG**

## TUGAS-10

Tiga batang mempunyai panjang yang sama, tetapi bentuk yang berbeda seperti tergambar. Ketiga batang ini mengalami beban aksial  $P$  yang sama. Hitunglah besarnya energi regangan yang disimpan pada masing-masing batang, dengan menganggap perilaku elastis linier.



JAWABANNYA

$$U_1 = \frac{P^2 L}{2EA} = \frac{(25 \cdot 10^3 \text{ N})^2 \cdot 3000 \text{ mm}}{2 \cdot \left(200 \cdot 10^3 \frac{\text{N}}{\text{mm}^2}\right) \cdot \left(\frac{1}{4} \pi (10 \text{ mm})^2\right)} = 59683 \text{ N} \cdot \text{mm}$$

$$U_2 = \sum_{i=1}^n \frac{N_i^2 L_i}{2E_i A}$$

$$U_2 = \frac{(25 \cdot 10^3 \text{ N})^2 \cdot 1500 \text{ mm}}{2 \cdot \left(200 \cdot 10^3 \frac{\text{N}}{\text{mm}^2}\right) \cdot \left(\frac{1}{4} \pi (15 \text{ mm})^2\right)} + \frac{(25 \cdot 10^3 \text{ N})^2 \cdot 500 \text{ mm}}{2 \cdot \left(200 \cdot 10^3 \frac{\text{N}}{\text{mm}^2}\right) \cdot \left(\frac{1}{4} \pi (10 \text{ mm})^2\right)} + \frac{(25 \cdot 10^3 \text{ N})^2 \cdot 1000 \text{ mm}}{2 \cdot \left(200 \cdot 10^3 \frac{\text{N}}{\text{mm}^2}\right) \cdot \left(\frac{1}{4} \pi (15 \text{ mm})^2\right)}$$



$$U_2 = 32052 \text{ N} \cdot \text{mm}$$

$$U_3 = \sum_{i=1}^n \frac{N_i^2 L_i}{2E_i A}$$

$$U_3 = \frac{(25 \cdot 10^3 \text{ N})^2 \cdot 2000 \text{ mm}}{2 \cdot \left(200 \cdot 10^3 \frac{\text{N}}{\text{mm}^2}\right) \cdot \left(\frac{1}{4} \pi (15 \text{ mm})^2\right)} + \frac{(25 \cdot 10^3 \text{ N})^2 \cdot 250 \text{ mm}}{2 \cdot \left(200 \cdot 10^3 \frac{\text{N}}{\text{mm}^2}\right) \cdot \left(\frac{1}{4} \pi (10 \text{ mm})^2\right)} \\ + \frac{(25 \cdot 10^3 \text{ N})^2 \cdot 750 \text{ mm}}{2 \cdot \left(200 \cdot 10^3 \frac{\text{N}}{\text{mm}^2}\right) \cdot \left(\frac{1}{4} \pi (15 \text{ mm})^2\right)}$$

$$U_3 = 29289 \text{ N} \cdot \text{mm}$$