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. مقاطع فيديوهات لشرح المقرر بشكل وافي
. ملخص للمادة Pdf للمزكرة والمراجعة
. محاضرات مباشرة علي برنامج زووم
لمناقشة الأجزاء الغير مفهومة
. تواصل مستمر مع معلم المادة
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Tutorial No (3)

STATIC TENSION TEST

Example 1

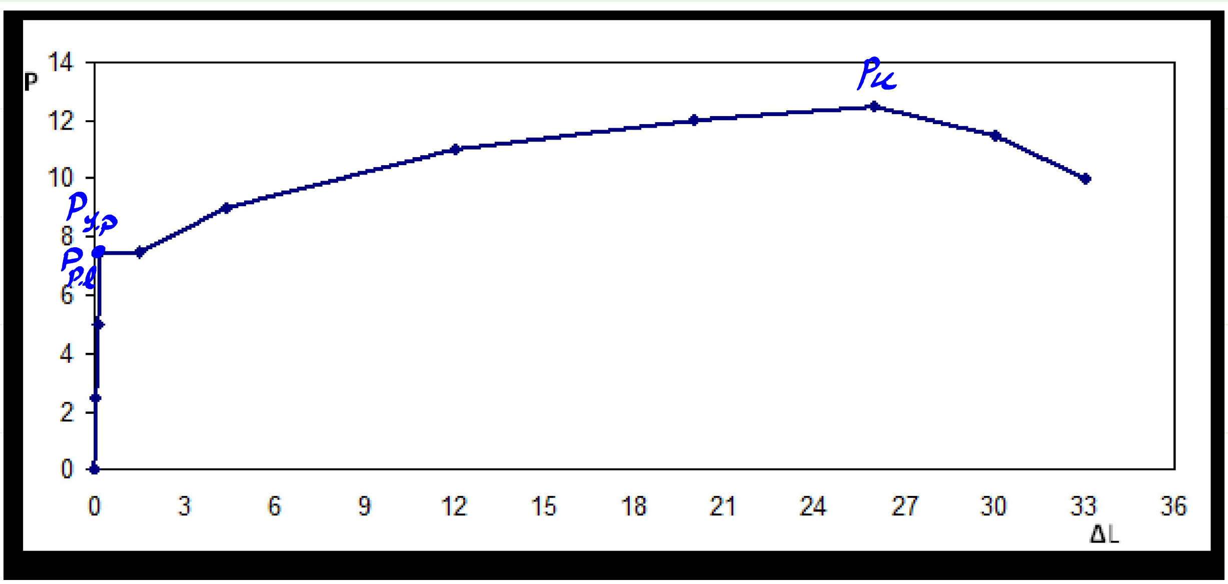
A tension test was carried out an a short standard test specimen of steel of 20 mm diameter . The test results were as follows:

P Load, ton	2.5	5	7.5	7.5	9	11	12	12.5	11.5	10
ΔL, mm	0.06	0.12	0.18	1.5	4.4	12	20	26	30	33

Draw the load- extension diagram and determine the following:

1. **Yield stress**
2. **Tensile strenght**
3. **Elongation %**
4. **Modulus of elasticity**
5. **Modulus of Resilence**
6. **Modulus of toughness**

Take L= 10 cm



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$d_o = 20mm$

$A_o = \pi r^2 = \pi \left(\frac{d}{2}\right)^2 = \frac{\pi d^2}{4} = \frac{\pi (20)^2}{4} = 314 \ mm^2$

① $\sigma_y = \frac{P_y}{A_o} = \frac{7.5 \ ton}{314 mm^2} = 0.024 \ Ton/mm^2$

② $\sigma_u = \frac{P_{max}}{A_o} = \frac{12.5 \ ton}{314 mm^2} = 0.04 \ Ton/mm^2$

③ $\% e = \frac{\Delta l_f}{l_o} = \frac{33mm}{100mm} = 0.33 = 33\%$

④ $E = \left(\frac{\sigma}{\epsilon}\right)_{pl} = \frac{\frac{P_{p.l}}{A_o}}{\frac{\Delta l_{p.l}}{l_o}} = \frac{\frac{7.5 \ ton}{314 mm^2}}{\frac{0.18}{100}} = 13.3 \ Ton/mm^2$

⑤ $M.R = \frac{\frac{1}{2} P_{p.l} \cdot \Delta l_{pl}}{A_o * l_o} = \frac{\frac{1}{2} * 7.5 * 18}{314 * 100} = 2.14 \times 10^{-3} \ Ton/mm^2$

⑥ $M.T = \frac{\frac{1}{2}(P_y + P_{max}) * \Delta l_f}{A_o * l_o}$

$= \frac{\frac{1}{2}(7.5 + 12.5) * 33}{314 * 100} = 0.011 \ Ton/mm^2$

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A tension test was conducted on a specimen of AISI (**American Iron and Steel Institute**) 1020 hot-rolled steel having an initial diameter of 9.11 mm. The load at 0.2 % plastic strain offset was 17.21 kN, the highest load reached was 25.75 kN, and the load at fracture was 17.39 kN. After fracture, the following measurements were made:

Marks on opposite side of the necked region that were originally 25 mm apart had stretched to 38 mm apart.

Similar marks originally 50 mm apart had stretched to 68.5 mm apart.

The final diameter was 5.28 mm.

Determine the following properties from this test:

1. **Yield strength,**
2. **Ultimate (Maximum) strength,**
3. **Percent elongation (%e), and**
4. **Percent reduction in area (%R).**
5. **Modulus of toughness**

$d_o = 9.11mm$, $P_y = 17.21kN$, $P_u = 25.75kN$, $P_f = 17.39kN$

$l_{o1} = 25mm$, $l_{f1} = 38mm$, $l_{o2} = 50mm$, $l_{f2} = 68.5mm$

$d_f = 5.28mm$

$$A_o = \frac{\pi}{4} d^2 = \frac{\pi}{4} * 9.11^2 = 65.18\ mm^2$$

(1) $\sigma_y = \frac{P_y}{A_o} = \frac{17.21}{65.18} = 0.264\ Ton/mm^2 = \quad MPa$

حل اوز (1)

$$\sigma_y = \frac{17.21 * 1000N}{65.18mm^2} = 264\ MPa$$

حل اوز (2)

$$\sigma_y = \frac{17.21 * 10^3 N}{65.18 * (10^{-3})^2 m^2} = 264 * 10^6\ Pa = 264\ MPa$$

(2) $\sigma_u = \dfrac{P_u}{A_o} = \dfrac{25.75 * 10^3 N}{65.18 mm^2} = 395$ MPa

(3) $\% e_1 = \dfrac{\Delta l_f}{l_o} = \dfrac{l_f - l_o}{l_o} = \dfrac{38 - 25}{25} = 0.52 = 52\%$

$\% e_2 = \dfrac{68.5 - 50}{50} = 0.37 = 37\%$

(4) $\% A = \dfrac{A_o - A_f}{A_o} = \dfrac{\pi \frac{d_o^2}{4} - \pi \frac{d_f^2}{4}}{\pi \frac{d_o^2}{4}} = \dfrac{d_o^2 - d_f^2}{d_o^2}$

$\% A = \% R = \dfrac{9.11^2 - 5.28^2}{9.11^2} = 0.664 = 66.4\%$

(5) $M.T = \dfrac{\frac{1}{2}(P_y + P_{max}) * \Delta l_f}{A_o * l_o} = \frac{1}{2}(\sigma_y + \sigma_u)\, e_f \quad \dfrac{\Delta l}{l_o}$

$= \frac{1}{2}(264 + 395) * 0.37 = 121.9$ MPa