

פירושון אבאן
מחייב

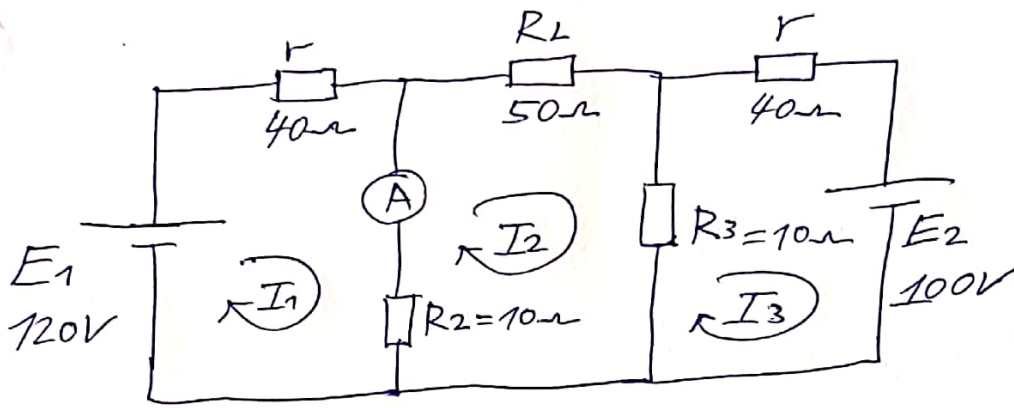
הגורם החדש

קיץ 2020 מוצר 12

פירושון אבאן קוביות

הזקק: מחירם אולם גם

1. Aufgabe 1c 28/1N 2020 P1



r:

$$l = 200 \text{ m}$$

$$A = 0.25 \text{ mm}^2$$

$$\rho = 0.05 \frac{\Omega \cdot \text{mm}^2}{\text{m}}$$

RL:

$$U_h = 30 \text{ V}$$

$$P_h = 18 \text{ W}$$

R2 = R3:

$$U = 3 \text{ V} \Rightarrow I = 300 \text{ mA}$$

$$r = \frac{\rho \cdot l}{A}$$

$$r = \frac{0.05 \cdot 200}{0.25} = 40 \Omega$$

$$R_L = \frac{U_h^2}{P_h}$$

$$R_L = \frac{30^2}{18} = 50 \Omega$$

$$R_2 = R_3 = \frac{U}{I}$$

$$R_2 = R_3 = \frac{3}{300 \text{ mA}} = 10 \Omega$$

① $P_{RL} = ?$ $I_A = ?$

$$\begin{cases} 50I_1 - 10I_2 - 0I_3 = 120 \\ -10I_1 + 70I_2 - 10I_3 = 0 \\ -0I_1 - 10I_2 + 50I_3 = -100 \end{cases}$$

$$I_1 = 2.412 \text{ A}$$

$$I_2 = 60.606 \text{ mA}$$

$$I_3 = -1.988 \text{ A}$$

$$I_{RL} = I_2 = 60.606 \text{ mA}$$

$$P_{RL} = I_{RL}^2 \cdot R_L$$

$$P_{RL} = 60.606 \text{ m}^2 \cdot 50 = \boxed{183.65 \text{ mW}}$$

$$I_A = I_1 - I_2$$

$$I_A = 2.412 - 60.606 \text{ m} = \boxed{2.351 \text{ A}}$$

$$\textcircled{2} \quad \boxed{\eta = ?}$$

$$P_{E1} = E_1 \cdot I_1$$

$$P_{E1} = 120 \cdot 2.412 = \underline{289.44 \text{ W}}$$

$$P_{E2} = E_2 \cdot I_3$$

$$P_{E2} = 100 \cdot 1.988 = \underline{198.8 \text{ W}}$$

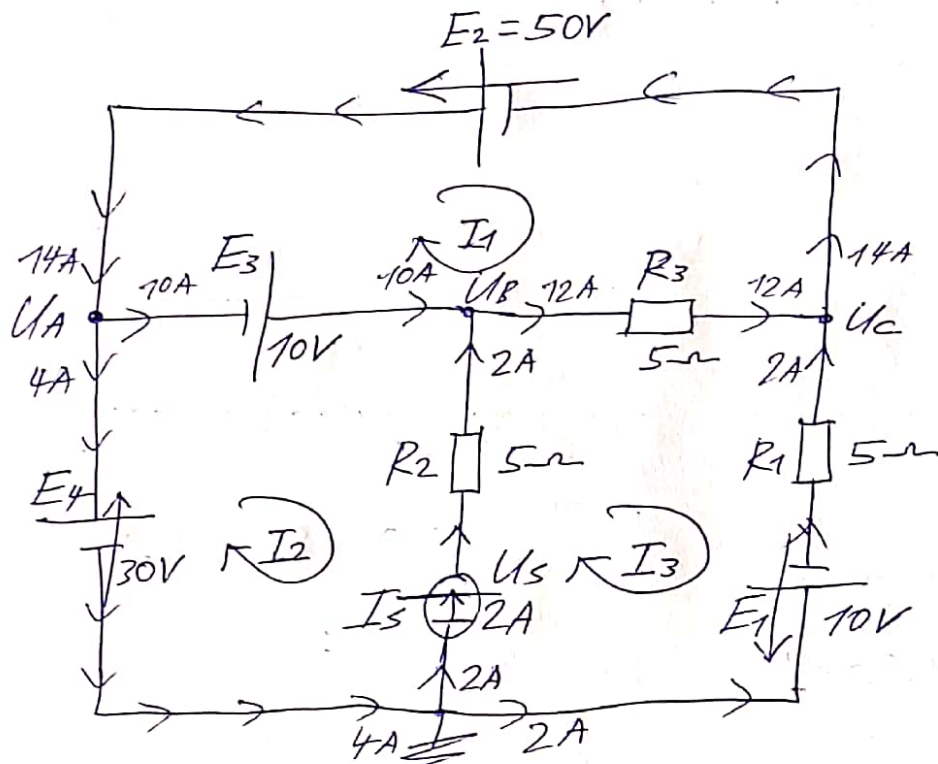
$$\eta = \frac{P_{RL}}{P_{E1} + P_{E2}} \cdot 100$$

$$\eta = \frac{183.65 \text{ m}}{289.44 + 198.8} \cdot 100 = \boxed{37.615 \text{ m}\%}$$

⊕ '2'N '2'N '2'N (ONIX KD) '2'N '2'N '2'N
!!! RL=0Ω '2'N '2'N '2'N RL ONIX

2. side 1c 38/1N 2020 P17

① $U_A=?$ $U_B=?$ $U_C=?$



$I_3 - I_2 = 2A$
 $I_3 = 2 + I_2$

$5I_1 - 0I_2 - 5I_3 = -60$

$5I_1 - 0I_2 - 5(2 + I_2) = -60$

$5I_1 - 0I_2 - 10 - 5I_2 = -60$

$5I_1 - 5I_2 - 10 = -60$

$-0I_1 + 5I_2 - 5I_3 = 40 - U_s$

$-0I_1 + 5I_2 - 5(2 + I_2) = 40 - U_s$

$0I_1 + 5I_2 - 10 - 5I_2 = 40 - U_s$

$0I_1 + 0I_2 + U_s = 50$

$-5I_1 - 5I_2 + 15I_3 = U_s + 10$

$-5I_1 - 5I_2 + 15(2 + I_2) = U_s + 10$

$-5I_1 - 5I_2 + 30 + 15I_2 = U_s + 10$

$-5I_1 + 10I_2 - U_s = -20$

$$I_1 = \boxed{-14A}$$

$$I_2 = \boxed{-4A}$$

$$U_s = \boxed{50V}$$

$$I_3 = 2 + I_2$$

$$I_3 = 2 + (-4) = \boxed{-2A}$$

$$\boxed{U_A = 30V \text{ (!, 11A)}} \quad \text{II}$$

$$U_B = U_s - U_{R2}$$

$$U_{R2} = I_{R2} \cdot R_2$$

$$U_{R2} = 2 \cdot 5 = 10V$$

$$U_B = 50 - 10 = \boxed{40V}$$

$$U_C = -U_{R1} - E_3$$

$$U_{R1} = I_3 \cdot R_1$$

$$U_{R1} = 2 \cdot 5 = 10V$$

$$U_C = -10 - 10 = \boxed{-20V}$$

$$\boxed{U_A = 30V \text{ (!, 11A)}} \quad \text{II}$$

$$U_B = U_A + E_3$$

$$U_B = 30 + 10 = \boxed{40V}$$

$$U_C = -U_{CA} - E_3 + U_B$$

$$U_C = -50 + 10 + 40 = \boxed{-20V}$$

$$\textcircled{2} \quad \boxed{I_{R1}=?} \quad \boxed{I_{R2}=?} \quad \boxed{I_{R3}=?}$$

$$\boxed{I_{R1} = I_3 = 2A}$$

$$\boxed{I_{R2} = I_s = 2A}$$

$$I_{R3} = I_1 - I_3$$

$$I_{R3} = 14 - 2 = \boxed{12A}$$

$$\textcircled{2} \quad P_{E2} = ?$$

$$P_{E2} = E_2 \cdot I_1$$

$$P_{E2} = 50 \cdot 14 = \boxed{700 \text{ W}}$$

$$\boxed{! \cdot 73!}$$

$$\textcircled{3} \quad P_{E3} = ?$$

$$P_{E3} = E_3 \cdot (I_1 - I_2)$$

$$P_{E3} = 40 \cdot (14 - 4) = \boxed{400 \text{ W}}$$

$$\boxed{! \cdot 73!}$$

$$\textcircled{4} \quad P_{E4} = ?$$

$$P_{E4} = E_4 \cdot I_2$$

$$P_{E4} = 30 \cdot 4 = \boxed{120 \text{ W}}$$

$$\boxed{! \cdot 73!}$$

$$\textcircled{1} \quad P_{I5} = ?$$

$$P_{I5} = U_5 \cdot I_5$$

$$P_{I5} = 50 \cdot 2 = \boxed{100 \text{ W}}$$

$$\boxed{! \cdot 73!}$$

3.10.16 1/2 28/11 2020 8'17

$$\underline{E_T = 12V} \quad \underline{Q_T = 30A/h} \quad \underline{E_1 = 1.5V} \quad \underline{r_1 = 0.075\Omega}$$

$$\underline{Q_1 = 5A/h}$$

$$\textcircled{1} \quad \underline{h \cdot m = ?}$$

$$h = \frac{E_T}{E_1}$$

$$h = \frac{12}{1.5} = \underline{\underline{8}}$$

$$m = \frac{Q_T}{Q_1}$$

$$m = \frac{30}{5} = \underline{\underline{6}}$$

$$h \cdot m = 8 \cdot 6 = \underline{\underline{48}}$$

$$\textcircled{2} \quad \underline{I_{max} = ?} \quad (R_L = 0\Omega)$$

$$r_T = \frac{r_1 \cdot h}{m}$$

$$r_T = \frac{0.075 \cdot 8}{6} = \underline{\underline{100m\Omega}}$$

$$I_{max} = \frac{E_T}{r_T}$$

$$I_{max} = \frac{12}{100m} = \underline{\underline{120A}}$$

$$\textcircled{3} \quad \underline{W_T = ?}$$

$$W_T = P \cdot t$$

$$P_T = I_{max} \cdot E_T$$

$$P_T = 120 \cdot 12 = \underline{\underline{1440W}}$$

$$t = \frac{Q_T}{I_{\max}}$$

$$t = \frac{30}{120} = \underline{0.25 \text{ H}}$$

$$W_T = P \cdot t$$

$$W_T = 1440 \cdot 0.25 = \underline{360 \text{ W/h}}$$

$$\textcircled{2} \quad \boxed{R_L (P_{\max}) = ?} \quad \boxed{P_{RL} = ?}$$

$$R_L = r_T = \underline{100 \text{ m}\Omega}$$

$$U_{RL} = U_{r_T} = \frac{E_T}{2}$$

$$U_{RL} = \frac{12}{2} = 6 \text{ V}$$

$$P_{RL} = \frac{U_{RL}^2}{R_L}$$

$$P_{RL} = \frac{6^2}{100 \text{ m}} = \underline{360 \text{ W}}$$

$$\textcircled{3} \quad \underline{R_L = 1.9 \Omega} \quad \boxed{t = ?}$$

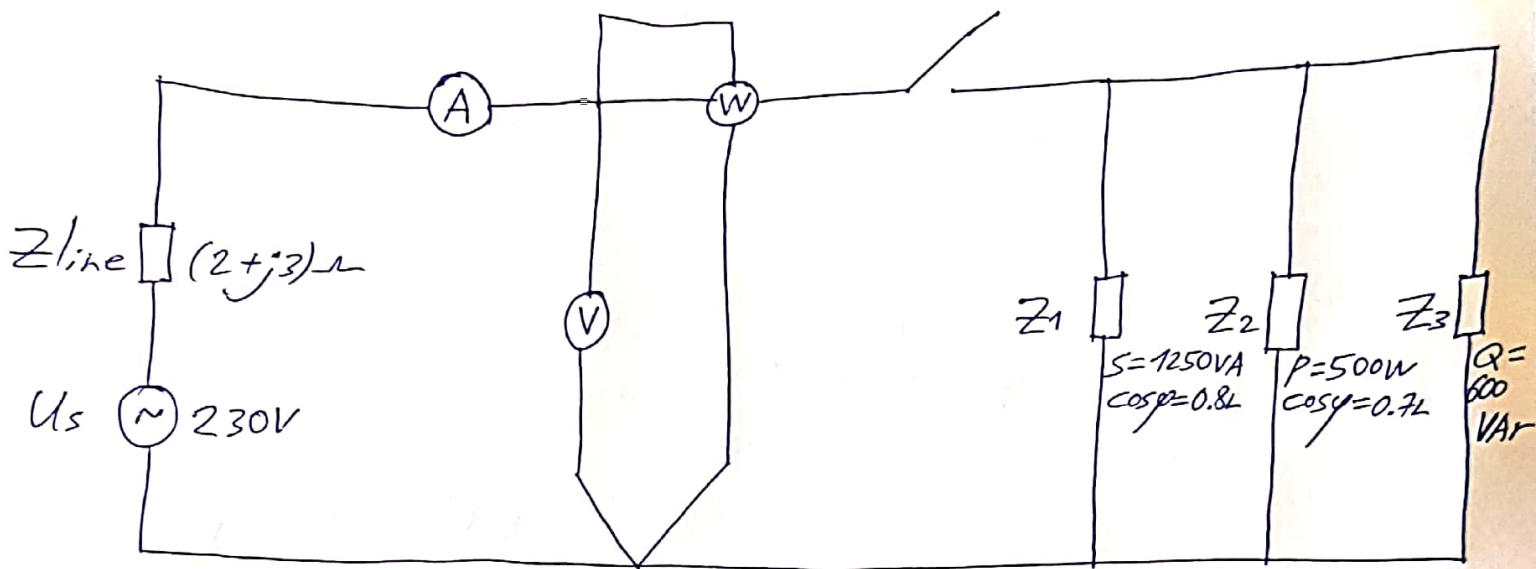
$$I_T = \frac{E_T}{r_T + R_L}$$

$$I_T = \frac{12}{0.1 + 1.9} = 6 \text{ A}$$

$$t = \frac{Q_T}{I_T}$$

$$t = \frac{30}{6} = \underline{5 \text{ H}}$$

4. inde 'k 28/1N 2020 2'p



1. $V = ?$ $A = ?$ $W = ?$

$V = 230V$ $A = 0A$ $W = 0W$

2. $\cos \varphi_{z1-3} = ?$

$$S_1 = \frac{U^2}{Z_1}$$

$$Z_1 = \frac{U^2}{S_1}$$

$$Z_1 = \frac{230^2}{1250} = 42.32 \angle 36.87^\circ \Omega$$

$$Z_2 = \frac{U^2}{S_2}$$

$$Z_2 = \frac{230^2}{714.286} = 74.06 \angle 45.573^\circ \Omega$$

$$Z_3 = \frac{U^2}{S_3}$$

$$Z_3 = \frac{230^2}{600} = 88.167 \angle -90^\circ \Omega$$

$$\cos \varphi_1 = 0.8 \Rightarrow \varphi_1 = 36.87^\circ$$

$$S = \frac{P}{\cos \varphi}$$

$$S = \frac{500}{0.7} = 714.286 VA$$

$$\cos \varphi_2 = 0.7 \Rightarrow \varphi_2 = 45.573^\circ$$

$$\varphi_3 = (-90^\circ)$$

$$Z_{1-3} = Z_1 // Z_2 // Z_3$$

$$Z_{1-3} = \left[(42.32 \angle 36.87^\circ)^{-1} + (74.06 \angle 45.573^\circ)^{-1} + (88.167 \angle -90^\circ)^{-1} \right]^{-1}$$

$$Z_{1-3} = 32.279 \angle 23.753^\circ \Omega = \underline{\underline{(29.545 + j13) \Omega}}$$

$$\cos \varphi = \cos(23.753^\circ) = \underline{\underline{0.9153}}$$

$$\textcircled{2} \quad \boxed{A=?} \quad \boxed{V=?} \quad \boxed{W=?}$$

$$Z_T = Z_{1-3} + Z_{\text{line}}$$

$$Z_T = 32.279 \angle 23.753^\circ + (2 + j3) = \underline{\underline{35.371 \angle 26.897^\circ \Omega}} = \underline{\underline{(31.545 + j16) \Omega}}$$

$$I_T = \frac{U_T}{Z_T}$$

$$I_T = \frac{230}{35.371 \angle 26.897^\circ} = 6.502 \angle -26.897^\circ \text{ A} \Rightarrow \boxed{A = 6.502 \text{ A}}$$

$$V = I_T \cdot Z_{1-3}$$

$$V = 6.502 \angle -26.897^\circ (32.279 \angle 23.753^\circ) = 209.893 \angle -3.144^\circ \text{ V}$$

$$\boxed{V = 209.893 \text{ V}}$$

$$P_{Z_{1-3}} = I^2 \cdot R_{1-3}$$

$$P_{Z_{1-3}} = 6.502^2 \cdot 29.545 = \underline{\underline{1249.04 \text{ W}}} \quad \boxed{W = 1249.04 \text{ W}}$$

$$\textcircled{2} \quad \underline{t = 4 \text{ h}} \quad \boxed{W=?}$$

$$W_T = P \cdot t = I_T^2 \cdot R_T \cdot t$$

$$W_T = 6.502^2 \cdot 31.545 \cdot 4 = \boxed{5.334 \text{ kWh}}$$

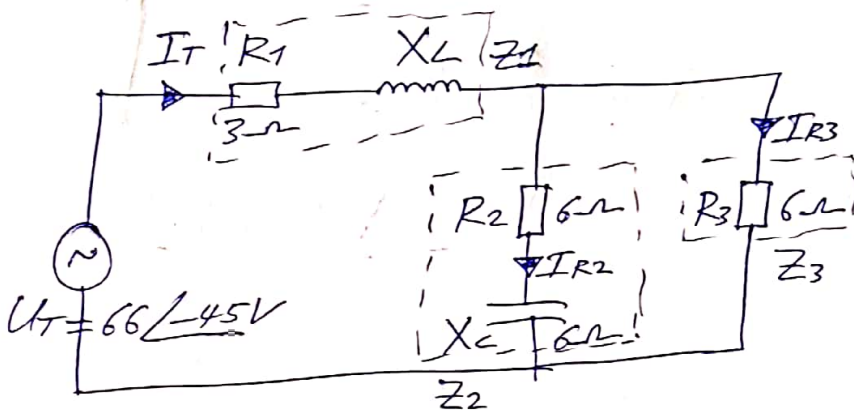
5 ימים 10 שאלות 2020 ג'י

$$U_{eff} = \frac{U_{max}}{\sqrt{2}}$$

$$U_{eff} = \frac{(66\sqrt{2}) \angle -45}{\sqrt{2}} = \underline{\underline{66 \angle -45V}}$$

$$\varphi = \frac{180}{4} = \underline{\underline{45V}}$$

1a) $X_L = ?$ הרבה



$$Z_{23} = Z_2 \parallel Z_3$$

$$Z_{23} = \frac{(6-j6) \cdot 6}{(6-j6)+6} = \frac{R \cdot X}{R+X} = (3.6 - j1.2) \Omega$$

כדי להחזיר את ה-180° של ה-45° שיש לי

$$\boxed{X_L = X_{23} = 1.2 \Omega}$$

2) $I_T = ?$ $I_{R2} = ?$ $I_{R3} = ?$ $P_T = ?$

$$Z_T = Z_{23} + Z_1$$

$$Z_T = (3.6 - j1.2) + (3 + j1.2) = \underline{\underline{6.6 \Omega}}$$

$$I_T = \frac{U_T}{Z_T}$$

$$I_T = \frac{66 \angle -45}{6.6} = \boxed{10 \angle -45 A}$$

$$U_{z2} = U_{z3} = U_T - (I_T \cdot Z_1)$$

$$U_{z2} = U_{z3} = 66 \angle -45^\circ - [10 \angle -45^\circ (3 + j1.2)] = 37.947 \angle -63.435^\circ \text{ V}$$

$$I_{R2} = \frac{U_{z2}}{Z_2}$$

$$I_{R2} = \frac{37.947 \angle -63.435^\circ}{(6 - j6)} = \boxed{4.472 \angle -18.435^\circ \text{ A}}$$

$$I_{R3} = \frac{U_{z3}}{Z_3}$$

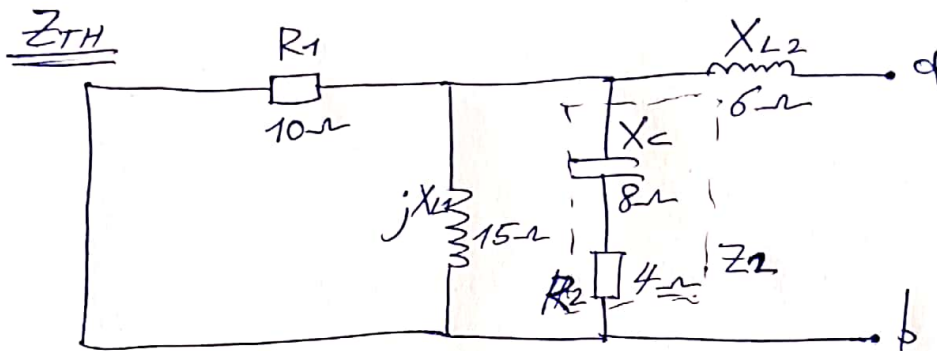
$$I_{R3} = \frac{37.947 \angle -63.435^\circ}{6} = \boxed{6.3245 \angle -63.435^\circ \text{ A}}$$

$$S_T = U \cdot I^*$$

$$S_T = 66 \angle -45^\circ \cdot 10 \angle 45^\circ = (660 + j0) \text{ VA} \Rightarrow \boxed{P_T = 660 \text{ W}}$$

6. 10. 2020 8:17

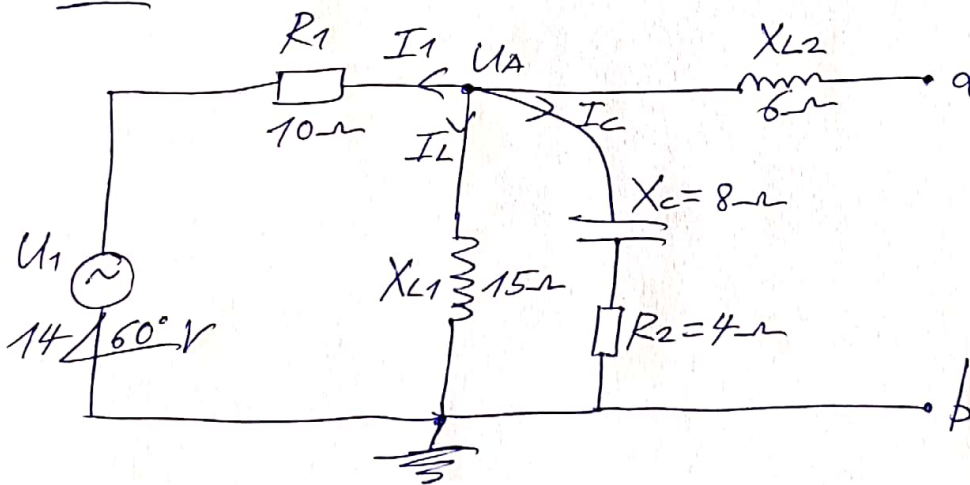
1) $Z_{TH}=?$ $U_{TH}=?$



$$Z_{TH} = (R_1 \parallel jX_{L1} \parallel Z_2) + X_{L2}$$

$$Z_{TH} = \left[(10)^{-1} + (j \cdot 15)^{-1} + (4 - j8)^{-1} \right]^{-1} + j6 = \boxed{7.836 \angle 35.84^\circ \Omega}$$

U_{TH}

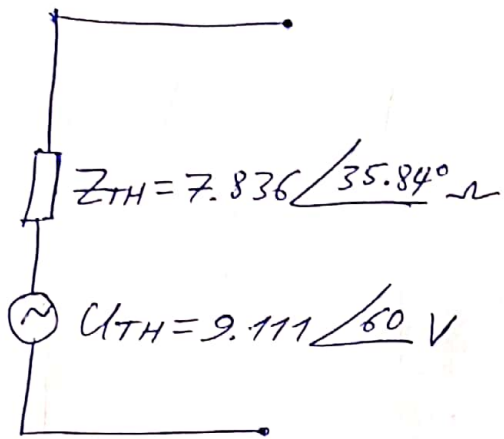


$$\frac{U_A - 14 \angle 60}{10} + \frac{U_A}{j \cdot 15} + \frac{U_A}{4 - j8} = 0$$

$$U_A \left(\frac{1}{10} + \frac{1}{j \cdot 15} + \frac{1}{4 - j8} \right) = \frac{14 \angle 60}{10}$$

$$0.15366 U_A = 1.4 \angle 60$$

$$\boxed{U_A = 9.111 \angle 60 \text{ V} = U_{TH}}$$



$$\textcircled{1} Z_{RL} = Z_{TH}^* = \boxed{7.836 \angle -35.84^\circ \Omega = (6.352 - j 4.588) \Omega}$$

$$\textcircled{2} \boxed{P_{ZL}=?} \quad \boxed{S_{ZL}=?} \quad \boxed{Q_{ZL}=?}$$

$$I_T = \frac{U_{TH}}{Z_{TH} + Z_L}$$

$$I_T = \frac{9.111 \angle 60}{7.836 \angle 35.84 + 7.836 \angle -35.84} = 0.71714 \angle 60 \text{ A}$$

$$P_{ZL} = I^2 \cdot R_L$$

$$P_{ZL} = 0.71714^2 \cdot 6.352 = \boxed{3.2667 \text{ W}}$$

$$Q_{ZL} = I^2 \cdot X_C$$

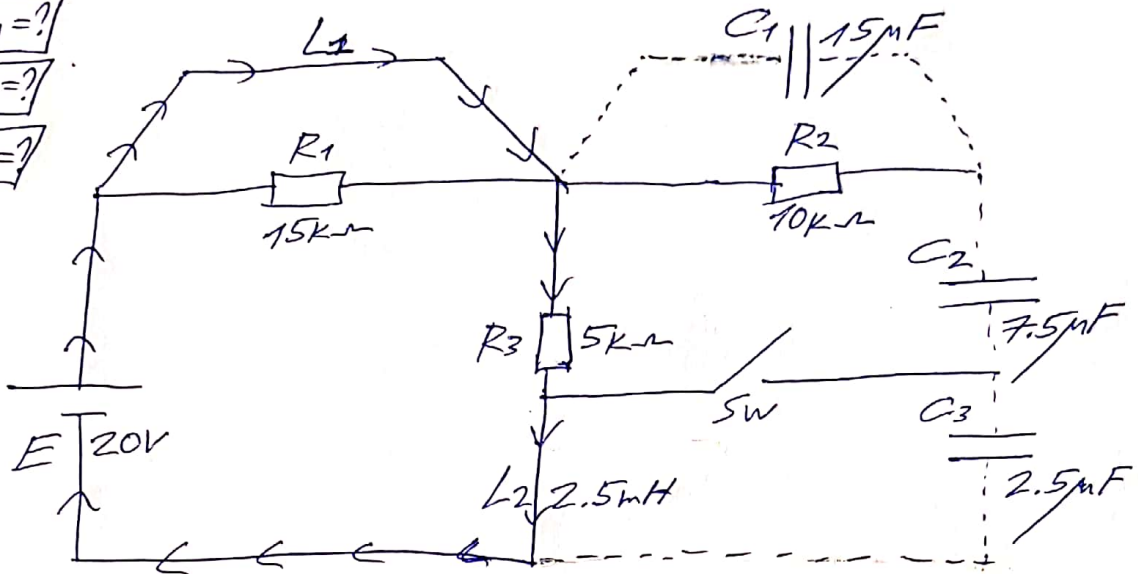
$$Q_{ZL} = 0.71714^2 \cdot 4.588 = \boxed{2.3596 \text{ VAR}}$$

$$S = (3.2667 - j 2.3596) = \boxed{4.03 \angle -35.84^\circ \text{ VA}}$$

פונקציה של הזרם והמתח
המתח והזרם הם תלויים זה בזה.

7. idke % 28/11/2020

- 1) $P_{R1}=?$
 $P_{R2}=?$
 $P_{R3}=?$



$$P_{R1} = P_{R2} = \boxed{0W}$$

$$I_T = \frac{E}{R_3}$$

$$I_T = \frac{20}{5k} = \underline{4mA}$$

$$P_{R3} = I_T^2 \cdot R_3$$

$$P_{R3} = 4m^2 \cdot 5k = \boxed{80mW}$$

- 2) $Q_{C1}=?$ $Q_{C2}=?$ $Q_{C3}=?$

$$\boxed{Q_{C1} = 0C}$$

$$C_{23} = \frac{C_2 \cdot C_3}{C_2 + C_3}$$

$$C_{23} = \frac{7.5\mu \cdot 2.5\mu}{7.5\mu + 2.5\mu} = \underline{1.875\mu F}$$

$$Q_{C23} = U_{C23} \cdot C_{23}$$

$$U_{C23} = U_{R3} = \underline{20V}$$

$$Q_{C23} = Q_{C2} = Q_{C3} = 20 \cdot 1.875\mu = \boxed{37.5\mu C}$$

$$\textcircled{2} \boxed{W_T = ?}$$

$$W_{L1} = \frac{I_T^2 \cdot L_1}{2}$$

$$W_{L1} = \frac{4\text{m}^2 \cdot 5\text{m}}{2} = \underline{40\text{mJ}}$$

$$W_{L2} = \frac{I_T^2 \cdot L_2}{2}$$

$$W_{L2} = \frac{4\text{m}^2 \cdot 2.5\text{m}}{2} = \underline{20\text{mJ}}$$

$$W_{C23} = \frac{U_{C23}^2 \cdot C_{23}}{2}$$

$$W_{C23} = \frac{20^2 \cdot 1.875\text{m}}{2} = \underline{375\text{mJ}}$$

$$W_T = W_{L1} + W_{L2} + W_{C23}$$

$$W_T = 40\text{m} + 20\text{m} + 375\text{m} = \boxed{375.06\text{mJ}}$$

$$\textcircled{3} \boxed{W_T = ?} \quad \underline{\text{SW on!}}$$

$$W_{C3} = 0\text{J} \quad (\text{shorted})$$

$$W_{C2} = \frac{U_{C2}^2 \cdot C_2}{2}$$

$$W_{C2} = \frac{20^2 \cdot 7.5\text{m}}{2} = \underline{1.5\text{mJ}}$$

$$W_T = W_{L1} + W_{L2} + W_{C2}$$

$$W_T = 40\text{m} + 60\text{m} + 1.5\text{m} = \boxed{1.5001\text{mJ}}$$

! תשובה נכונה ושלמה

8 הדיקור 16 28/11/2020 פי

ד"דו	182 ✓	ד"דו
$N=180$ $I=0.4A$	$L_1=312.159 \times 10^{-3}m$ $\mu r=1400$ $A=3.1416 \times 10^{-4}m^2$	$L=2 \times 10^{-3}m$ $\mu r=1$ $A=3.1416 \times 10^{-4}m^2$

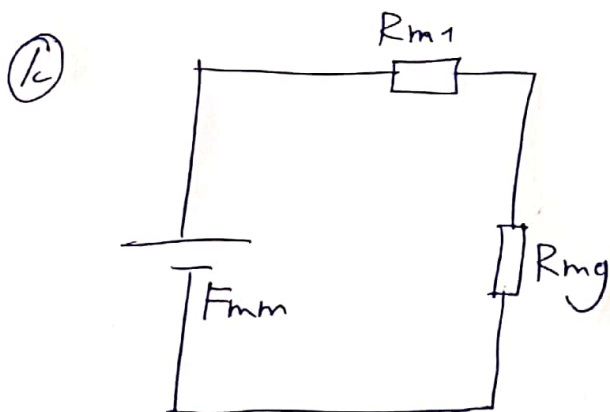
$$L_1 = 2\pi \cdot \frac{R+r}{2} \cdot l_0$$

$$L_1 = 2\pi \cdot \frac{60m+40m}{2} \cdot 2m = \underline{312.159mm}$$

$$A = \frac{D^2 \cdot \pi}{4}$$

$$A = \frac{20m^2 \cdot \pi}{4} = \underline{3.1416 \times 10^{-4}m^2}$$

קווי הדיקור
! הדיקור ד"דו



2 B=?

$$B = \frac{\phi}{A}$$

$$\phi = \frac{N \cdot I}{R_{meq}}$$

$$R_{m1} = \frac{L}{\mu_0 \cdot \mu_r \cdot A}$$

$$R_{m1} = \frac{312.159 \times 10^{-3}}{\mu_0 \cdot 1400 \cdot 3.1416 \times 10^{-4}} = 564790.1 \frac{1}{H}$$

$$R_{mg} = \frac{L_g}{\mu_0 \cdot \mu_r \cdot A}$$

$$R_{mg} = \frac{2 \times 10^{-3}}{\mu_0 \cdot 1 \cdot 3.1416 \times 10^{-4}} = 5068628.76 \frac{1}{H}$$

$$R_{meq} = R_{m1} + R_{mg}$$

$$R_{meq} = 564790.1 + 5068628.76 = \underline{\underline{5633418.86 \frac{1}{H}}}$$

$$\phi = \frac{N \cdot I}{R_{meq}}$$

$$\phi = \frac{180 \cdot 0.4}{5633418.86} = 12.781 \mu Wb$$

$$B = \frac{\phi}{A}$$

$$B = \frac{12.781 \mu}{3.1416 \times 10^{-4}} = \boxed{0.0407 T}$$

$$\textcircled{\Sigma} \boxed{F=?} \quad \underline{I=1.4 A}$$

$$F = B \cdot I \cdot L \cdot \sin \alpha$$

$$F = 0.0407 \cdot 1.4 \cdot 20 m \cdot \sin(90) = \boxed{1.1396 mN}$$

9. 10. 2020

$$R_L = 10 \Omega$$

$$\textcircled{1} f = ?$$

$$f = \frac{1}{T}$$

$$f = \frac{1}{8\text{m}} = \boxed{125\text{Hz}}$$

$$\textcircled{2} Q_{\text{av}} = ?$$

$$U_{\text{av}} = \frac{\Delta S}{T}$$

$$U_{\text{av}} = \frac{6\text{m} \cdot 5 - 2\text{m} \cdot 2}{8\text{m}} = \underline{3.25\text{V}}$$

$$I_{\text{av}} = \frac{U_{\text{av}}}{R_L}$$

$$I_{\text{av}} = \frac{3.25}{10} = \underline{325\text{mA}}$$

$$Q_{\text{av}} = I_{\text{av}} \cdot T$$

$$Q_{\text{av}} = 325\text{m} \cdot 8\text{m} = \boxed{2.6\text{mC}}$$

$$\textcircled{3} P_{\text{av}} = ?$$

$$U_{\text{eff}_T} = \sqrt{\frac{U_{\text{eff}_1^2 \cdot \Delta t + U_{\text{eff}_2^2 \cdot \Delta t}}{T}}$$

$$U_{\text{eff}_T} = \sqrt{\frac{5^2 \cdot 6\text{m} + 2^2 \cdot 2\text{m}}{8\text{m}}} = 4.444\text{V}$$

$$P_{\text{av}} = \frac{U_{\text{eff}}^2}{R_L}$$

$$P_{\text{av}} = \frac{4.444^2}{10} = \boxed{1.975\text{W}}$$

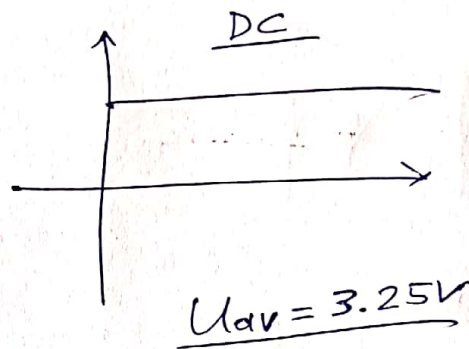
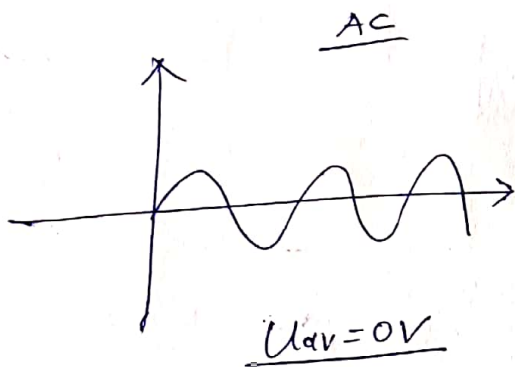
$$\textcircled{2} U(t) = A + B \cdot \sin(\omega t) \quad [A=?] \quad [B=?] \quad [\omega=?]$$

$$\underline{P_{av} = 1.975W} \quad \underline{Q_{av} = 2.6mC}$$

$$Q_{av} = 2.6mC \Rightarrow I_{av} = 325mA$$

$$U_{av} = I_{av} \cdot R_L$$

$$U_{av} = 325m \cdot 10 = 3.25V$$



$$U_{avDC} = U_{effDC} = \underline{3.25V}$$

$$P_{av} = 1.975W$$

$$P_{av} = \frac{U_{eff}^2}{R_L}$$

$$U_{eff} = \sqrt{P_{av} \cdot R_L}$$

$$U_{eff} = \sqrt{1.975 \cdot 10} = \underline{4.444V}$$

$$U_{effT} = \sqrt{U_{effAC}^2 + U_{effDC}^2}$$

$$U_{effAC} = \sqrt{U_{effT}^2 - U_{effDC}^2}$$

$$U_{effAC} = \sqrt{4.444^2 - 3.25^2} = 3.03V$$

$$U_{maxAC} = U_{eff} \cdot \sqrt{2}$$

$$U_{maxAC} = 3.03 \cdot \sqrt{2} = 4.285V \Rightarrow B = \underline{4.285V}$$

$$\omega = 2\pi \cdot f$$

$$\omega = 2\pi \cdot 125 = \underline{250\pi \frac{rad}{sec}}$$