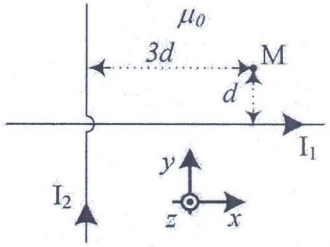
DRUGI KOLOKVIJUM IZ ELEKTROTEHNIKE
23. februar 2020.
GRUPA 1

1. Na Slici 1 prikazana su dva pravolinijska veoma dugačka provodnika sa strujama intenziteta $I_1 = I$ i $I_2 = 6I$, gde je $I = 5\text{A}$, koji se nalaze u vazduhu ($\mu = \mu_0$). Provodnici se nalaze u istoj ravni i međusobno zaklapaju ugao $\frac{\pi}{2}$. Odrediti i skicirati vektor jačine magnetnog polja $\vec{H}_M$ u tački M, koja se nalazi u istoj ravni, na rastojanju d=0.1m od provodnika sa strujom I_1 i na rastojanju $3d$ od provodnika sa strujom I_2. **(8 poena)**

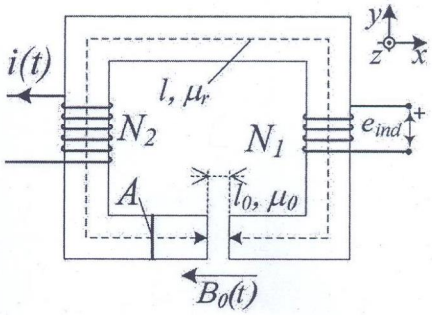


Slika 1

2. Na Slici 2 prikazano je magnetno kolo, koje se sastoji od jezgra, relativne magnetne permeabilnosti $\mu_r = 300$, dužine srednje linije $l = 60\text{cm}$ i vazdušnog procepa debljine $l_0 = 1\text{mm}$. Poprečni presek jezgra iznosi $A = 5\text{cm}^2$. Namotaj sa $N_1 = 200$ navojaka je otvorenih krajeva, a kroz namotaj sa $N_2 = 100$ navojaka protiče struja nepoznatog intenziteta. Poznato je da se u vazdušnom procepu intenzitet vektora magnetne indukcije $\vec{B}_0(t)$ menja u vremenu po formuli $B_0(t) = B_{0m}\cos\omega t$, gde je $B_{0m} = 8\pi\,\text{mT}$ i $\omega = 100\,\text{rad/s}$.

a) Odrediti trenutnu vrednost struje $i(t)$. **(6 poena)**

b) Odrediti efektivnu vrednost indukovane ems (E_{ind}) u namotaju čiji su krajevi otvoreni. **(6 poena)** (Poznato je: $\mu_0 = 4\pi \cdot 10^7\,\text{H/m}$)

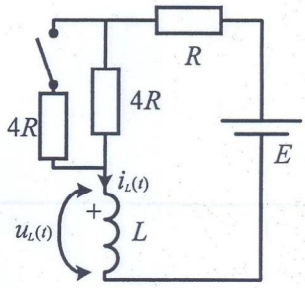


Slika 2

3. U kolu na Slici 3 poznate su parametri elemenata E, R i L. Prekidač П je zatvoren i u kolu je uspostavljeno stacionarno stanje. U trenutku $t = 0$, prekidač se otvara.

a) Odrediti izraz za struju i napon kalema nakon otvaranja prekidača i nacrtati odgovarajuće vremenske dijagrame. **(8 poena)**

b) Odrediti trenutak t_1 u kome energija kalema opadne na 64% svoje maksimalne vrednosti. **(2 poena)**



Slika 3

4. Kroz pretežno induktivni potrošač, koji je priključen na izvor naizmeničnog napona $U = 150\,\text{V}$, $\omega = 700\,\text{rad/s}$, protiče struja efektivne vrednosti $I = 30\,\text{A}$. Aktivna snaga potrošača iznosi $P = 2700\,\text{W}$. Odrediti kapacitivnost kondenzatora koji treba priključiti paralelno potrošaču da bi se dobio faktor snage $\cos\varphi = 0.8$. **(10 poena)**

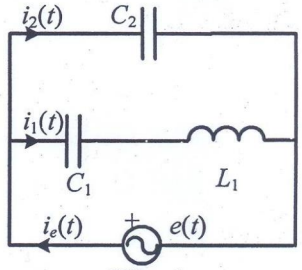
5. U kolu na slici 4 poznato je: $e(t) = 100\sqrt{2}\sin(1000t + \pi)\,\text{V}$, $C_1 = 50\,\mu\text{F}$, $C_2 = 100\,\mu\text{F}$, $L_1 = 25\,\text{mH}$. Odrediti:

a) kompleksne struje u granama i nacrtati fazorski dijagram, **(5 poena)**

b) efektivnu vrednost napona kondenzatora kapacitivnosti C_1, **(2 poena)**

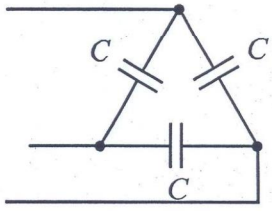
c) vremenski oblik napona na kalemu induktivnosti L_1, **(2 poena)**

d) aktivnu, reaktivnu i prividnu snagu celokupnog potrošača. **(3 poena)**



Slika 4

6. Na sistem trofaznog napona $3\times 400\text{V}$, $f = 25/\pi\,\text{Hz}$ priključen je simetričan trofazni potrošač sačinjen od tri kondenzatora povezana u trougao (Slika 5). Prividna snaga potrošača je $S = 12\,\text{kVA}$. Odrediti efektivnu vrednost linijske struje, reaktivnu snagu potrošača i kapacitivnost kondenzatora. **(8 poena)**

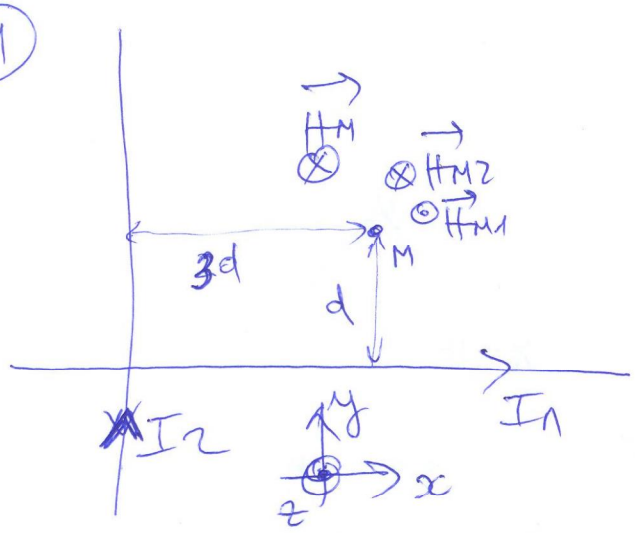


Slika 5

I grupa

$$H = \frac{B}{\mu_0} = \frac{I}{2\pi r}$$

(1)



$$\vec{H}_M = \vec{H}_{M1} + \vec{H}_{M2} =$$

$$= \frac{I_1}{2\pi d}\vec{k} + \frac{I_2}{2\pi \cdot 3d}(-\vec{k}) =$$

$$= \frac{I}{2\pi d}\vec{k} - \frac{6I}{6\pi d}\vec{k} =$$

$$= -\frac{I}{2\pi d}\vec{k} = -\frac{25}{\pi}\frac{A}{m}\vec{k}$$

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(2) a)

A.3.

$$H \cdot l + H_0 \cdot l_0 = N_2 \cdot i(t)$$

$$B = B_0$$

$$\frac{B_0}{\mu_r \mu_0} l + \frac{B_0}{\mu_0} l_0 = N_2 \cdot i(t)$$

$$\frac{B_0}{\mu_0}\left(\frac{l}{\mu_r} + l_0\right) = N_2 i(t)$$

$$i(t) = \frac{B_0(t)}{N_2 \mu_0}\left(\frac{l}{\mu_r} + l_0\right) =$$

$$= \frac{8\pi \cdot 10^{-3} \cdot \cos\omega t}{100 \cdot 4\pi \cdot 10^{-7}} \cdot \left(\frac{600 \cdot 10^{-3}}{300} + 1 \cdot 10^{-3}\right) =$$

$3 \cdot 10^{-3}$ m

$$= 0{,}6 \cdot \cos\omega t \ [A]$$

b)

$$B = B_0$$

$$\Phi = B_0 \cdot A$$

$$e_{ind} = -\frac{d(N_1 \Phi)}{dt} = -N_1 \cdot \frac{d\Phi}{dt} =$$

$$= -N_1 \cdot A \cdot \frac{d\, B_0(t)}{dt} = -N_1 \cdot A \cdot B_{0m} \cdot \omega \cdot (-\sin\omega t)$$

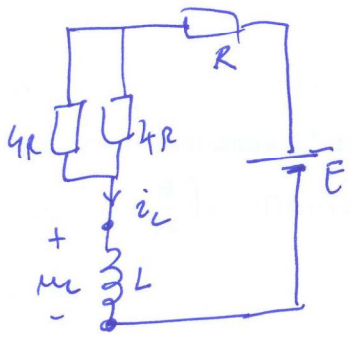
$$= N_1 A B_{0m} \omega \sin\omega t = 200 \cdot 5 \cdot 10^{-4} \cdot 8\pi \cdot 10^{-3} \cdot 100 \cdot \sin\omega t$$

$$= 0{,}08\pi \sin\omega t$$

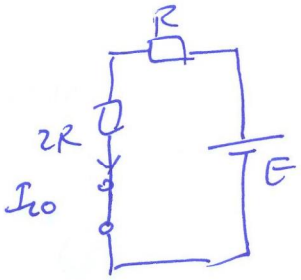
E_m

$$E = \frac{E_m}{\sqrt{2}} = \frac{0{,}08\pi}{\sqrt{2}} \approx 0{,}18\ V$$

(3) a)

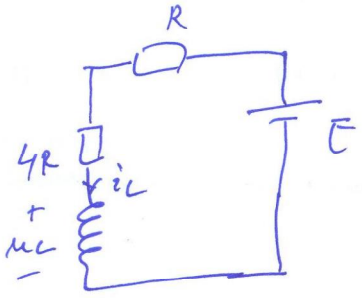


$\Rightarrow$ STAC. ST.



$$I_{L0} = \frac{E}{3R}$$

POČETNI USLOV



$$E - 5R\,i_L - u_L = 0$$

$$u_L = L\frac{di_L}{dt}$$

$$L\frac{di_L}{dt} + 5R\,i_L = E \;/ : L$$

$$\frac{di_L}{dt} + \frac{i_L}{\frac{L}{5R}} = \frac{E}{L} \qquad \frac{L}{5R} = \tau, \quad \frac{E}{L} = k$$

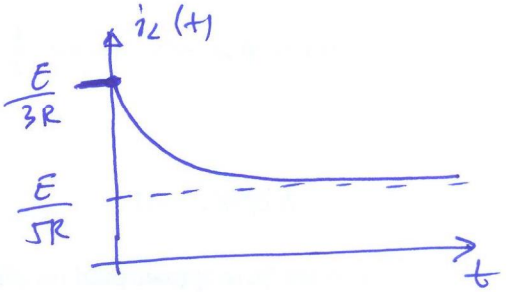
$$i_L(t) = Ae^{-t/\tau} + B$$

$$B = k\cdot\tau = \frac{E}{5R}$$

$$i_L(0) = A + B \Rightarrow A = I_{L0} - B$$

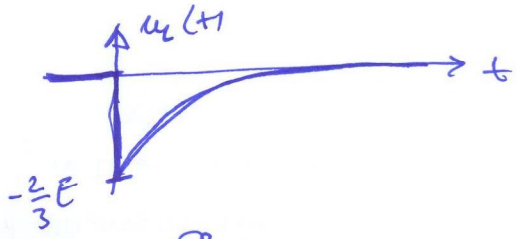
$$A = \frac{E}{3R} - \frac{E}{5R} = \frac{2E}{15R}$$

$$\boxed{i_L(t) = \frac{2E}{15R}e^{-\frac{5R}{L}t} + \frac{E}{5R}}$$



$$u_L(t) = L\frac{di_L}{dt} = L\cdot\frac{2E}{15R}\cdot\left(-\frac{5R}{L}\right)e^{-\frac{5R}{L}t}$$

$$\boxed{u_L(t) = -\frac{2}{3}Ee^{-\frac{5R}{L}t}}$$



b) $W_L(t) = \frac{1}{2}L\,i_L^2(t)$

$$W_{L\max} = \frac{1}{2}L\,I_{L\max}^2 = \frac{1}{2}L\left(\frac{E}{3R}\right)^2$$

$$W_L(t_1) = 0{,}64\cdot W_{L\max}$$

$$\frac{1}{2}L\,i_L^2(t_1) = 0{,}64\cdot\frac{1}{2}L\left(\frac{E}{3R}\right)^2$$

$$i_L^2(t_1) = \left(0{,}8\cdot\frac{E}{3R}\right)^2$$

$$i_L(t_1) = 0{,}8\frac{E}{3R}$$

$$\frac{2E}{15R}e^{-\frac{5R}{L}t_1} + \frac{E}{5R} = 0{,}8\frac{E}{3R} = \frac{8E}{30R} = \frac{4E}{15R}$$

$$\frac{2E}{15R}e^{-\frac{5R}{L}t_1} = \frac{4E}{15R} - \frac{E}{5R} = \frac{E}{15R}$$

$$e^{-\frac{5R}{L}t_1} = 1/2 \;/\ln(\cdot)$$

$$-\frac{5R}{L}t_1 = \ln(1/2)$$

$$t_1 = -\frac{L}{5R}\ln(1/2)$$

$$\boxed{t_1 = \frac{L}{5R}\ln(2)}$$

(4) $U = 150\,V$

$\omega = 700\,rad/s$

$I = 30\,A$

$P = 2700\,W$

$\cos\varphi_e = 0{,}8$

$S = UI = 150 \cdot 30 = 4500\,VA$

$Q = +\sqrt{S^2 - P^2} = \sqrt{4500^2 - 2700^2} = \sqrt{(5\cdot 900)^2 - (3\cdot 900)^2}$

$Q = 900\sqrt{5^2 - 3^2} = 900\sqrt{4^2} = 4 \cdot 900$

$Q = 3600\,VAR$

$P_e = P = 2700\,W \Rightarrow S_e = \frac{P_e}{\cos\varphi_e} = \frac{2700}{0{,}8} = 3375\,VA$

$\sin\varphi_e = \sqrt{1 - \cos^2\varphi_e} = \sqrt{1 - \frac{64}{100}} = \sqrt{\frac{36}{100}} = \frac{6}{10} = 0{,}6$

$Q_e = S_e \cdot \sin\varphi_e = 2025\,VAR$

$Q_e = Q + Q_c \Rightarrow Q_c = Q_e - Q = 2025 - 3600 = -1575\,VAR$

$Q_c = -\omega C U^2 \Rightarrow C = \frac{(-Q_c)}{\omega U^2} = \frac{1575}{700 \cdot 22500}$

$C = \frac{1575}{1575 \cdot 10^4} = 10^{-4}\,F$

$\boxed{C = 100\,\mu F}$

(5) $\bar{E} = 100 e^{j\bar{u}}\,V = -100\,V$

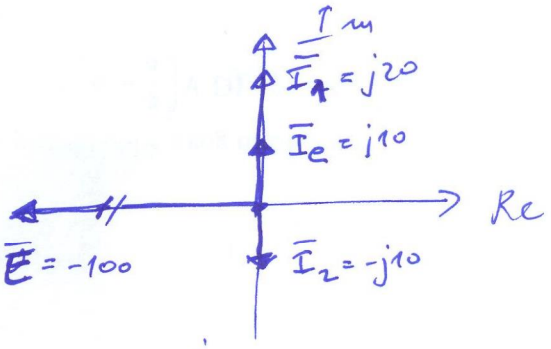
a) $\bar{Z}_1 = \bar{Z}_{C1} + \bar{Z}_{L1} = -j\frac{1}{10^3 \cdot 500 \cdot 10^{-6}} + j10^3 \cdot 25 \cdot 10^{-3} = -j20 + j25 = j5\,\Omega$

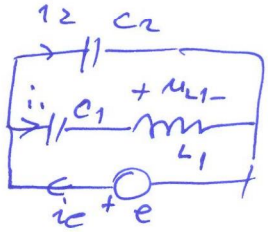
$\bar{Z}_2 = \bar{Z}_{C2} = -j\frac{1}{10^3 \cdot 100 \cdot 10^{-6}} = -j10\,\Omega$

$\bar{I}_1 = \frac{\bar{E}}{\bar{Z}_1} = \frac{-100}{j5} = j20\,A$

$\bar{I}_2 = \frac{\bar{E}}{\bar{Z}_2} = \frac{-100}{-j10} = -j10\,A$

$\bar{I}_e = \bar{I}_1 + \bar{I}_2 = j10\,A$





b) $U_{C1} = Z_{C1} \cdot I_1 = 20 \cdot 20 = 400\,V$

c) $\bar{U}_{L1} = \bar{Z}_{L1} \cdot \bar{I}_1 = j25 \cdot j20 = -500\,V = 500 e^{j\bar{u}}\,V$

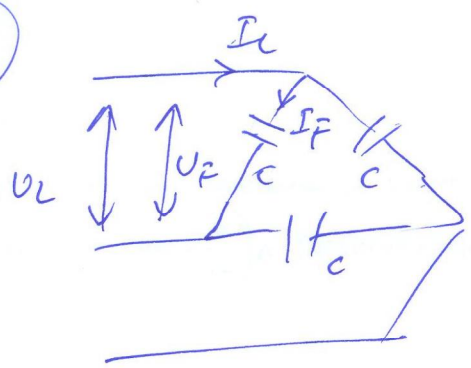
$u_{L1}(t) = 500\sqrt{2}\sin(1000t + \bar{u})$

d) $\bar{S}_{ze} = \bar{S}_e = \bar{E} \cdot \bar{I}_e^{*} = (-100) \cdot (-j10) = j1000\,VA \Rightarrow$

$P_e = 0\,W \quad Q_e = 1000\,VAR$

$S_e = 1000\,VA$

(6)



$U_L = U_F = 400V$

$S = 12\,kVA$

$S = U_F I_F \cdot 3 \Rightarrow I_F = \frac{S}{3U_F} = \frac{12000}{3 \cdot 400}$

$I_F = 10A$

$\boxed{I_L = I_F\sqrt{3} = 10\sqrt{3}\,A}$

$P = 0W$

$\boxed{Q = -S = -12\,kVAR \quad (\text{condensatore } Q < 0)}$

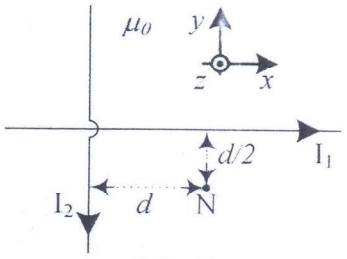
$Q = 3X_C I_F^2 = 3\left(-\frac{1}{\omega C}\right) \cdot I_F^2 = -\frac{3I_F^2}{\omega C}$

$C = \frac{3I_F^2}{f 2\pi (-Q)} = \frac{3 \cdot 10^2}{2\pi \cdot 25 \,(12 \cdot 10^3)} = \frac{1}{2000} = 0{,}5\,mF$

$\boxed{C = 0{,}5\,mF}$

DRUGI KOLOKVIJUM IZ ELEKTROTEHNIKE
23. februar 2020.
GRUPA 2

1. Na Slici 1 prikazana su dva pravolinijska veoma dugačka provodnika sa strujama intenziteta $I_1 = I$ i $I_2 = 4I$, gde je $I = 15\text{A}$, koji se nalaze u vazduhu ($\mu = \mu_0$). Provodnici se nalaze u istoj ravni i međusobno zaklapaju ugao $\frac{\pi}{2}$. Odrediti i skicirati **vektor** jačine magnetnog polja $\vec{H}_N$ u tački N koja se nalazi u istoj ravni, na rastojanju d=0.1m od provodnika sa strujom I_2 i na rastojanju $d/2$ od provodnika sa strujom I_1. **(8 poena)**

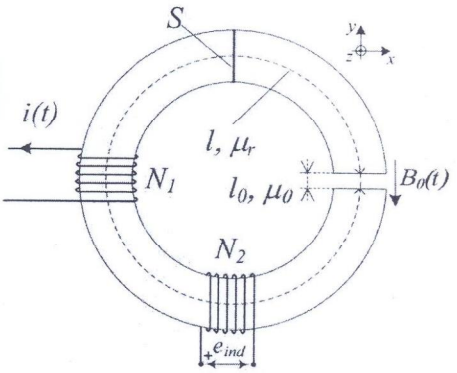


Slika 1

2. Na Slici 2 prikazano je magnetno kolo, koje se sastoji od jezgra, relativne magnetne permeabilnosti $\mu_r = 400$, dužine srednje linije $l = 40\text{cm}$, sa vazdušnim procepom debljine $l_0 = 1\text{mm}$. Poprečni presek jezgra iznosi $S = 10\text{cm}^2$. Namotaj sa $N_2 = 100$ navojaka je otvorenih krajeva, a kroz namotaj sa $N_1 = 200$ navojaka protiče struja nepoznatog intenziteta. Poznato je da se u vazdušnom procepu intenzitet vektora magnetne indukcije $\vec{B}_0(t)$ menja u vremenu po formuli $B_0(t) = B_{0m}\cos\omega t$, gde je $B_{0m} = 16\pi\,\text{mT}$ i $\omega = 1000\,\text{rad/s}$.

a) Odrediti trenutnu vrednost struje $i(t)$. **(6 poena)**

b) Odrediti efektivnu vrednost indukovane ems (E_{ind}) u namotaju čiji su krajevi otvoreni. **(6 poena)** (Poznato je: $\mu_0 = 4\pi\cdot 10^7\,\text{H/m}$)

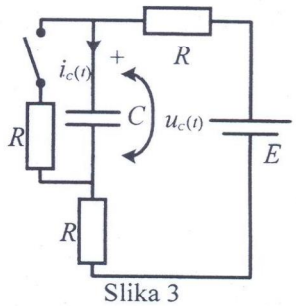


Slika 2

3. U kolu na Slici 3 poznate su parametri elemenata E, R i C. Prekidač Π je zatvoren i u kolu je uspostavljeno stacionarno stanje. U trenutku $t = 0$, prekidač se otvara.

a) Odrediti izraz za struju i napon kondenzatora nakon otvaranja prekidača i nacrtati odgovarajuće vremenske dijagrame. **(8 poena)**

b) Odrediti trenutak t_1 u kome energija kondenzatora dostigne 25% svoje maksimalne vrednosti. **(2 poena)**



Slika 3

4. Kroz potrošač, koji je priključen na izvor naizmeničnog napona $U = 1000\,\text{V}$, $\omega = 500\,\text{rad/s}$, protiče struja efektivne vrednosti $I = 10\,\text{A}$. Reaktivna snaga potrošača iznosi $Q = 8\,\text{kvar}$. Odrediti kapacitivnost kondenzatora koji treba priključiti paralelno potrošaču da bi se dobio faktor snage $\cos\varphi = 0.8$. **(10 poena)**

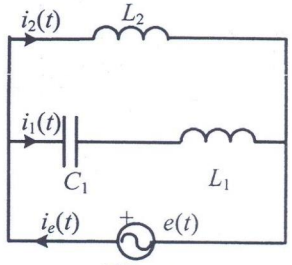
5. U kolu na slici 4 poznato je: $e(t) = 500\sqrt{2}\sin(500t - \pi)\,\text{V}$, $C_1 = 80\,\mu\text{F}$, $L_1 = 40\,\text{mH}$, $L_2 = 20\,\text{mH}$. Odrediti:

a) kompleksne struje u granama i nacrtati fazorski dijagram, **(5 poena)**

b) efektivnu vrednost napona kalema induktivnosti L_1, **(2 poena)**

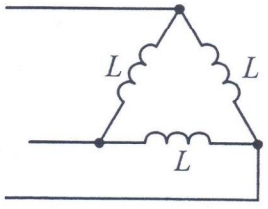
c) vremenski oblik napona na kondenzatoru kapacitivnosti C_1, **(2 poena)**

d) aktivnu, reaktivnu i prividnu snagu celokupnog potrošača. **(3 poena)**



Slika 4

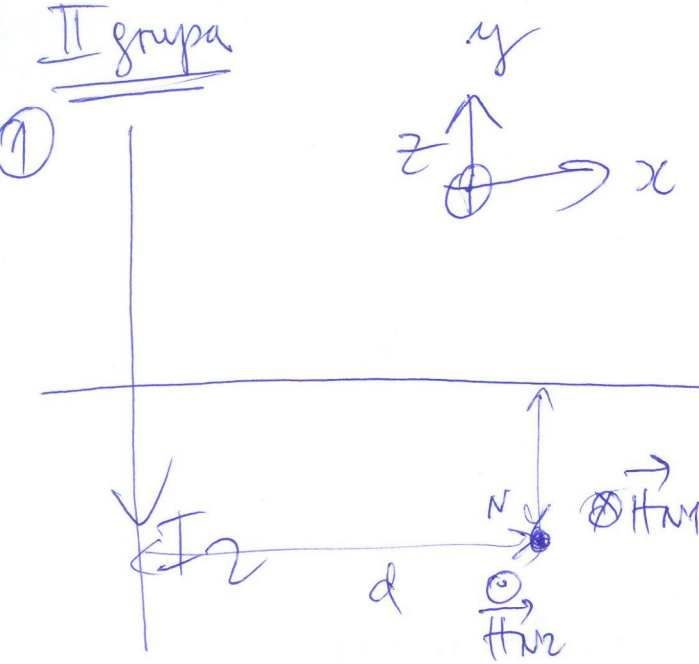
6. Na sistem trofaznog napona $3\times 400\,\text{V}$, $f = 25/\pi\,\text{Hz}$ priključen je simetričan trofazni potrošač koji je sačinjen od tri kalema povezana u trougao (Slika 5). Prividna snaga potrošača je $S = 24\,\text{kVA}$. Odrediti efektivnu vrednost linijske struje, reaktivnu snagu potrošača i induktivnost kalema. **(8 poena)**



Slika 5

II grupa

$$H = \frac{B}{\mu} = \frac{I}{2\pi r}$$

① 

$$\vec{H}_N = \vec{H}_{N1} + \vec{H}_{N2} =$$

$$= \frac{I_1}{2\pi\frac{d}{2}}(-\vec{k}) + \frac{I_2}{2\pi d}(\vec{k}) =$$

$$= \frac{I}{\pi d}(-\vec{k}) + \frac{4I}{2\pi d}\vec{k}$$

$$= \frac{I}{\pi d}\vec{k} = \frac{150}{\pi}\frac{A}{m}\vec{k}$$

---

② a)

A. 3.

$$Hl + H_0 l_0 = N_1 i(t)$$

$$B = B_0$$

$$\frac{B_0}{\mu_r \mu_0} l + \frac{B_0}{\mu_0} l_0 = N_1 i(t)$$

$$\frac{B_0}{\mu_0}\left(\frac{l}{\mu_r} + l_0\right) = N_1 i(t)$$

$$i(t) = \frac{B_0(t)}{N_1 \mu_0}\left(\frac{l}{\mu_r} + l_0\right) =$$

$$= \frac{16\pi \cdot 10^{-3}\cos\omega t}{200 \cdot 4\pi \cdot 10^{-7}}\left(\frac{400\cdot 10^{-3}}{400} + 1\cdot 10^{-3}\right)$$

$$= 0{,}4\cos\omega t\ [A]$$

b)

$$B = B_0$$

$$\phi = B_0 S$$

$$e_{ind} = -\frac{d(N_2\phi)}{dt} = -N_2\frac{d\phi}{dt} =$$

$$= -N_2 S\frac{dB_0(t)}{dt} = -N_2 S B_{0m}\omega(-\sin\omega t)$$

$$= N_2 S B_{0m}\omega \sin\omega t = 100 \cdot 10\cdot 10^{-4}\cdot 16\pi\cdot 10^{-3}\cdot 1000 \cdot \sin\omega t$$

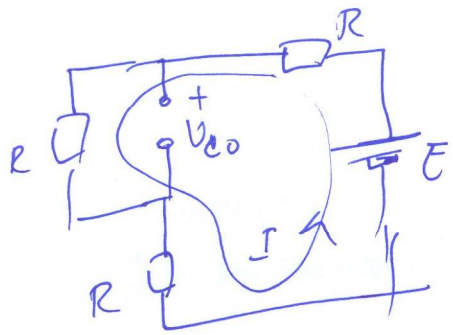
$$= 1{,}6\pi \sin\omega t\ [V]$$

$$E_m = 1{,}6\pi\ V$$

$$E = \frac{E_m}{\sqrt{2}} = \frac{1{,}6\cdot\pi}{\sqrt{2}} \approx 3{,}6\ V$$

(3)

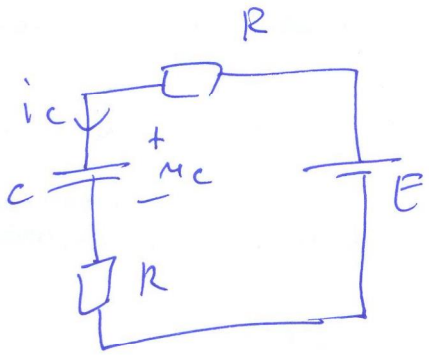
a)



$$I = \frac{E}{7R}$$

$$U_{c0} = R \cdot I = E/3$$

POČETNI USLOV!



$$E - 2Ri_c - u_c = 0$$

$$2Ri_c + u_c = E$$

$$i_c = C\frac{du_c}{dt}$$

$$2RC\frac{du_c}{dt} + u_c = E \;/ : 2RC$$

$$\frac{du_c}{dt} + \frac{u_c}{2RC} = \frac{E}{2RC}$$

$2RC = \tau$, $\frac{E}{2RC} = K$

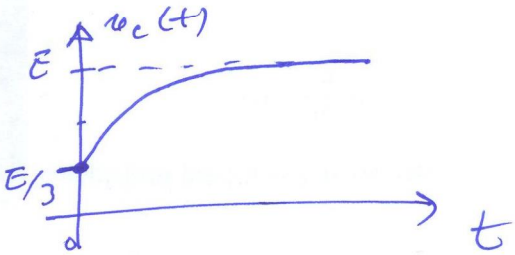
$$u_c(t) = Ae^{-t/\tau} + B$$

$$B = KI = E$$

$$U_{c0} = A + B \Rightarrow A = U_{c0} - B = E/3 - E$$

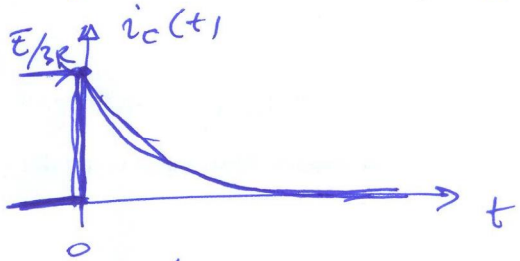
$$A = -\frac{2}{3}E$$

$$u_c(t) = -\frac{2}{3}Ee^{-\frac{t}{2RC}} + E$$



$$i_c(t) = C\frac{du_c}{dt} = C\cdot\left(-\frac{2}{3}E\right)\cdot\left(-\frac{1}{2RC}\right)e^{-\frac{t}{2RC}}$$

$$i_c(t) = \frac{E}{3R}e^{-\frac{t}{2RC}}$$



b)

$$W_c(t) = \frac{1}{2}Cu_c^2(t)$$

$$W_{cmax} = \frac{1}{2}C\left(\frac{E}{2}\right)^2$$

$$W_c(t_1) = 0{,}25 \cdot W_{cmax}$$

$$\frac{1}{2}Cu_c^2(t_1) = \frac{1}{4}\cdot\frac{1}{2}C\left(\frac{E}{2}\right)^2$$

$$u_c^2(t_1) = \left(\frac{E}{2}\right)^2$$

$$u_c(t_1) = \frac{E}{2}$$

$$-\frac{2}{3}Ee^{-\frac{t_1}{2RC}} + E = \frac{E}{2}$$

$$-\frac{2}{3}Ee^{-\frac{t_1}{2RC}} = -E/2$$

$$e^{-\frac{t_1}{2RC}} = \frac{3}{4} \;/ \ln(\cdot)$$

$$-\frac{t_1}{2RC} = \ln(3/4)$$

$$t_1 = -2RC\ln(3/4)$$

$$t_1 = 2RC\ln(4/3)$$

(4) $U = 1000V$

$\omega = 500 \frac{rad}{s}$

$I = 10A$, $Q = 8 kVAR$

$\cos\varphi_e = 0,8$

$S = UI = 10 kVA$

$P = \sqrt{S^2 - Q^2} = 6 kW$

$P_c = P = 6 kW$

$S_e = \frac{P_c}{\cos\varphi_c} = 7,5 kVA$

$Q_e = \sqrt{S_e^2 - P_c^2} = \sqrt{7500^2 - 6000^2}$

$Q_e = \sqrt{(5 \cdot 1500)^2 - (4 \cdot 1500)^2}$

$Q_e = 1500\sqrt{5^2 - 4^2} = 1500\sqrt{3^2} = 3 \cdot 1500$

$\boxed{Q_e = 4500 VAR}$

$Q_c = Q + Q_c$

$Q_c = Q_e - Q$

$Q_c = 4500 - 8000$

$\boxed{Q_c = -3500 VAR}$

$Q_c = -\omega C U^2 \Rightarrow C = \frac{(-Q_c)}{\omega U^2} = \frac{3500}{500 \cdot 10^6} = 7 \cdot 10^{-6}$

$\boxed{C = 7 \mu F}$

(5) a) $\bar{E} = 500\, e^{+j\bar{\pi}} = -500\,V$

$$\bar{Z}_{C1} = -j\frac{1}{\omega C_1} = -j\frac{1}{500 \cdot 80 \cdot 10^{-6}} = -j25\,\Omega$$

$$\bar{Z}_{L1} = j\omega L_1 = j\,500 \cdot 40 \cdot 10^{-3} = j20\,\Omega$$

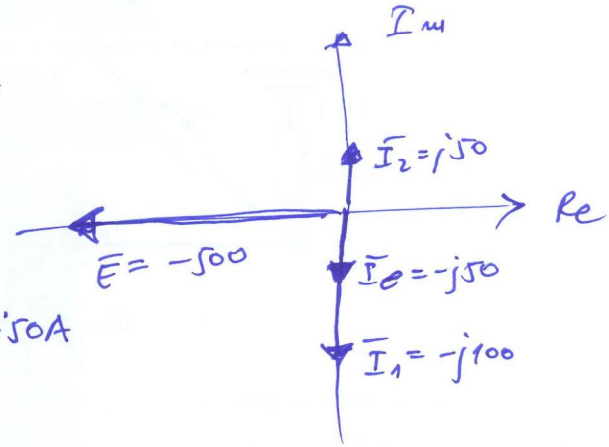
$$\bar{Z}_1 = \bar{Z}_{L1} + \bar{Z}_{C1} = j20 - j25 = -j5\,\Omega$$

$$\bar{Z}_2 = \bar{Z}_{L2} = j\omega L_2 = j\,500 \cdot 20 \cdot 10^{-3} = j10\,\Omega$$

$$\bar{I}_1 = \frac{\bar{E}}{\bar{Z}_1} = \frac{-500}{-j5} = -j100\,A$$

$$\bar{I}_2 = \frac{\bar{E}}{\bar{Z}_2} = \frac{-500}{j10} = j50\,A$$

$$\bar{I}_e = \bar{I}_1 + \bar{I}_2 = -j100 + j50 = -j50\,A$$



b) $U_{L1} = X_{L1} \cdot I_1 = 20 \cdot 100 = 2\,kV$

c) $\bar{U}_{C1} = \bar{Z}_{C1} \cdot \bar{I}_1 = (-j25) \cdot (-j100) = -2500\,V = 2500\, e^{+j\bar{\pi}}\,V$

$u_C(t) = 2500\sqrt{2}\,\sin(500t + \bar{\pi})\,V$

d) $\bar{S}_{ze} = \bar{S}_e = \bar{E} \cdot \bar{I}_e^{\,*} = (-500)(-j50)^* = (-500)(j50)$

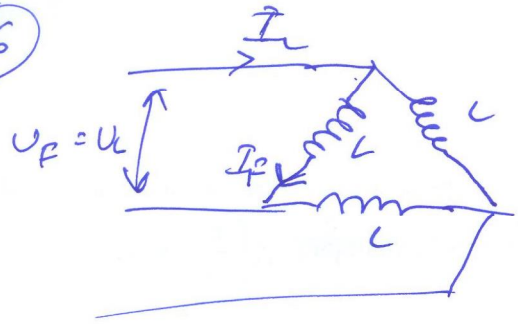
$\bar{S}_{ze} = -j25000\,VA$

$P_{ze} = 0\,W$

$Q_{ze} = -25\,kVAR$

$S_{ze} = 25\,kVA$

(6)



$$U_F = U_L = 400V$$

$$S = 3 U_F I_F$$

$$I_F = \frac{S}{3U_F} = \frac{24000}{3 \cdot 400} = 20\,A$$

$$\boxed{I_L = I_F \sqrt{3} = 20\sqrt{3}\,A}$$

$$P = 0\,W \Rightarrow \boxed{Q = S = 24\,kVAR}$$

$$Q = 3 X_F \cdot I_F^2 \Rightarrow X_F = \frac{Q}{3 I_F^2} = \omega L$$

$$L = \frac{Q}{3\omega I_F^2} = \frac{24000}{3 \cdot 2 \cdot \pi \cdot \frac{25}{\pi} \cdot (20)^2}$$

$$\boxed{L = 0{,}4\,H}$$