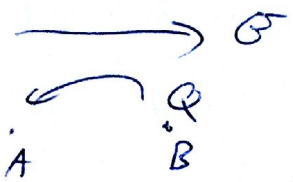
① $E = 10\ MV/m$

$Q_0 = -100\ pC$



$U_{BA} = \frac{W_{BA}}{Q_0} \Rightarrow W_{BA} = U_{BA} \cdot Q_0$

$U_{BA} = \varphi_B - \varphi_A < 0$ (smjer polja)

$U_{BA} = -E \cdot (x_B - x_A) = -200\ kV$

$W_{BA} = -200 \cdot 10^3 \cdot (-100 \cdot 10^{-12}) = 20\ \mu J$

---

② $S = 20\ cm^2 = 20 \cdot 10^{-5}\ m^2$

$d = 0.5 \cdot 10^{-3}\ m$

$W = 10\ \mu J$

E u kondenzatoru je homogenog stoga $U = E \cdot d$

$E = \frac{U}{d}$

$W = \frac{CU^2}{2} \Rightarrow U = \sqrt{\frac{2W}{C}}$

$C = \varepsilon_0 \frac{S}{d} = 3.54 \cdot 10^{-11}\ F$

$U = 751.47\ V$

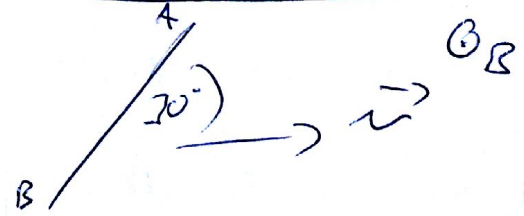
$E = 1502937 \frac{V}{m} = 1.5 \frac{kV}{cm}$

---

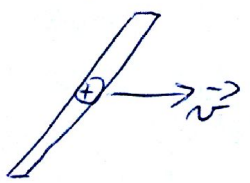
③ $l = 1\ m$

$B = 0.5\ T$

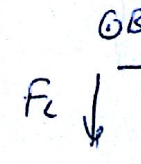
$v = 6\ m\,s^{-1}$



$|U| = Blv \sin\alpha = 1.5\ V$



$\vec{F_L} = Q(\vec{v} \times \vec{B})$

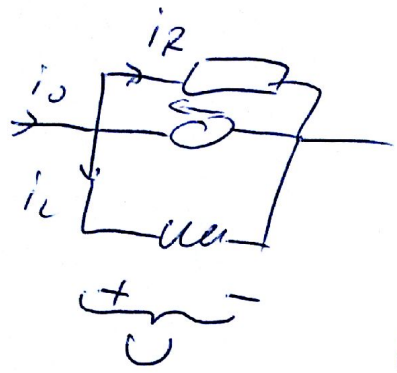


smjer

$\varphi_B > \varphi_A$

$U_{AB} = -1.5\ V$

④ $i(t) = 2A$, $i_L(t) = -2t$ } $t = 2s$ → $i(t) = 2A$, $i_L(t) = -5A$



$\frac{di_L}{dt} = -2$

$U = L \cdot \frac{di_L}{dt} = 2.5 \cdot (-2) = -5V$

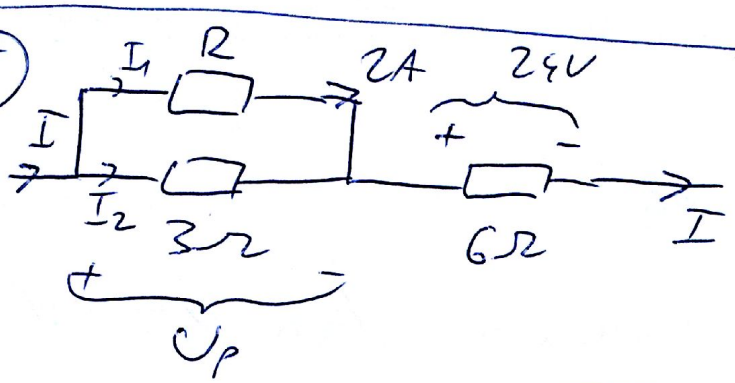
$i_R = \frac{U}{R} = -\frac{5V}{5\Omega} = -1A$

KZS: $i_0 + i = i_L + i_R$

$i_0 = i_L + i_R - i = -5 - 1 - 2 = -7A$

---

⑤



$I = \frac{24}{6} = 4A$

$I_1 + I_2 = 4A$

$2 + I_2 = 4$

$I_2 = 2A$

$U_p = I_2 \cdot 3$

$U_p = 6V$

$R = \frac{U_p}{I_1} = 3\Omega$

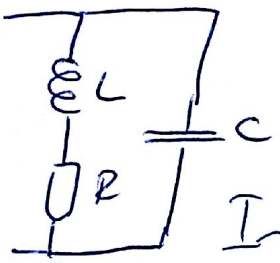
---

⑥ $I = 2 + j2 \Rightarrow I = 2\sqrt{2}\angle 45°$

$i(t) = 2\sqrt{2} \cdot \sqrt{2} \sin(\omega t + 45°) = 4 \sin 45° = 2\sqrt{2}\ A$

---

⑦



Rez $\Rightarrow$ $\mathrm{Im}(Y) = 0$

$Y = \frac{1}{R + jX_L} + \frac{1}{-jX_C} = \frac{R - jX_L}{R^2 + X_L^2} + j\frac{1}{X_C}$

$\mathrm{Im}(Y) = \frac{-X_L}{R^2 + X_L^2} + \frac{1}{X_C} = 0$

$\frac{X_L}{R^2 + X_L^2} = \frac{1}{X_C}$

$X_L X_C = R^2 + X_L^2$

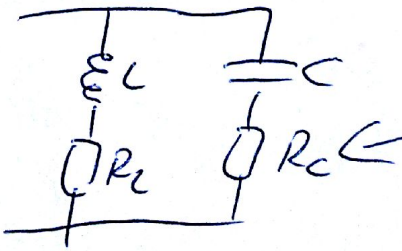
$L\omega \frac{1}{C\omega} = R^2 + L^2\omega^2$

$\frac{L}{C} = R^2 + L^2\omega^2$

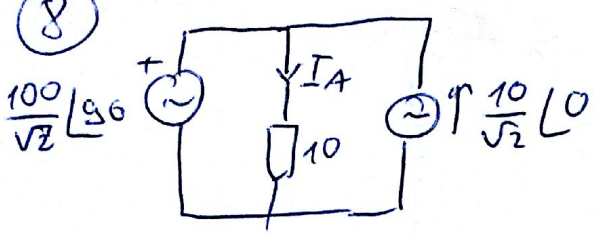
$\omega = \frac{1}{L}\sqrt{\frac{L}{C} - R^2} = 3000 \frac{rad}{s}$

ILI SLUŽBENI S.

$\omega_0 = \frac{1}{\sqrt{LC}} \sqrt{\frac{R_L^2 - \frac{L}{C}}{R_C^2 - \frac{L}{C}}}$ U2 $R_C = 0$



(8)



$$I_A = \left| \frac{\frac{100}{\sqrt{2}}\angle 90}{10} \right| = \left| \frac{10}{\sqrt{2}}\angle 90 \right| = 5\sqrt{2}\ A$$

Strujni izvor je "prespojen"

superpoziciju:

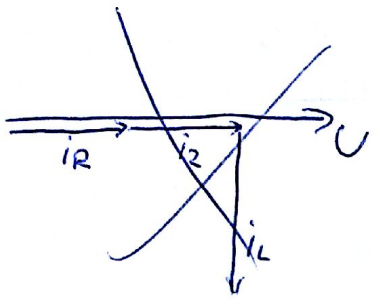
---

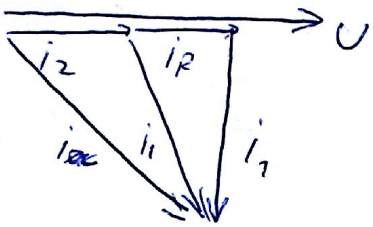
(9) $\dot{U} = |U|\angle 0^\circ\ V$

$I = 30$

$I_1 = 18$

$I_2 = 15$





Pitagora:

$$(i_2 + i_R)^2 + i_L^2 = i_{ekv}^2$$

$$i_R^2 + i_L^2 = i_1^2 \quad / -$$

$$i_2^2 + 2 i_2 i_R + i_R^2 - i_R^2 = i^2 - i_1^2$$

$$15^2 + 2 \cdot 15 \cdot i_R + 0 = 30^2 - 18^2$$

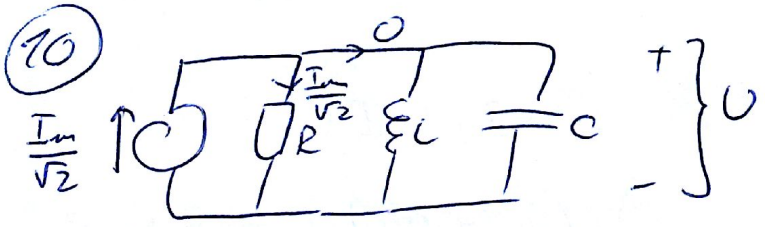
$$i_R = 11.7\ A$$

$$U = I_2 \cdot 4 = 60\ V$$

$$R = \frac{U}{i_R} = 5.1\ \Omega$$

---

(10)



$$U = \frac{I_m}{\sqrt{2}} \cdot R$$

$$i_L = \left| \frac{U}{jX_L} \right| = \left| \frac{\frac{I_m}{\sqrt{2}} R}{jL\omega} \right|$$

$$i_L = \frac{I_m R}{L\omega\sqrt{2}}$$

---

(11) PRILAGODBA IZVORA OTPORU. (NE OTPORA IZVORU!)

$Z_{izv} \rightarrow$ najmanji $\Rightarrow R$ najmanji

$$R = 1$$

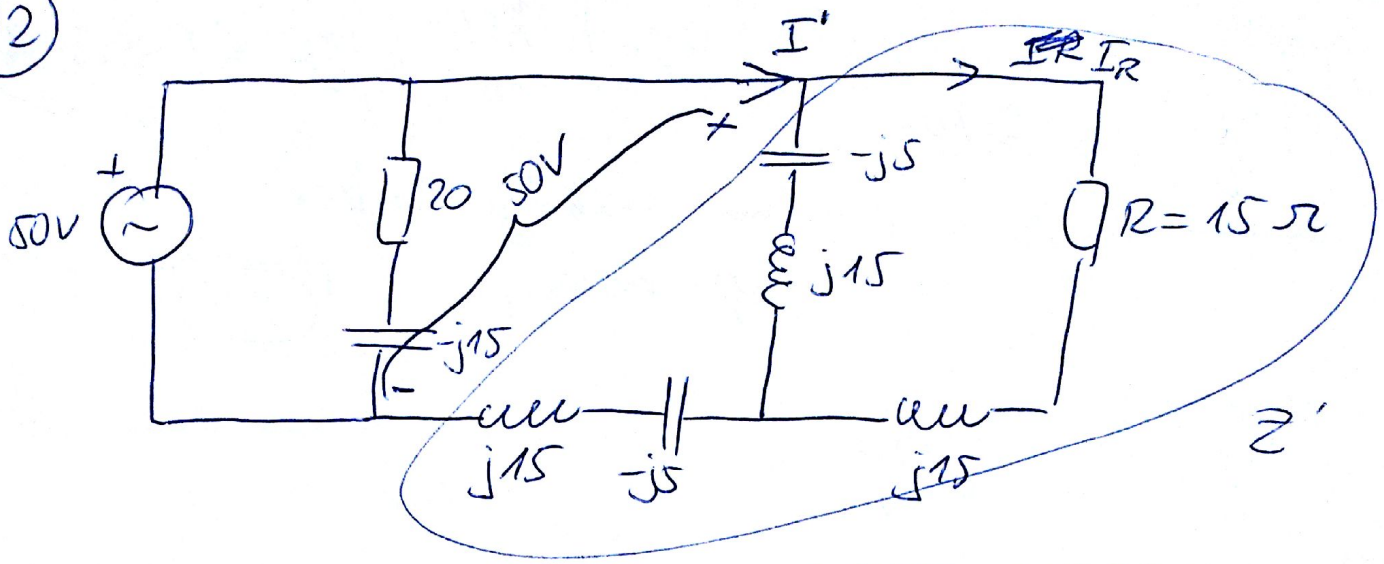
→ najmanji otpor ⇒ najveća struja.

$$P_{TROŠ} = I^2 \cdot R_T$$

↑

NE MIJENJAMO OVO!

(12)



$$Z' = [j10 \parallel (15+j15)] + j10 = 1.765 + j17.06\ \Omega$$

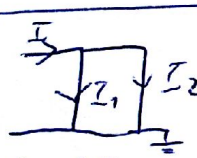
$$I' = \frac{50V}{Z'} = \frac{3}{10} - j2.9\ A$$

$$I_R = I' \cdot \frac{j10}{j10+15+j15} = 1\angle -53^\circ$$

$$P = |I|^2 \cdot R = 1^2 \cdot 15 = 15\ W$$

---

(13) $P_1 = 0$



$R = X_L = X_C$

$$I_1 = I \cdot \frac{R - jR}{2R} = I\,\frac{1-j}{2}$$

$$I_2 = I \cdot \frac{R + jR}{2R} = I\,\frac{1+j}{2}$$

$$P_4 = I_1 \cdot jR = I\,\frac{1-j}{2}\,jR$$

$$= IR\,(0.5 + j0.5)\ V$$

$$P_5 = I_2 \cdot (-jR) = I\,\frac{1+j}{2}\,(-jR)$$

$$-IR\,(0.5 - j0.5)\ V$$

$$U_{4T} = IR(0.5+j0.5) - IR(0.5-j0.5)$$

$$= IR(j) = IR\angle 90$$

$$IR\angle 90 = 20\angle 90 \Rightarrow IR = 20$$

$$P_2 = P_4 + I_1 R + I(jR)$$

$$= IR(0.5+j0.5) + I\,\frac{1-j}{2}R + jIR$$

$$= IR\left(0.5 + j0.5 + \frac{1-j}{2} + j\right)$$

$$= 20(1+j)$$

$$U_{12} = 0 - 20(1+j)$$

$$= -20 - j20$$

$$= 20\sqrt{2}\angle -135^\circ\ V$$

15

$I_m(Y_{uc}) = 0$

$I_m\left(\frac{1}{jX_L} + \frac{1}{8-j8}\right) = 0$

$I_m\left(-j\frac{1}{X_L} + \frac{1}{8} + j\frac{1}{8}\right) = 0$

$\frac{1}{8} - \frac{1}{X_L} = 0 \Rightarrow X_L = 8$

$U = |1 \cdot j8| = 8V$

$U = 8\angle 0$

$I_{DESNO} = \frac{8\angle 0}{8-j8}$

$I_D = 1+j = \sqrt{2}\angle 45°$

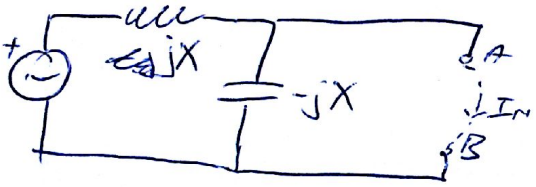
$P = |I_D|^2 \cdot 8 = 8W$

15

$U_{ef} = \sqrt{\left(\frac{8}{\sqrt{2}}\right)^2 + \left(\frac{8}{\sqrt{2}}\right)^2} = 2\sqrt{16}V$

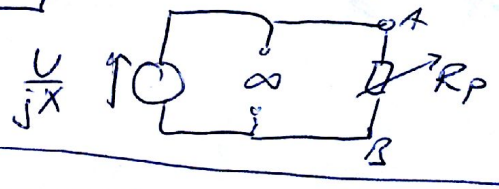
$P = \frac{U^2}{R} = 16W$

16



$Z_m = jX \,||\, -jX = \infty$

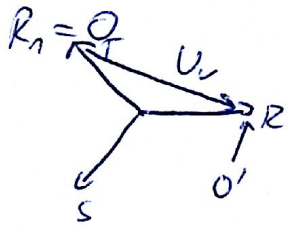
$I_m = \frac{U}{jX}$



IDEALNI STRUJNI IZVOR.

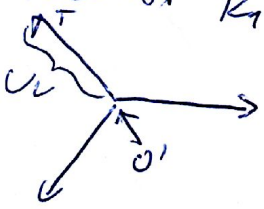
$I_p = const$

17



$R_1 = 0$

$U_V = U_L$



$R_1 = R$

$U_V = U_R$

$R_1 \to \infty$

$U_V \approx \frac{U_L}{2}$

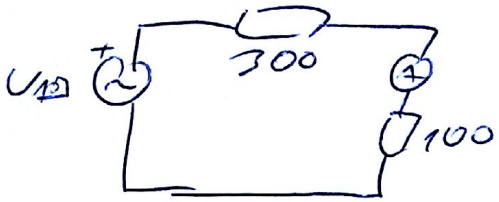
pada →

(18) $Z_{TH} = (100 \,||\, j100 \,||\, -j100) + (200 \,||\, -j50 \,||\, j50) = 300\,\Omega$

$$U_A = \frac{\frac{220\angle 0}{-j100} + \frac{220\angle -120}{j100} + \frac{220\angle -240}{100}}{\frac{1}{100} + \frac{1}{j100} + \frac{1}{-j100}} = 601.05\angle 120^\circ\ V$$

$$U_B = \frac{\frac{220\angle 0}{j50} + \frac{220\angle -120}{-j50} + \frac{220\angle -240}{200}}{\frac{1}{j50} + \frac{1}{-j50} + \frac{1}{200}} = 1305.20\angle -60^\circ\ V$$

$U_{AB} = U_A - U_B = 1905.25\angle 120^\circ\ V$



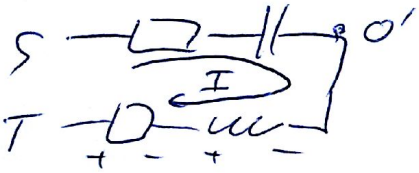
$$I_A = \left| \frac{U_{TH}}{300+100} \right| = 5.76\ A$$

---

(19)

$U_x = U_R = 180\angle 0$

$$I_{//} = \frac{U_S - U_R}{100 - j100 + j100 + 100} = -j\ 1.55\ A$$

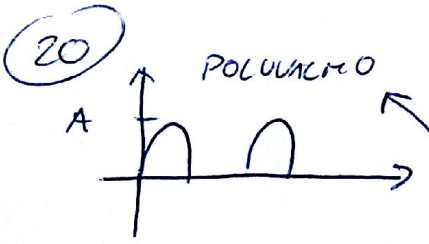


$U_O' = U_T + I(100 + j100) = 65.88\ V$

$U_V = |U_x - U_y| = 111.1\ V$

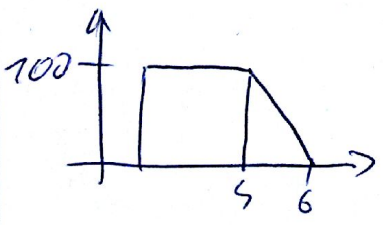
---

(20)



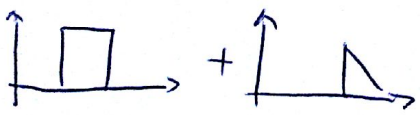
$EF = A \cdot \frac{A}{\sqrt{2}} \cdot \sqrt{\frac{1}{2}} = \frac{A}{2}$

$A = EF \cdot 2$



$T = 6$

$$EF = \sqrt{\left(100 \cdot \sqrt{\frac{3}{6}}\right)^2 + \left(\frac{100}{\sqrt{3}}\sqrt{\frac{2}{6}}\right)^2} = 78.17$$



POLUVALNO

$A = EF \cdot 2 = 156.3\ V$