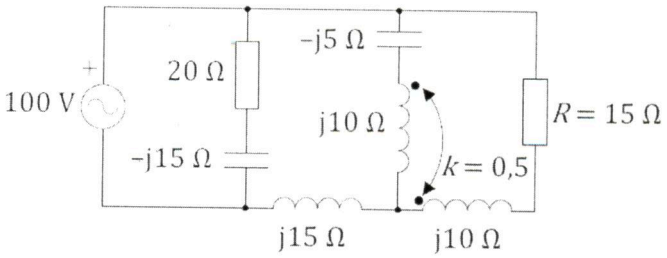
3. MASOVNE INSTRUKCIJE IZ OSNOVA ELEKTROTEHNIKE 2016./17.

1. DIO – SNAGA, TOPOGRAFSKI DIJAGRAMI, KRUGOVI IZMJENIČNE STRUJE

LJR 14-15

13. Izračunajte snagu na otporniku R u spoju prema slici.
3 boda

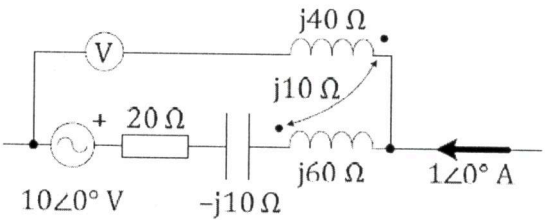
A) 30 W
B) 60 W
C) 90 W
D) 120 W
E) 150 W



ZR 15-16

12. Koliki napon mjeri idealni voltmetar u dijelu mreže prema slici?
3 boda

A) 30 V
B) $30\sqrt{2}$ V
C) $30\sqrt{5}$ V
D) 50 V
E) 75 V



ZR 13-14

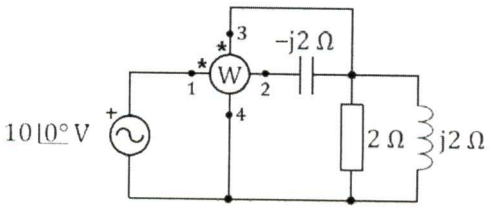
2. (2b) Serijski su spojeni otpornik $R = 5\Omega$ i kapacitet $X_C = 15\Omega$. Ako je napon na otporniku jednak $U_R = 31.623$V, odredite radnu i jalovu snagu spoja.

A) $P = 200\,\text{W}, Q = -600\,\text{VAr}$ B) $P = 200\,\text{W}, Q = 600\,\text{VAr}$ C) $P = 600\,\text{W}, Q = -200\,\text{VAr}$
D) $P = 600\,\text{W}, Q = 200\,\text{VAr}$ E) $P = 0\,\text{W}, Q = 0\,\text{VAr}$

ZR 14-15

10. Odredite koliku snagu pokazuje vatmetar (strujne stezaljke 1 i 2, naponske stezaljke 3 i 4) u mreži prema slici.
3 boda

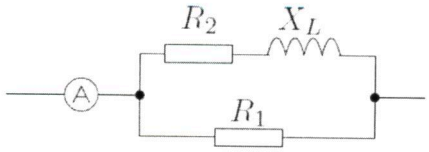
A) 12,5 W
B) 25 W
C) 32,5 W
D) 45 W
E) 50 W



ZI 14-15

6. (3b) Odredite pokazivanje ampermetra u mreži prema slici ako je ukupna radna snaga u krugu jednaka $P_{uk} = 1100\text{W}$, te $R_1 = 10\Omega$, $R_2 = 6\Omega$ i $X_L = 8\Omega$.

A) $I_A = 14.03\,\text{A}$
B) $I_A = 14.83\,\text{A}$
C) $I_A = 19.24\,\text{A}$
D) $I_A = 20.98\,\text{A}$
E) $I_A = 25.69\,\text{A}$

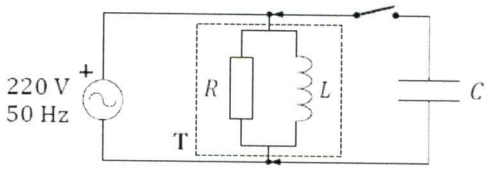


ZI 15-16

1. *3 boda*

Induktivno trošilo **T** sa $\cos\varphi = 0{,}707$ i $R = 22\ \Omega$ priključeno je na izvor prema slici. Koliki najmanji kapacitet C treba priključiti paralelno trošilu da bi se $\cos\varphi$ cijelog spoja povećao na 0,866?

A) 21,15 μF
B) 33,33 μF
C) 47,15 μF
D) 61,15 μF
E) 87,32 μF

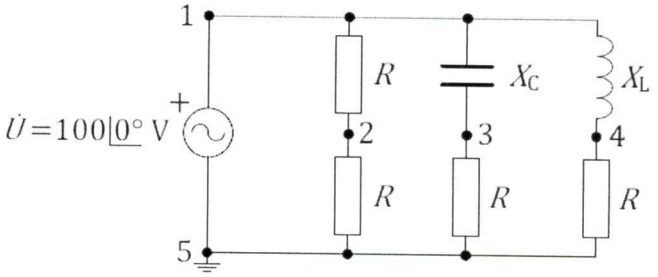


DR 15-16

11. *3 boda*

Ako je $R = X_\text{L} = X_\text{C}$, fazor napona $\dot{U}_{54}$ u odnosu na fazor napona $\dot{U}_{24}$:

A) prethodi 45°
B) zaostaje 45°
C) prethodi 90°
D) zaostaje 90°
E) u fazi je

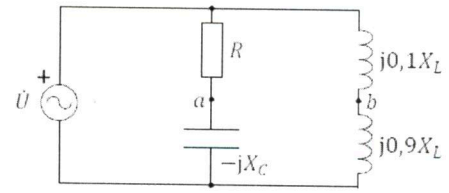


ZI 15-16

2. *3 boda*

Napon $U_{ab} = 6{,}403$ V. Odredite efektivnu vrijednost struje izvora. Zadano $R = X_C = X_L = 10\ \Omega$.

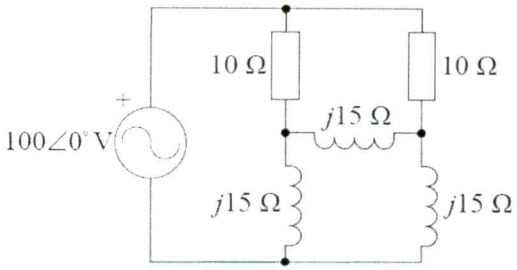
A) 2 A
B) $\sqrt{2}$ A
C) 1 A
D) $\sqrt{2}/2$ A
E) 1/2 A



ZI 12-13

5. Odrediti struju izvora u mreži prema slici.
3 boda

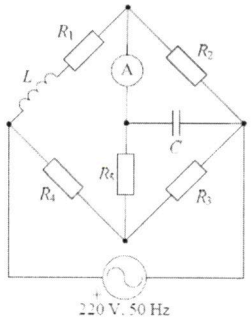
A) $I = 12{,}5$ A
B) $I = 11{,}1$ A
C) $I = 9{,}7$ A
D) $I = 7{,}4$ A
E) $I = 6{,}1$ A



ZI 13-14

9. U spoju prema slici struja kroz ampermetar iznosi $I_A = 0$. Zadano je:
3 boda $R_2 = 1$ kΩ, $R_3 = R_4 = 2$ kΩ, $R_5 = 200$ Ω, $C = 1$ μF. Odredite R_1.

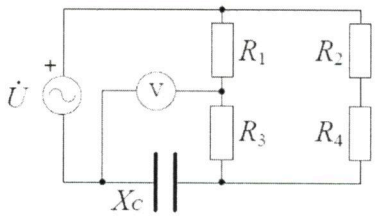
A) $R_1 = 5$ kΩ
B) $R_1 = 4$ kΩ
C) $R_1 = 1$ kΩ
D) $R_1 = 3$ kΩ
E) $R_1 = 2$ kΩ



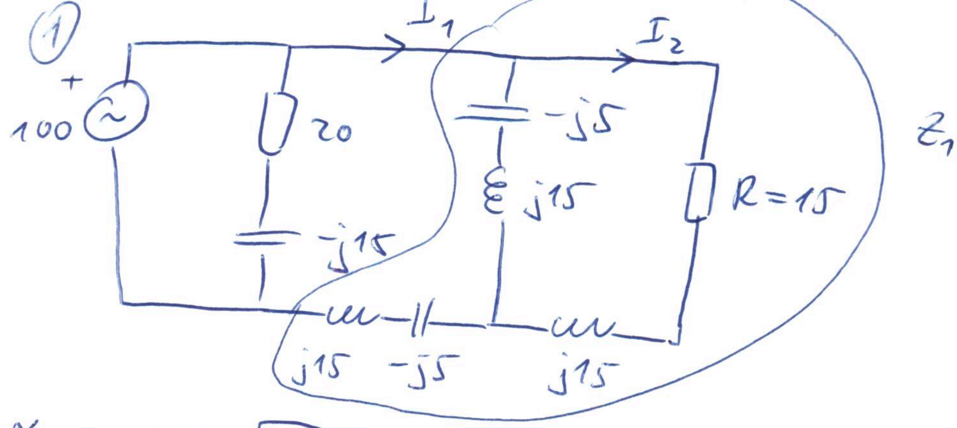
JR 11-12

17. Koliki iznos napona pokazuje voltmetar u mreži prema slici? Zadano je: $R_1 = 8$ Ω, $R_2 = 8$ Ω,
3 boda $R_3 = 4$ Ω, $R_4 = 16$ Ω, $X_C = 8$ Ω, $U = 24$ V.

A) 15,8 V
B) 17,9 V
C) 19,9 V
D) 22,0 V
E) 24,0 V



①



$$X_M = 0.5 \cdot \sqrt{10 \cdot 10} = 5$$

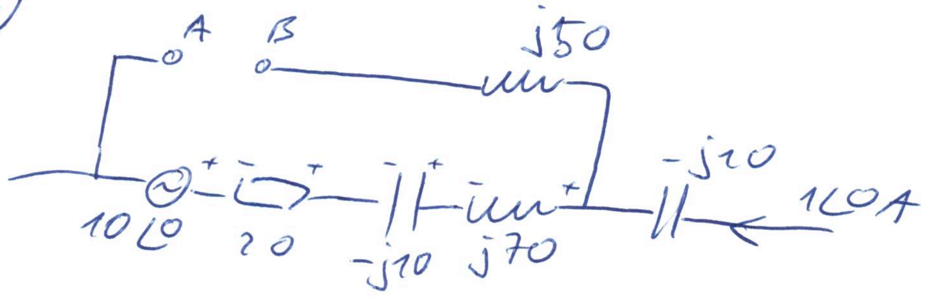
$$Z_1 = \left[j10 \,||\, (15 + j15) \right] + j10 = 17.15 \angle 84^\circ \ \Omega$$

$$I_1 = \frac{100}{Z_1} = 0.6 - j5.8 \ A$$

$$I_2 = I_1 \cdot \frac{j10}{j10 + 15 + j15} = 1.2 - j1.6 \ A = 2 \angle -53^\circ \ A$$

$$P_R = |I_2|^2 \cdot R = 2^2 \cdot 15 = 60 W$$

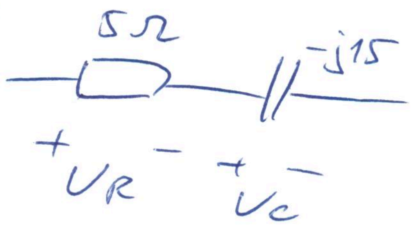
②



$$U_V = |U_{AB}| = \left| -1\angle 0 \cdot (j70 - j10 + 20) - 10\angle 0 \right| = |-30 - j60| = 30\sqrt{5} \ V$$

SNAGA

③



$$|U_R| = 31,623 V$$

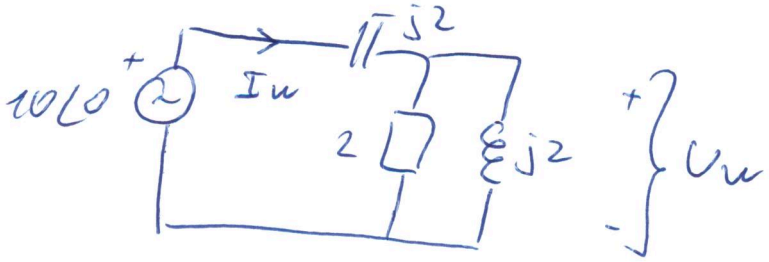
$$|I| = \frac{|U_R|}{R} = 6,3246 A$$

$$P = |I|^2 \cdot R = 200 W$$

$$Q = |I|^2 \cdot X_C = -600 VAr$$

④

$$P_w = |U_w| \cdot |I_w| \cdot \cos(\theta_{U_w} - \theta_{I_w})$$



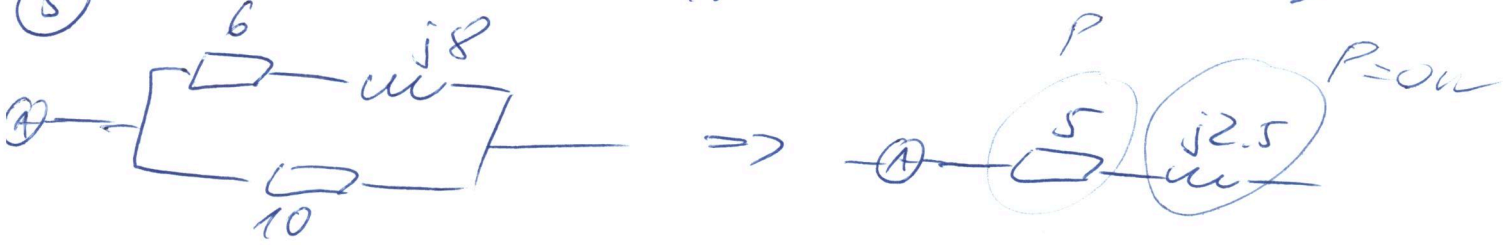
$$Z_{uc} = -j2 + 2 \| j2 = 1 - j1\ \Omega \quad \Omega$$

$$I_{uc} = I_w = \frac{10\angle 0}{Z_{uc}} = 5 + j5 = 5\sqrt{2}\angle 45^\circ\ A$$

$$U_w = I_{uc} \cdot [2 \| j2] = j10\ V = 10\angle 90\ V$$

$$P_w = 10 \cdot 5\sqrt{2} \cdot \cos(\underbrace{90 - 45}_{45}) = 50\sqrt{2} \cdot \frac{\sqrt{2}}{2} = 50\ W$$

⑤



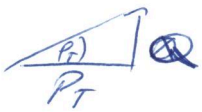
$$Z = 10 \| (6 + j8) = 5 + j2.5$$

$$P_{uc} = |I_A|^2 \cdot 5$$

$$I_A = \sqrt{\frac{1100}{5}} = 19,83A$$

⑥

$$P_T = \frac{220^2}{22} = 2200W$$



$$Q_T = P_T \cdot tg\theta_T = P_T \cdot tg(\arccos 0.707)$$

$$Q_T = +2200\ var$$

$\cos\varphi' = 0{,}866$

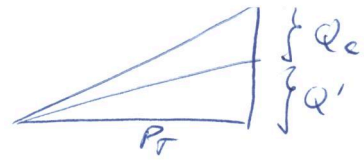
$\varphi' = \pm 30°$

$Q_c = \frac{|U|^2}{X_c} = |U|^2 \cdot C \cdot \omega$

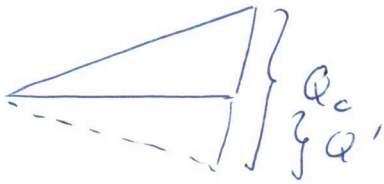
$Q_c \sim \omega$

⊕ → 1)

⊖ → 2)



manji C



veći C

$Q' = P_T \cdot tg(\arccos 0{,}866) = 1270\,var$

$Q_c = Q_T - Q' = 2200 - 1270 = 930\,var$

$930 = \frac{220^2}{X_c} = 220^2 \cdot 2\pi \cdot 50 \cdot C$

$C = \frac{930}{220^2 \cdot 2\pi \cdot 50} = 61{,}16\,\mu F$

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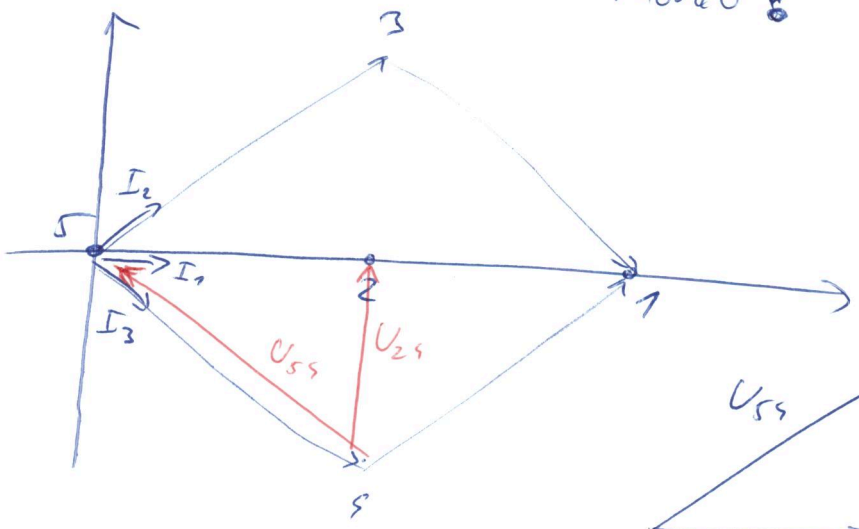
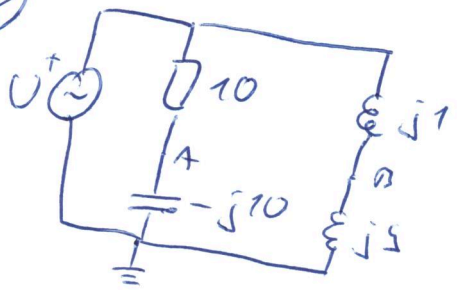
⑦ TOPOGRAFSKI DIJAGRAM – Nacrtao ?



pretheda 60°

⑧



$Z = (10 - j10) // j10$

$Z = 10 + j10$

$I_A = \frac{U}{10 - j10} \cdot (-j10) = U(0{,}5 - j0{,}5)$

$I_B = \frac{U}{j10} \cdot j1 = U \cdot \frac{1}{10}$

$|U_{10}| = 6{,}603 = \left|U(0{,}5 - j0{,}5) - \frac{1}{10}\right| = U \cdot \frac{\sqrt{41}}{10}$

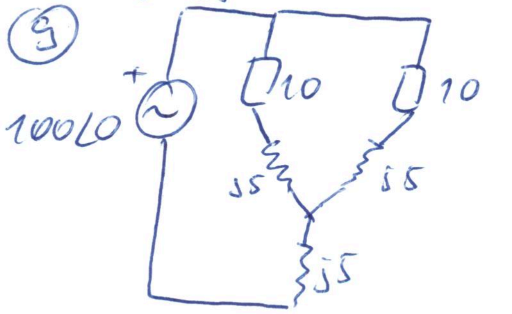
$\Rightarrow |U| = 10\,V$

$I = \left|\frac{10}{10 + j10}\right| = \frac{\sqrt{2}}{2}\,A$

/3

[illegible] PROSTOPERIODIČNE STRUJE KOLA

(9)

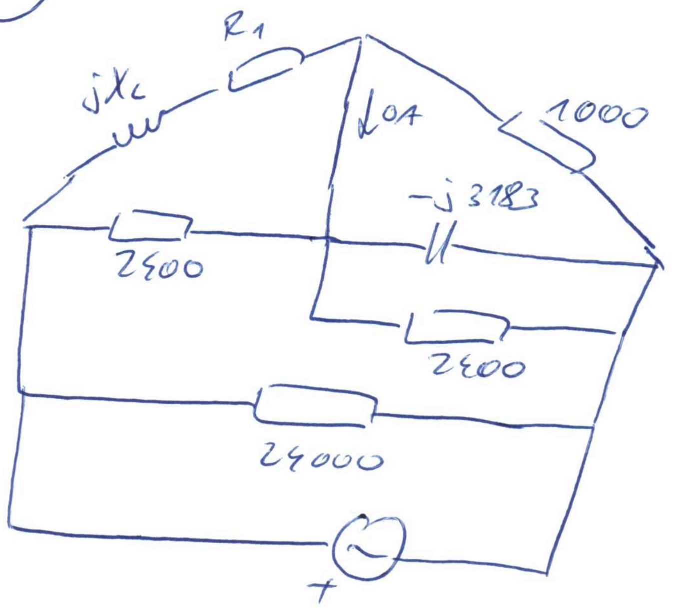


$$Z = (10 + j5) \,||\, (10 + j5) + j5$$

$$Z = 5 + j2.5 + j5 = 5 + j7.5\ \Omega$$

$$I = \left| \frac{100\angle 0}{5 + j7.5} \right| = 11{,}09\ A$$

(10)



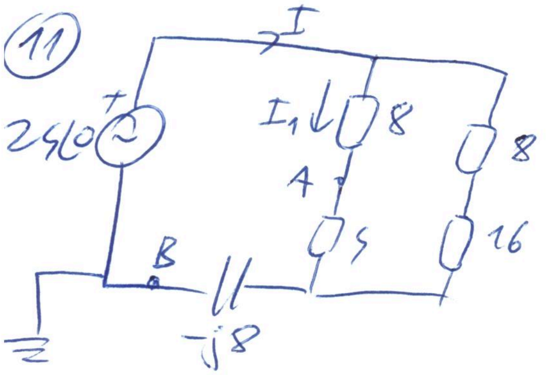
$$X_C = -j \frac{1}{10^{-6} \cdot 2\pi \cdot 50} = -j\,3183$$

$$1000 \cdot 2400 = (2400 \,||\, -j3183) \cdot (R_1 + jX_L)$$

$$R_1 + jX_L = 1000 + j754\ \Omega$$

$$R_1 = 1000\ \Omega$$

(11)



$$\varphi_B = 0\,V$$

$$I = \frac{U}{Z_{uk}}$$

$$Z_{uk} = (12 \,||\, 24) - j8 = 8 - j8\ \Omega$$

$$I = \frac{24}{8 - j8} = 1.5 + j1.5\ A$$

$$I_1 = I \cdot \frac{24}{24 + 12} = 1 + j$$

$$\varphi_A = 0 + (-j8) \cdot I + 4 \cdot I_1 = (-j8) \cdot (1.5 + j1.5) + 4(1 + j)$$

$$\varphi_A = 16 - j8$$

$$U_V = |\varphi_A - \varphi_B| = |16 - j8 - 0| = 8\sqrt{5} = 17.9\ V$$