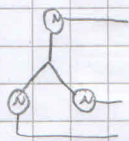


# OE-4 MASOVNE INSTRUKCIJE

12V. U  $\Delta$



$$U_{F, 12V} = U_F = \frac{U_L}{\sqrt{3}}$$

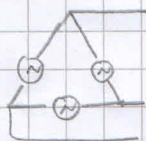
MREŽA

R  
S  
T

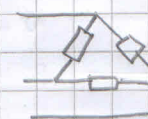
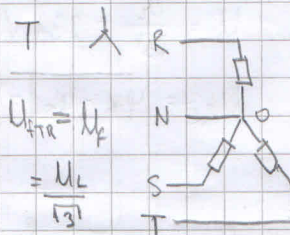
N

$$U_L = U_F \sqrt{3}$$

12V. U  $\Delta$

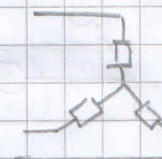


$$U_{Fin} = U_L$$



$$U_{FTE} = U_L$$

$$U_{FTE} = ?$$



Millman

	R	
12V.	S	
	T	TR.
	N	

Fazni napon je iznos razlike potencijala između bilo koje dvije faze i nul vodiča

$$|U_R|, |U_S|, |U_T| \rightarrow \text{faza}$$

Linijski napon je iznos razlike potencijala između bilo koje dvije faze.

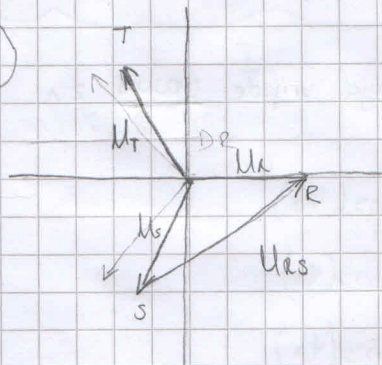
$$|U_{RS}|, |U_{ST}|, |U_{TR}| \rightarrow \text{linijski napon}$$

$$U_L = U_F \cdot \sqrt{3} \quad \text{UVIJEK!!}$$

$$U_R = U_F \angle 0^\circ$$

$$U_S = U_F \angle -120^\circ$$

$$U_T = U_F \angle 240^\circ$$



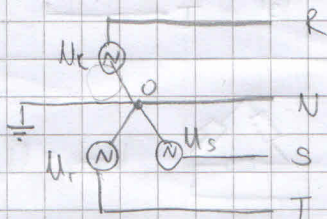


$$U_L = 400 \text{ V}$$

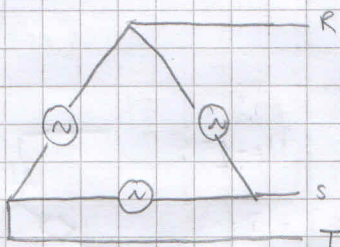
$$U_{RS} = ?$$

$$U_f = \frac{U_L}{\sqrt{3}} = 231 \text{ V}$$

$$U_{RS} = |\varphi_R - \varphi_S| = |231 \angle 0^\circ - 231 \angle -120^\circ| = 400 \angle 30^\circ$$

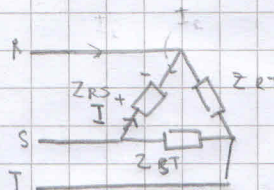


$$U_{f_{izv}} = U_f = \frac{U_L}{\sqrt{3}}$$



$$U_{f_{izv}} = U_L$$

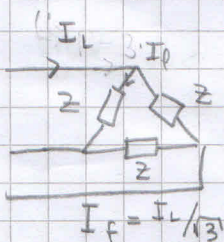
TROŠILA U TRIKUT SPOJU



$$U_{f_{izv}} = U_L$$

$$I = \frac{U_S - U_R}{Z_{RS}}$$

$$Z_{RS} = Z_{RT} = Z_{ST}$$



$$P_{uk} = 3 \cdot I_f \cdot U_{p_{TE}} \cdot \cos(\varphi_z)$$

$$\sqrt{3} \cdot I_L \cdot \cos(\varphi_z)$$

$$I_F = I_L / \sqrt{3}$$

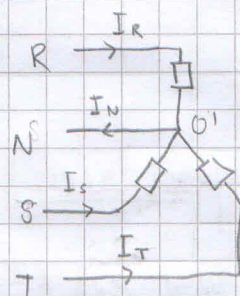
Liniska i fazna struja vrijede samo za simetrično trošilo!

$$P_{uk} = 3 \cdot U_f \cdot I_k \cdot \cos(\varphi_z)$$

$$= 3 \cdot \frac{U_L}{\sqrt{3}} \cdot I_L \cdot \cos(\varphi_z)$$

$$= \sqrt{3} \cdot U_L \cdot I_L \cdot \cos(\varphi_z)$$

TROŠILA U ZVJEZDA SPOJU S Ø VODIČEM



$$U_{01} = 0 \text{ V}$$

$$U_{2R} = U_R - U_{01}$$

$$= U_R \angle 0^\circ$$

↑ mreža

$$I_N = I_R + I_S + I_T \quad (\text{uzmite u obzir kutove})$$

$$I_N = \frac{U_R}{Z_R} + \frac{U_S}{Z_S} + \frac{U_T}{Z_T}$$

$$Z_R = Z_S = Z_T \Rightarrow I_N = 0 \text{ A}$$

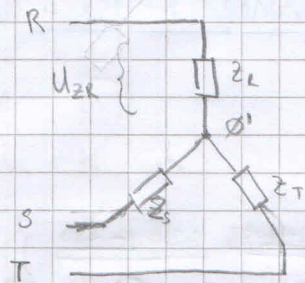
$$P = P_1 + P_2 + P_3 \quad (P = I^2 \cdot R)$$

Liniska struja ide kroz izvor.

Fazna struja ide kroz otpornik.



# TRÓŠILA U ZVIJEZDA SPOJU (bez nul vodiča)



$$\varphi_{O'} \neq 0V \quad (\text{osim ako simetrično } \varphi_{O'} = 0V)$$

$$U_{ZR} = \varphi_R - \varphi_{O'}$$

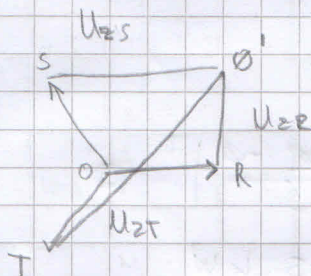
$$i_R + i_S + i_T = 0$$

$$\frac{\varphi_R - \varphi_{O'}}{Z_R} + \frac{\varphi_S - \varphi_{O'}}{Z_S} + \frac{\varphi_T - \varphi_{O'}}{Z_T} = 0$$

$$\frac{\varphi_R}{Z_R} + \frac{\varphi_S}{Z_S} + \frac{\varphi_T}{Z_T} = \varphi_{O'} \left( \frac{1}{Z_R} + \frac{1}{Z_S} + \frac{1}{Z_T} \right)$$

$$\varphi_{O'} = \frac{\frac{\varphi_R}{Z_R} + \frac{\varphi_S}{Z_S} + \frac{\varphi_T}{Z_T}}{\frac{1}{Z_R} + \frac{1}{Z_S} + \frac{1}{Z_T}} \rightarrow U_{Ob} = \frac{\frac{U_R}{Z_R} + \frac{U_S}{Z_S} + \frac{U_T}{Z_T}}{\frac{1}{Z_R} + \frac{1}{Z_S} + \frac{1}{Z_T} + \frac{1}{R}}$$

↑ ako ima  
otpor na  
nul vodiču

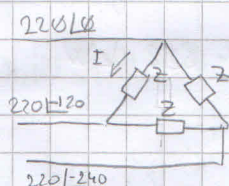


## ZADACI:

1.

$$(18.) \quad U_L = 380V$$

$$U_L = \frac{380}{\sqrt{3}} = 220$$



$$P_{Uk} = 3 \cdot P = 3 \cdot \left| \frac{220 \angle 0^\circ - 220 \angle -120^\circ}{80 - j60} \right|^2 \cdot 80$$

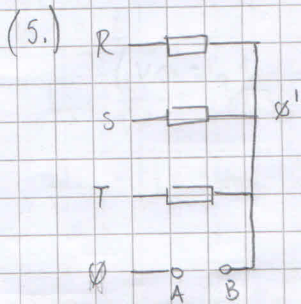
$$= 3465.6 \text{ W}$$

$$3 \cdot \left| \frac{U_L}{Z} \right|^2 \cdot \operatorname{Re}\{Z\}$$

(jednostavan način)



2



$$U_v = |\varphi_A - \varphi_B|$$

$$U_f = \frac{400}{\sqrt{3}} = 231 \text{ V}$$

$$\varphi_A = 0^\circ$$

$$\varphi_B = \varphi_0 = \frac{\frac{230 \angle 0^\circ}{Z_1} + \frac{230 \angle -120^\circ}{Z_2} + \frac{230 \angle -240^\circ}{Z_3}}{\frac{1}{Z_1} + \frac{1}{Z_2} + \frac{1}{Z_3}}$$

$$= 146.1 \angle -11.6^\circ$$

3

(13.)

$$|I_N| = 60 \text{ A}$$

$$60 = |I_R + I_S + I_T| = \left| \frac{\varphi_R - \varphi}{5} + \frac{\varphi_S - \varphi}{5 - j5} + \frac{\varphi_T - \varphi}{5 + j5} \right| = \left| \frac{U_f \angle 0^\circ}{5} + \frac{U_f \angle 120^\circ}{5 - j5} + \frac{U_f \angle -240^\circ}{5 + j5} \right|$$

$$60 = U_f \left| \frac{1 \angle 0^\circ}{5} + \frac{1 \angle -120^\circ}{5 - j5} + \frac{1 \angle -240^\circ}{5 + j5} \right|$$

$$U_f = 219.6 \text{ V}$$

$$U_R = 219.6 \angle 0^\circ \text{ V}$$

$$U_S = 219.6 \angle -120^\circ \text{ V}$$

$$U_T = 219.6 \angle -240^\circ \text{ V}$$

$$P_{\text{tot}} = P_1 + P_2 + P_3 = 19.$$

$$P_1 = \left| \frac{219.6 \angle 0^\circ - \varphi}{5} \right|^2 \cdot 5 = 8.645 \text{ kW}$$

$$P_2 = \left| \frac{219.6 \angle -120^\circ - \varphi}{5 - j5} \right|^2 \cdot 5 = 4.822 \text{ kW}$$

$$P_3 = \left| \frac{219.6 \angle -240^\circ - \varphi}{5 + j5} \right|^2 \cdot 5 = 4.822 \text{ kW}$$

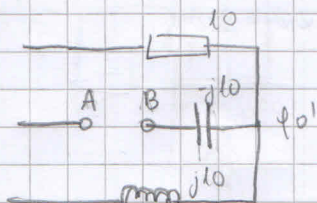


4

(1S.)

$$U_L = 400 \text{ V}$$

$$U_p = 231 \text{ V}$$



$$U_v = |U_A - U_B|$$

$$U_A = 231 \angle -120^\circ \text{ V}$$

$$U_B = U_{0'}$$

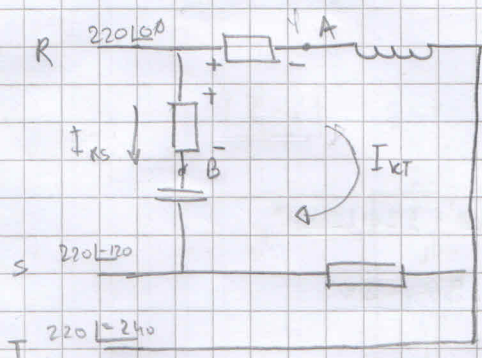
$$U_v = 546 \text{ V}$$

$$U_{0'} = \frac{\frac{231 \angle 0^\circ}{10} + \frac{231 \angle -240^\circ}{j10}}{\frac{1}{10} + \frac{1}{j10}} = 315.55 \angle 60^\circ$$

5

(20.)

$$U_L = 381 \Rightarrow U_L = 220 \text{ V}$$



predpostavka

$$I_{RT} = \frac{U_R - U_T}{Z_{RT}} = \frac{220 \angle 0^\circ - 220 \angle -240^\circ}{100 + j100} = 2.49 \angle -75^\circ \text{ A}$$

$$U_A = U_R - I_{RT} \cdot 100 = 300.5 \angle 60^\circ \text{ V}$$

predpostavka

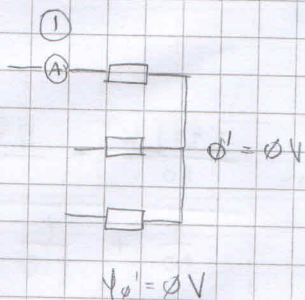
$$I_{RS} = \frac{U_R - U_S}{Z_{RS}} = \frac{220 \angle 0^\circ - 220 \angle -120^\circ}{200 - j200}$$

$$|U_A - U_B| = 520 \text{ V}$$

$$U_B = U_R - I_{RS} \cdot 200 = 300.5 \angle 60^\circ$$



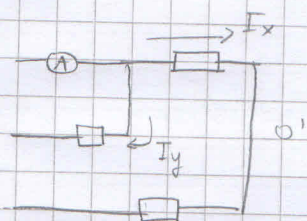
6 (20.)



$$\left| \frac{U_s - U_{s'}}{Z} \right| = 2 \Rightarrow |U_s| = 2 \cdot |Z|$$

$$U_s = 2 \cdot 100 = 200$$

②



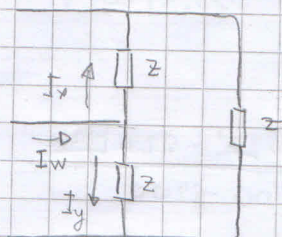
$$I_y = \frac{U_s - U_{s'}}{R} = \frac{200 \angle 0^\circ - 200 \angle 120^\circ}{100} = 3.46 \angle 30^\circ$$

$$I_x = \frac{U_s - U_{s'}}{2Z} = \frac{200 \angle 0^\circ - 200 \angle 120^\circ}{2 \cdot 100 \angle 60^\circ} = 1.73 \angle -90^\circ$$

$$I_A = 3A$$

7 (3.)

$$U_s = 230V$$



$$U_w = U_{RT} = 230 \angle 0^\circ - 230 \angle 240^\circ = 398.37 \angle -30^\circ$$

$$I_w = I_x + I_y = \frac{230 \angle 0^\circ - 230 \angle 120^\circ}{60 + j0} + \frac{230 \angle 120^\circ - 230 \angle 240^\circ}{60 + j0}$$

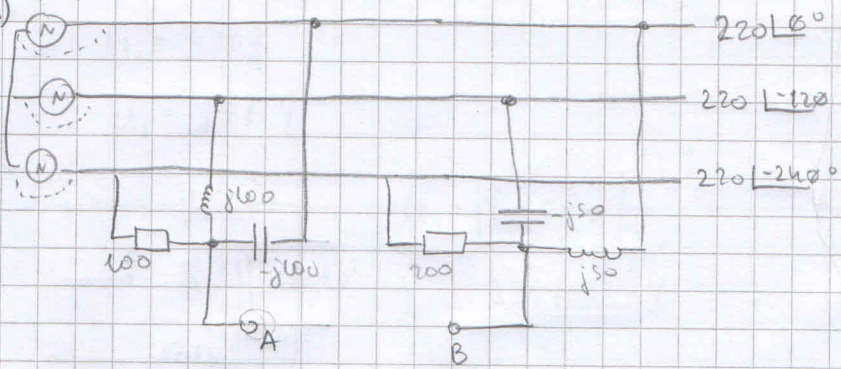
$$I_w = 11.5 \angle -120^\circ \text{ A}$$

$$P_w = |U_w| \cdot |I_w| \cdot \cos(\angle U_w - \angle I_w) = 398.37 \cdot 11.5 \cdot \cos(-30 - (-120)) = 0$$



8

(18.)



$$V_A = \frac{200 \angle 0}{-j100} + \frac{200 \angle -120}{j100} + \frac{200 \angle -240}{-j100}$$

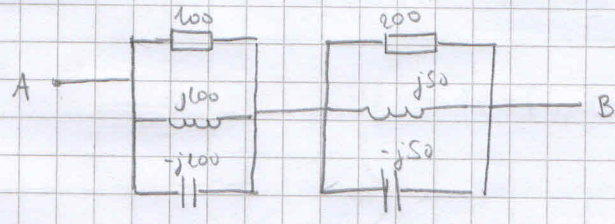
$$= \frac{1}{-j100} + \frac{1}{j100} + \frac{1}{100} = 601.05 \angle 120^\circ V$$

$$V_B = 1304.2 \angle -60^\circ$$

$$U_{AB} = 1905.25 \angle 120^\circ$$

$$I_A = \left| \frac{U_{TH}}{400} \right| = 4.763 A$$

$Z_{TH}$  RST ista točka



$$Z_{AB} = 300 \Omega$$