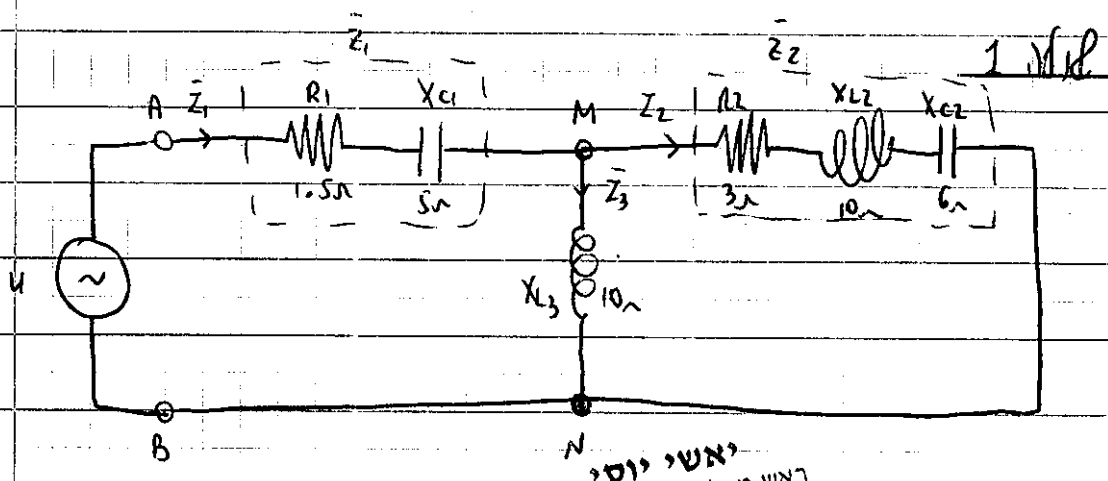


כרמון של ארן - 733001 תורת המעגלים
 יולי '01 - מועד אביב תשס"א, 2011



יחסי יוסי
 ראש מחלקת אלקטרוניקה

$$\bar{V}_{MN} = 10 \angle 30^\circ \text{ V}$$

(K)

$$\bar{I}_2 = \frac{\bar{V}_{MN}}{\bar{Z}_2} = \frac{10 \angle 30^\circ}{(3 + j10 - j6)} = 2 \angle -23.13^\circ \text{ A}$$

$$\bar{I}_2 = \bar{I}_{L2} = 2 \angle -23.13^\circ \text{ (A)}$$

$$\bar{Z}_T = (\bar{Z}_{L3} \parallel \bar{Z}_2) + \bar{Z}_1$$

(L)

$$\bar{Z}_T = \left(\frac{1}{j10} + \frac{1}{3 + j10 - j6} \right)^{-1} + 1.5 - j5$$

$$\bar{Z}_{AB} = \bar{Z}_T = (2.963 - j1.829) \Omega = 3.482 \angle -31.686^\circ \Omega$$

אנני, ה'מחשב קיבול' כי בנויה הסדר שלילית!

$$\bar{I}_3 = \frac{\bar{V}_{MN}}{\bar{Z}_{L3}} = \frac{10 \angle 30^\circ}{10 \angle 90^\circ} = 1 \angle -60^\circ \text{ A}$$

(I)

$$\bar{I}_1 = \bar{I}_2 + \bar{I}_3 = 2 \angle -23.13^\circ + 1 \angle -60^\circ = 2.863 \angle -35.224^\circ \text{ A}$$

$$\bar{U}_T = \bar{Z}_T \cdot \bar{I}_T = 2.863 \angle -35.224^\circ \cdot 3.482 \angle -31.686^\circ = 9.97 \angle -66.91^\circ \text{ (V)}$$

(תנן) וזכרונות (התלמוד) (ולא) (ולא) (ולא)

$$|\bar{U}_L| = 6 \text{ kV}$$

$$\bar{U}_{L1} = 6 \angle 0^\circ \text{ kV}; \bar{U}_{L2} = 6 \angle 120^\circ \text{ kV}; \bar{U}_{L3} = 6 \angle -120^\circ \text{ kV}$$

יחסי
אנרגיה

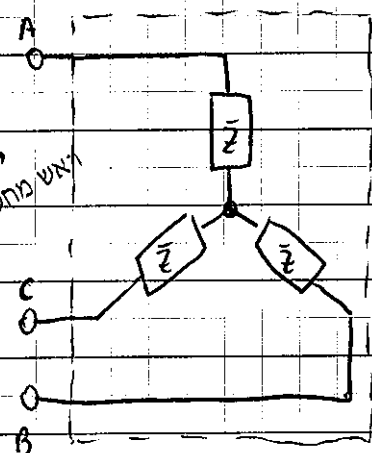
$$\bar{U}_{PH} = \frac{|\bar{U}_L|}{\sqrt{3}} = \frac{6 \cdot 10^3}{\sqrt{3}} = 3.464 \text{ kV}$$

$$\bar{U}_{PH1} = 3.464 \angle -30^\circ \text{ kV}; \bar{U}_{PH2} = 3.464 \angle 90^\circ \text{ kV};$$

$$\bar{U}_{PH3} = 3.464 \angle -150^\circ \text{ kV}$$

זכרונות

30° - 2 U_L אחר U_{PH}



$$P_T = 200 \text{ kW}; \cos \phi = 0.85$$

$$(ולא) P_1 = P_2 = P_3 = P_T / 3 = 200 \cdot 10^3 / 3 = 66.666 \text{ kW} (\cos \phi = 0.85 \text{ ולא})$$

$$\cos \phi = \frac{P}{|S|}$$

$$|S_1| = \frac{P_1}{\cos \phi} = \frac{66.666 \cdot 10^3}{0.85} = 78.431 \text{ kVA}$$

$$|\bar{S}_1| = 78.431 \angle 31.388^\circ \text{ kVA}$$

cos (0.85)

$$|\bar{S}| = \frac{|\bar{U}_{PH}|^2}{|\bar{Z}|}$$

$$|\bar{Z}| = \frac{|\bar{U}_{PH}|^2}{|S|} = \frac{(3.464 \cdot 10^3)^2}{78.431 \cdot 10^3} = 152.991 \Omega$$

$$\bar{Z} = 152.991 \angle 31.388^\circ \Omega = (130.042 + j80.592) \Omega$$

α_Z = α_S

$$\bar{I}_{PH1} = \frac{\bar{U}_{PH1}}{\bar{Z}} = \frac{3.464 \cdot 10^3 \angle -30^\circ}{152.991 \angle 31.388^\circ} = 22.641 \angle -61.388^\circ \text{ A}$$

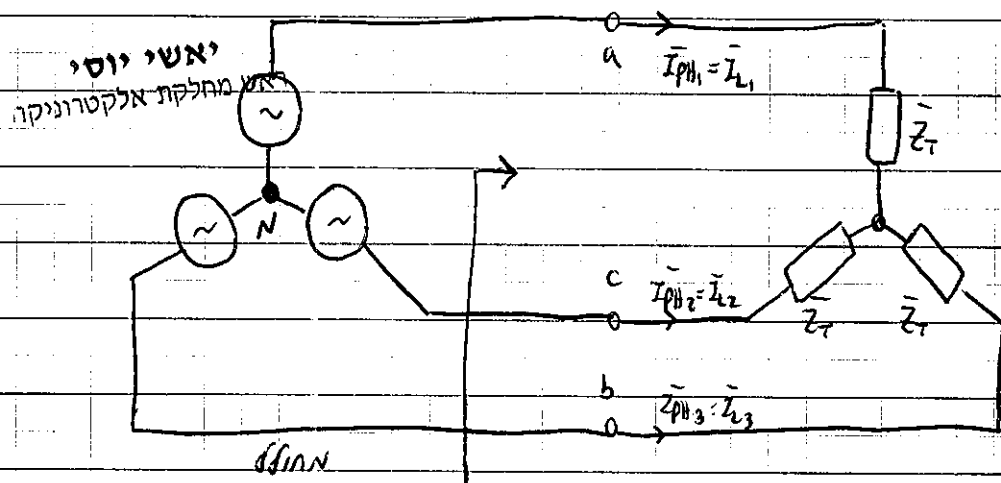
$$\bar{I}_{PH2} = \frac{\bar{U}_{PH2}}{\bar{Z}} = 22.641 \angle 58.212^\circ \text{ A}$$

$$\bar{I}_{PH3} = \frac{\bar{U}_{PH3}}{\bar{Z}} = 22.641 \angle -131.388^\circ \text{ A}$$

⊙ אר (60) מר הניסוי הלקוח "לראש" הנתון הנתון

$$\bar{Z}_T = \bar{Z}_{line} + \bar{Z}_{load} = 10 + j25 + 130.042 + j80.592$$

$$\bar{Z}_T = (140.042 + j105.592) \Omega = 175.389 \angle 37.016^\circ \Omega$$



$$|\bar{U}_{ph}| = |\bar{I}_{ph}| \cdot |\bar{Z}_T| = 22.641 \cdot 175.389 = 3.939 \text{ kV}$$

$$\bar{U}_{ph1} = 3.939 \angle -24.332^\circ \text{ kV}, \bar{U}_{ph2} = 3.939 \angle 95.228^\circ \text{ kV}, \bar{U}_{ph3} = 3.939 \angle -144.332^\circ \text{ kV}$$

$$\rightarrow |\bar{U}_L| = \sqrt{3} \cdot |\bar{U}_{ph}| = \sqrt{3} \cdot 3.939 \cdot 10^3 = 6.823 \text{ kV}$$

$$K) \bar{U}_{L1} = 6.823 \angle 5.228^\circ \text{ (kV)}$$

$$\bar{U}_{L2} = 6.823 \angle 125.228^\circ \text{ (kV)}$$

$$\bar{U}_{L3} = 6.823 \angle -114.332^\circ \text{ (kV)}$$

מקרים U_L
אם $30^\circ - ?$
! U_{ph}

$$\bar{U}_{ph} = \bar{U}_{Z_{ph}} + \bar{U}_{Z_T}$$

$$2) \cos \varphi_{Z_T} = \cos(37.016) = 0.798$$

$$P.F. = 0.798$$

$$C) \eta = \frac{P_T(\text{load})}{P_T(\text{source})} \cdot 100$$

$$P_T(\text{source}) = \sqrt{3} \cdot |\bar{I}_L| \cdot |\bar{U}_L| \cdot \cos \varphi = \sqrt{3} \cdot 22.641 \cdot 6.823 \cdot 10^3 \cdot \cos(37.016)$$

$$P_T(\text{source}) = 213.643 \text{ kW}$$

$$\eta = \frac{200}{213.643} \cdot 100 = 93.614 [\%]$$

$$R_{m1} = \frac{F_{m1}}{\phi} = \frac{NI}{\phi} = \frac{200 \cdot 4.113}{0.25 \cdot 10^{-4}} = 10.969 \cdot 10^6 \left(\frac{AT}{wb} \right)$$

$$R_g = \frac{l_g}{\mu_0 \mu_r} = \frac{297.887 \cdot 10^3 \cdot 2 \cdot 10^{-3}}{0.25 \cdot 10^{-4}} = 10.61 \cdot 10^6 \left(\frac{AT}{wb} \right)$$

$$R_{m1} = R_g + R_m$$

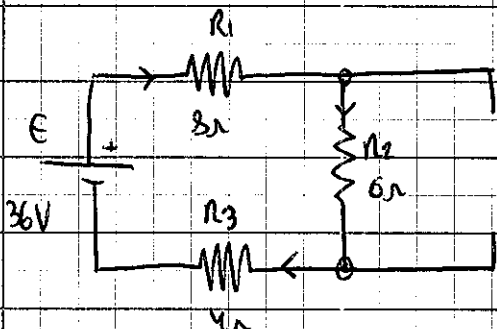
$$R_m = R_{m1} - R_g = 10.969 - 10.61 = 358.68 \cdot 10^3 \left(\frac{AT}{wb} \right)$$

ראשי יוסי
ראש מחלקת אלקטרוניקה

4. א. 4

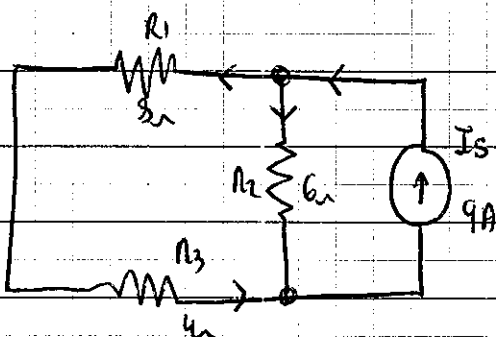
פתרון דעבור מלש ווונכר :

סדרת E ק"מ -



$$R_T = R_1 + R_2 + R_3 = 8 + 6 + 4 = 18\Omega$$

$$I_T = \frac{E}{R_T} = \frac{36}{18} = 2A = I_{R2}$$



סדרת Is ק"מ -

$$I_{R2} = I_s \cdot \frac{(R_1 + R_3)}{(R_1 + R_3) + R_2}$$

$$I_{R2} = 9 \cdot \frac{12}{12 + 6} = 6A$$

שלב 1 (הכנה):

$I_{R2} = 2+6 = 8A$ ↓

(א)

$P_{R2} = I_{R2}^2 \cdot R2$

$P_{R2} = 8^2 \cdot 6 = 384W$

יש לי יוסי
ראש מחלקת אלקטרוניקה

(ב)

אם ניתן להחליף את ההספק (ההספק) P_{R2} דרך $R2$ לבד
"הכנה" (סומכנו/נציגו)

הנחה:

הנחה 1
מקור הנחה

$P_{R2} = 2^2 \cdot 6 = 24W$

הנחה 2
מקור הנחה

$P_{R2} = 6^2 \cdot 6 = 216W$

$P_{R2} = 24 + 216 = 240W$

$\neq$

$384W$