

733003 - ארז תל אביב

מסמך תלמיד ?

תאריך

1. ארז

$$C_T = \frac{C_1 \cdot C_2}{C_1 + C_2} = \frac{25 \cdot 62}{25 + 62} = 17.816 \mu F$$

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(K)

$$L_T = L_1 + L_2 = 32 + 15 = 47 \text{ mH}$$

$$f_0 = \frac{1}{2\pi\sqrt{L_T \cdot C_T}} = \frac{1}{2\pi\sqrt{47 \cdot 10^{-3} \cdot 17.816 \cdot 10^{-6}}} = 113.926 \text{ (Hz)}$$

$$Q_0 = \frac{X_{L_T}}{R_T} = \frac{X_{L_T}}{R_1 + R_2 + R_3}$$

(?)

$$X_{L_T} = 2\pi f_0 \cdot L_T = 2\pi \cdot 113.926 \cdot 47 \cdot 10^{-3} = 51.362 \Omega$$

$$Q_0 = \frac{51.362}{0.51 + 1.3 + 0.24} = 25.054$$

$$BW = \frac{f_0}{Q_0} = \frac{113.926}{25.054} = 6.941 \text{ Hz}$$

(1)

$$f_1 = f_0 - \frac{1}{2} BW = 113.926 - \frac{1}{2} \cdot 6.941 = 110.456 \text{ (Hz)}$$

$$f_2 = f_0 + \frac{1}{2} BW = 113.926 + \frac{1}{2} \cdot 6.941 = 117.396 \text{ (Hz)}$$

$$|\bar{Z}_L| = 50 \Omega; \cos \phi = 0.8 \text{ (inductive)}$$

(A)

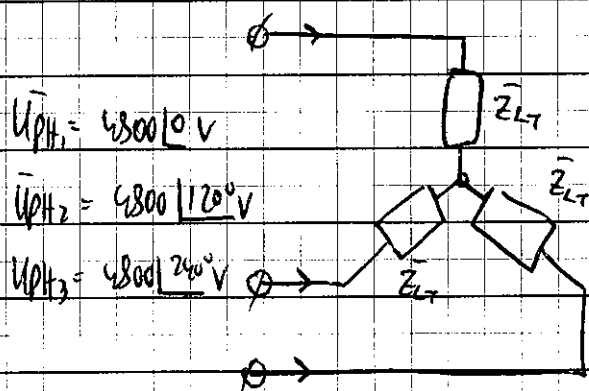
$$\bar{Z}_L = 50 \angle 36.869^\circ \Omega = (40 + j30) \Omega$$

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(מלבד ארבעה נקודות יחידות) נקודות

$$\bar{Z}_{LT} = \bar{Z}_0 + \bar{Z}_L = \underbrace{\left[(0.3 - j0.3) \frac{\Omega}{\text{km}} \cdot 10 \text{ km} \right]}_{\bar{Z}_0 = (3 - j3) \Omega} + \underbrace{50 \angle 36.869^\circ}_{\bar{Z}_L}$$

$$\bar{Z}_{LT} = (43 + j27) \Omega = 50.774 \angle 32.124^\circ \Omega$$



$$\bar{I}_{L1} = \bar{I}_{PH1} = \frac{\bar{U}_{PH1}}{\bar{Z}_{LT}} = \frac{4800 \angle 0^\circ}{50.774 \angle 32.124^\circ} = 94.536 \angle -32.124^\circ \text{ (A)}$$

$$\bar{I}_{L2} = \bar{I}_{PH2} = \frac{\bar{U}_{PH2}}{\bar{Z}_{LT}} = \frac{4800 \angle 120^\circ}{50.774 \angle 32.124^\circ} = 94.536 \angle 87.876^\circ \text{ (A)}$$

$$\bar{I}_{L3} = \bar{I}_{PH3} = \frac{\bar{U}_{PH3}}{\bar{Z}_{LT}} = \frac{4800 \angle 240^\circ}{50.774 \angle 32.124^\circ} = 94.536 \angle 207.876^\circ \text{ (A)}$$

$$\bar{Z}_0 = (3 + j3) \Omega = 4.242 \angle 45^\circ \Omega$$

(P)

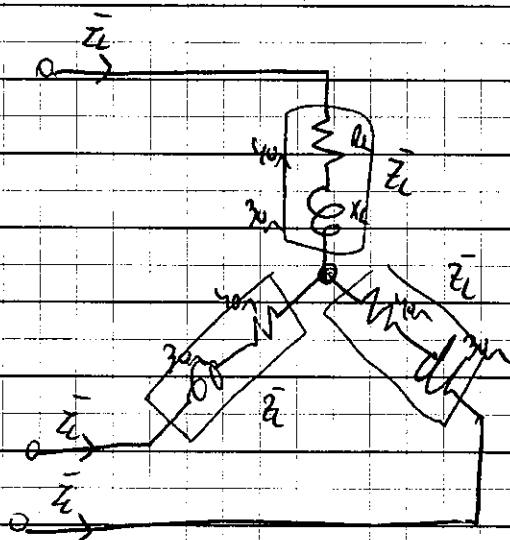
$$\Delta P = |\bar{I}_L|^2 \cdot R_0 = 94.536^2 \cdot 3 = 26,812.965 \text{ W}$$

$$\Delta P_T = 3 \Delta P =$$

$$80.433 \text{ (kW)}$$

(1) חילון (2) הספק (3) וולט

יחס ישר
מכוח המכללה



$$P_T = 3 \cdot |\bar{Z}_L|^2 \cdot R_L = 3 \cdot 94.536^2 \cdot 40 = 1.072 \text{ MW}$$

$$|Q_T| = 3 \cdot |\bar{Z}_L|^2 \cdot X_L = 3 \cdot 94.536^2 \cdot 30 = 0.804 \text{ MVAR}$$

$$\bar{S}_T = P_T + jQ_T = (1.072 + j0.804) \text{ MVA} = 1.34 \angle 36.86^\circ \text{ MVA}$$

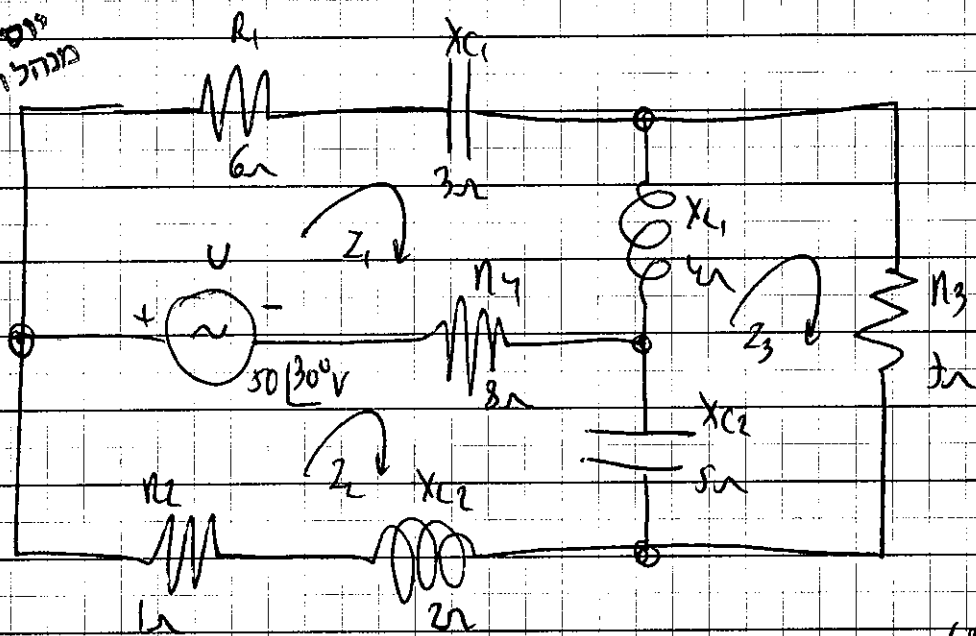
(1) חילון (2) הספק (3) וולט

$$\eta = \frac{P_T}{P_T + \Delta P_T} \cdot 100$$

$$\eta = \frac{1.072 \cdot 10^6}{1.072 \cdot 10^6 + 80.433 \cdot 10^3} \cdot 100 = 93.02 (\%)$$

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3 נק'.



(K)

$$I) \quad + (R_1 - jX_{C1} + jX_{L1} + R_4) \bar{I}_1 - R_4 \bar{I}_2 - jX_{L1} \bar{I}_3 = \bar{U}$$

$$II) \quad - R_4 \bar{I}_1 + (R_4 - jX_{C2} + jX_{L2} + R_2) \bar{I}_2 - (-jX_{C2}) \bar{I}_3 = -\bar{U}$$

$$III) \quad - jX_{L1} \bar{I}_1 - (-jX_{C2}) \bar{I}_2 + (jX_{L1} + R_3 - jX_{C2}) \bar{I}_3 = 0$$

$$I) \quad (14 + j) \bar{I}_1 - 8 \bar{I}_2 - j4 \bar{I}_3 = 50 \angle 30^\circ$$

$$II) \quad -8 \bar{I}_1 + (9 - j3) \bar{I}_2 + j5 \bar{I}_3 = -50 \angle 30^\circ$$

$$III) \quad -j4 \bar{I}_1 + j5 \bar{I}_2 + (7 - j) \bar{I}_3 = 0$$

$$\begin{bmatrix} (14+j) & -8 & -j4 \\ -8 & (9-j3) & j5 \\ -j4 & j5 & (7-j) \end{bmatrix} \begin{bmatrix} \bar{I}_1 \\ \bar{I}_2 \\ \bar{I}_3 \end{bmatrix} = \begin{bmatrix} 50 \angle 30^\circ \\ -50 \angle 30^\circ \\ 0 \end{bmatrix} \quad (?)$$

$$\vec{I}_2 = \frac{\Delta Z_2}{\Delta}$$

(8)

$$\Delta = \begin{vmatrix} (14+j) & -8 & -j4 \\ -8 & (9-j3) & j5 \\ -j4 & j5 & (7-j) \end{vmatrix} =$$

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$$= + (14+j) [(9-j3) \cdot (7-j) - j5 \cdot j5] - (-8) \cdot$$

$$\cdot [-8 \cdot (7-j) - j5 \cdot (-j4)] + (-j4) [-8 \cdot j5 - (9-j3) \cdot (-j4)] =$$

$$= (596 - j319)$$

$$\Delta Z_2 = \begin{vmatrix} (14+j) & 50\angle 30^\circ & -j4 \\ -8 & -50\angle 30^\circ & j5 \\ -j4 & 0 & (7-j) \end{vmatrix} =$$

$$= (14+j) \cdot [-(7-j) \cdot 50\angle 30^\circ] - (50\angle 30^\circ) \cdot [-8 \cdot (7-j) - j5 \cdot (-j4)] +$$

$$+ (-j4) [50\angle 30^\circ \cdot (-j4)] = (-1663.749 - j1018.301)$$

$$\vec{I}_2 = \frac{\Delta Z_2}{\Delta} = \frac{-1663.749 - j1018.301}{596 - j319} = 2.885 \angle -120.333^\circ$$

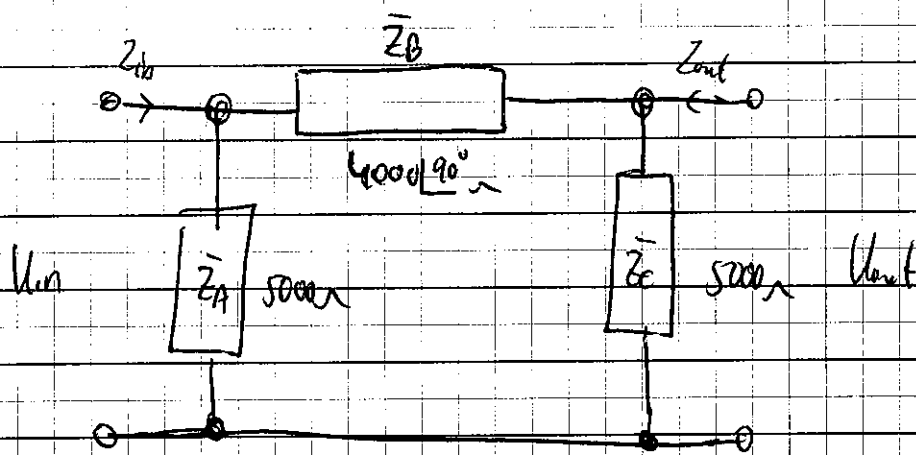
4 אלק

(ג) אר (כ"ר) הנלס כעקור $\bar{Z}$:

$$\bar{Z}_A = \bar{Z}_C = \frac{1}{\bar{Y}_A} = \frac{1}{0.2 \cdot 10^{-3}} = 5000 \Omega$$

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במודל המכללה

$$\bar{Z}_B = \frac{1}{\bar{Y}_B} = \frac{1}{0.25 \cdot 10^{-3} \angle -90^\circ} = 4000 \angle 90^\circ \Omega$$



K)

$$Y_{11} = Y_{22} = \frac{\bar{Z}_A + \bar{Z}_B}{\bar{Z}_A \cdot \bar{Z}_B} = \frac{5000 + 4000 \angle 90^\circ}{5000 \cdot 4000 \angle 90^\circ} = (0.2 - j0.25) \cdot 10^{-3}$$

$$Y_{12} = Y_{21} = -\frac{1}{\bar{Z}_B} = -\frac{1}{4000 \angle 90^\circ} = j0.25 \cdot 10^{-3}$$

$$\bar{Y} = \begin{bmatrix} (0.2 - j0.25) \cdot 10^{-3} & j0.25 \cdot 10^{-3} \\ j0.25 \cdot 10^{-3} & (0.2 - j0.25) \cdot 10^{-3} \end{bmatrix}$$

$$\bar{Z}_{SC} = \bar{Z}_A \parallel \bar{Z}_B$$

1 (2)

$$\bar{Z}_{SC} = \left(\frac{1}{5000} + \frac{1}{4000 \angle 90^\circ} \right)^{-1} = (1951.219 + j 2439.074) \Omega =$$

$$= 3123.475 \angle 51.34^\circ (\Omega)$$

חסר פאזי
מנהל המכללה

2

$$\bar{Z}_{OC} = (\bar{Z}_B + \bar{Z}_C) \parallel \bar{Z}_A$$

$$\bar{Z}_{OC} = (5000 + j 4000) \parallel 5000 = \left(\frac{1}{5000 + j 4000} + \frac{1}{5000} \right)^{-1} =$$

$$= (2844.827 + j 862.068) \Omega = 2972.575 \angle 16.858^\circ \Omega$$

$$\bar{Z}_0 = \sqrt{\bar{Z}_{OC} \cdot \bar{Z}_{SC}}$$

(1)

$$\bar{Z}_0 = \sqrt{3123.475 \angle 51.34^\circ \cdot 2972.575 \angle 16.858^\circ}$$

$$\bar{Z}_0 = \sqrt{9284763.698 \angle 68.198^\circ} = \sqrt{9284763.698} \angle \frac{68.198^\circ}{2}$$

$$\bar{Z}_0 = 3047.091 \angle 34.099^\circ (\Omega)$$

$$\begin{cases} \bar{Z}_1 = y_{11} \bar{V}_1 + y_{12} \bar{V}_2 \\ \bar{Z}_2 = y_{21} \bar{V}_1 + y_{22} \bar{V}_2 \end{cases}$$

(3)

דוגמה קצת קטנה ממקור $V_2=0$ וסקן -

$$\begin{cases} \bar{I}_1 = \bar{y}_{11} \bar{V}_1 + \cancel{\bar{y}_{12} \bar{V}_2} \\ \bar{I}_2 = \bar{y}_{21} \bar{V}_1 + \cancel{\bar{y}_{22} \bar{V}_2} \end{cases}$$

נוסחי יאנשי
מנהל המכללה

נחלק את שתי המשוואות:

$$\frac{\bar{I}_1}{\bar{I}_2} = \frac{\bar{y}_{11}}{\bar{y}_{21}} \frac{\cancel{\bar{V}_1}}{\cancel{\bar{V}_1}}$$

$$\frac{\bar{I}_1}{\bar{I}_2} = \frac{(0.2 - j0.25) \cdot 10^{-3}}{(+j0.25) \cdot 10^{-3}} = 1.28 \angle -41.34^\circ$$

$$\left| \frac{\bar{I}_1}{\bar{I}_2} \right| = 1.28$$