

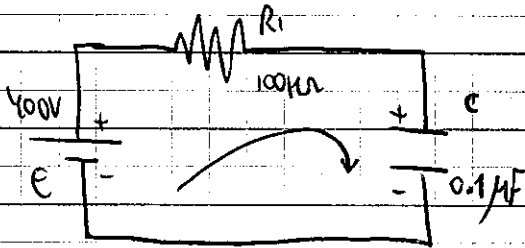
כתובן שאלון - 733003 - מעבדות חשמל ק'

יולי '01 - מועד אביב תשס"א, 2011

יאשי יוסי
ראש מחלקת אלקטרוניקה

שאלה 1

$0 < t < 15 \text{ msec}$ - מתח 2 מ"מ (מועד ראשון קודם)

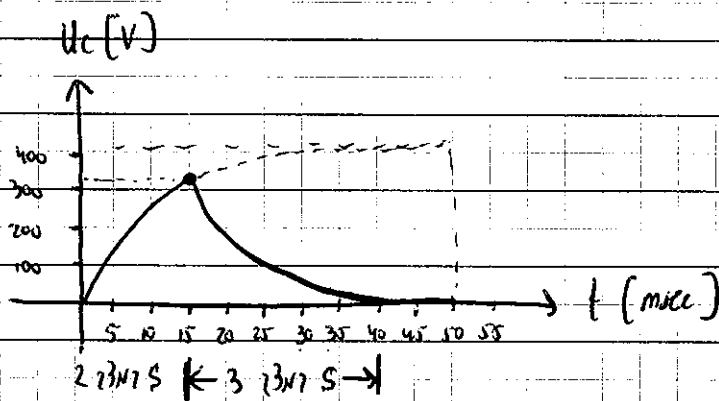


$$\tau = R_1 \cdot C = 100 \cdot 10^3 \cdot 0.1 \cdot 10^{-6} = 10 \text{ msec}$$

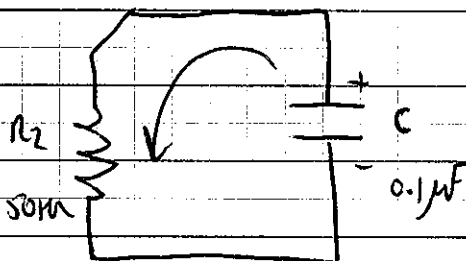
$$U_C(t) = U_C(\infty) - (U_C(\infty) - U_{C(0+)})e^{-t/\tau} \quad (K)$$

$$U_C(t) = 400 - (400 - 0)e^{-t/10}$$

$$U_C(t=15 \text{ msec}) = 400 - 400e^{-1.5} = 310.343 \text{ (V)}$$



$t > 15 \text{ msec}$ - מתח 3 מ"מ (מועד שני קודם)



$$\tau = R_2 \cdot C = 50 \cdot 10^3 \cdot 0.1 \cdot 10^{-6} = 5 \text{ msec}$$

$$u_c(t) = u_c(\infty) - (u_c(\infty) - u_c(0^+))e^{-\frac{t}{\tau}} \quad (7)$$

$$100 = 0 - (0 - 310.34) e^{-\frac{t}{5 \cdot 10^{-3}}}$$

$$100 = 310.34 e^{-\frac{t}{5 \cdot 10^{-3}}}$$

$$\frac{100}{310.34} = e^{-\frac{t}{5 \cdot 10^{-3}}}$$

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$$\ln\left(\frac{100}{310.34}\right) = -\frac{t}{5 \cdot 10^{-3}}$$

$$t = -5 \cdot 10^{-3} \cdot (-1.133) = 5.665 \text{ (msec)}$$

2 מאל

$$f_0 = \frac{1}{2\pi\sqrt{LC}} = \frac{1}{2\pi\sqrt{4 \cdot 10^{-3} \cdot 4 \cdot 10^{-6}}} = 5.032 \text{ (kHz)} \quad (8)$$

$$Z_0 = R_s = 5 \text{ (k}\Omega\text{)}$$

$$Q_0 = \frac{R_s}{X_{L_0}}$$

$$X_{L_0} = 2\pi f_0 L = 2\pi \cdot 5.032 \cdot 10^3 \cdot 1 \cdot 10^{-3} = 31.622 \Omega$$

$$Q_0 = \frac{5000}{31.622} = 158.113$$

$$BW = \frac{f_0}{Q_0} = \frac{5.032 \cdot 10^3}{158.113} = 31.825 \text{ (Hz)}$$

$$\bar{U}_{R_{S_0}} = \bar{I}_s \cdot R_s = 10 \cdot 10^{-3} \angle 0^\circ \cdot 5 \cdot 10^3 = 50 \angle 0^\circ \text{ V} \quad (9)$$

$$\bar{U}_{R_{S_0}} = \bar{U}_{L_0} = \bar{U}_{C_0} = 50 \angle 0^\circ \text{ (V)}$$

$$\bar{I}_C = \frac{\bar{U}_{C0}}{-jX_{C0}} = \frac{50 \angle 0}{-j31.622} = 1.581 \angle 90^\circ \text{ (A)} \quad (1)$$

$$\bar{I}_L = \frac{\bar{U}_{L0}}{jX_{L0}} = \frac{50 \angle 0}{j31.622} = 1.581 \angle -90^\circ \text{ (A)}$$

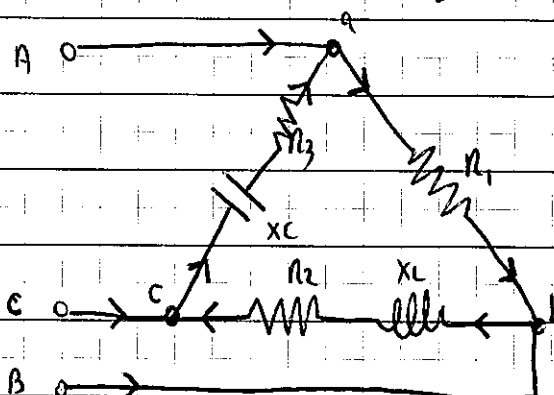
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3 שאלה

$$\bar{I}_{ab} = \frac{\bar{E}_{AB}}{R_1} = \frac{208 \angle 0}{10} = 20.8 \angle 0^\circ \text{ (A)} \quad (11)$$

$$\bar{I}_{ca} = \frac{\bar{E}_{CA}}{R_3 - jX_C} = \frac{208 \angle 120}{12 - j12} = 12.256 \angle 165^\circ \text{ (A)}$$

$$\bar{I}_{bc} = \frac{\bar{E}_{BC}}{R_2 + jX_L} = \frac{208 \angle -120}{15 + j20} = 8.32 \angle -113.13^\circ \text{ (A)}$$



$$\bar{I}_{Aa} + \bar{I}_{Ca} = \bar{I}_{ab}$$

$$\bar{I}_{Aa} = \bar{I}_{ab} - \bar{I}_{Ca} = 20.8 \angle 0 - 12.256 \angle 165 = 32.792 \angle -5.551^\circ \text{ (A)}$$

$$\bar{I}_{Bb} + \bar{I}_{ab} = \bar{I}_{bc}$$

$$\bar{I}_{Bb} = \bar{I}_{bc} - \bar{I}_{ab} = 8.32 \angle -113.13 - 20.8 \angle 0 = 29.031 \angle -118.038^\circ \text{ (A)}$$

$$\bar{I}_{Cc} + \bar{I}_{bc} = \bar{I}_{ca}$$

$$\bar{I}_{Cc} = \bar{I}_{ca} - \bar{I}_{bc} = 12.256 \angle 165 - 8.32 \angle -113.13 = 5.492 \angle 130.65^\circ \text{ (A)}$$

$$P_T = P_{R1} + P_{R2} + P_{R3} \quad (1)$$

$$P_{R1} = |\bar{I}_{ab}|^2 \cdot R_1 = 20.8^2 \cdot 10 = 4326.4 \text{ W}$$

$$P_{R2} = |\bar{I}_{bc}|^2 \cdot R_2 = 8.32^2 \cdot 15 = 1038.336 \text{ W}$$

$$P_{R3} = |\bar{I}_{ca}|^2 \cdot R_3 = 12.256^2 \cdot 12 = 1802.514 \text{ W}$$

$$P_T = 7167.25 \text{ (W)}$$

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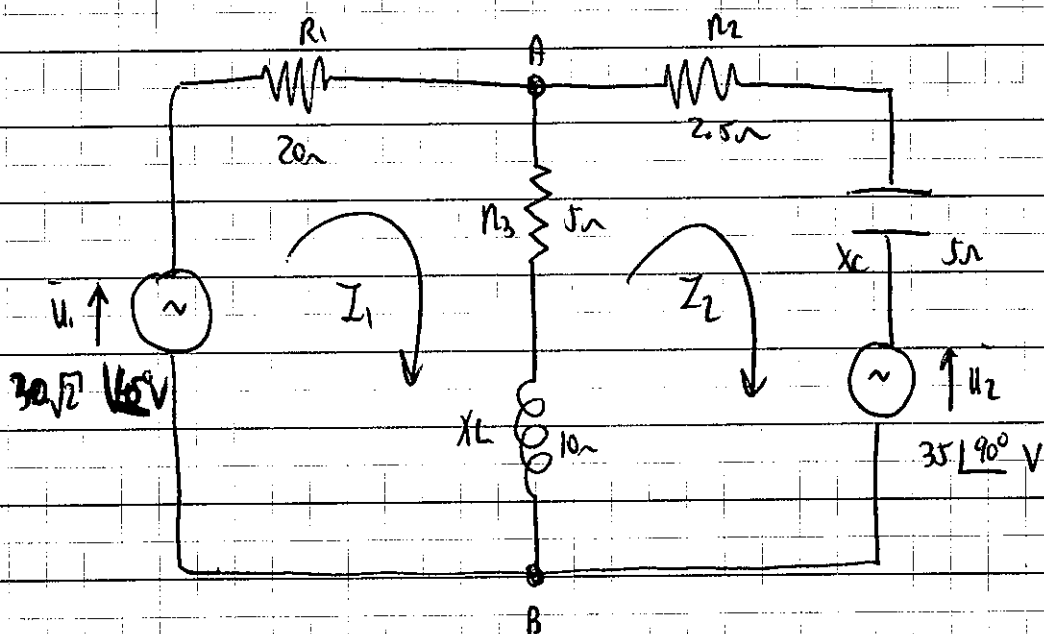
לחץ

$$X_L = 2\pi fL$$

$$X_L = 2\pi \cdot 50 \cdot 31.85 \cdot 10^{-3} = 10 \Omega$$

$$X_C = \frac{1}{2\pi f \cdot C}$$

$$X_C = \frac{1}{2\pi \cdot 50 \cdot 636 \cdot 10^{-6}} = 5 \Omega$$



$$\begin{cases} + (R_1 + R_3 + jX_L) \bar{I}_1 - (R_3 + jX_L) \bar{I}_2 = \bar{U}_1 \\ - (R_3 + jX_L) \bar{I}_1 + (R_2 + R_3 + jX_L - jX_C) \bar{I}_2 = -\bar{U}_2 \end{cases} \quad (K)$$

$$\begin{bmatrix} (R_1 + R_3 + jX_L) & -(R_3 + jX_L) \\ -(R_3 + jX_L) & (R_2 + R_3 + jX_L - jX_C) \end{bmatrix} \begin{bmatrix} \bar{I}_1 \\ \bar{I}_2 \end{bmatrix} = \begin{bmatrix} \bar{U}_1 \\ -\bar{U}_2 \end{bmatrix} \quad (?)$$

$$\begin{bmatrix} (25 + j10) & (-5 - j10) \\ (-5 - j10) & (7.5 + j5) \end{bmatrix} \begin{bmatrix} \bar{I}_1 \\ \bar{I}_2 \end{bmatrix} = \begin{bmatrix} 30\sqrt{2} \angle 45^\circ \\ -35 \angle 90^\circ \end{bmatrix} \quad (I)$$

$$\Delta = \begin{vmatrix} (25 + j10) & (-5 - j10) \\ (-5 - j10) & (7.5 + j5) \end{vmatrix} = (212.5 + j100)$$

$$\Delta_{I_1} = \begin{vmatrix} 30\sqrt{2} \angle 45^\circ & (-5 - j10) \\ -35 \angle 90^\circ & (7.5 + j5) \end{vmatrix} = (425 + j200)$$

$$\Delta_{I_2} = \begin{vmatrix} (25 + j10) & 30\sqrt{2} \angle 45^\circ \\ (-5 - j10) & -35 \angle 90^\circ \end{vmatrix} = (200 - j425)$$

$$\bar{I}_1 = \frac{\Delta_{I_1}}{\Delta} = \frac{425 + j200}{212.5 + j100} = 2(A)$$

$$\bar{I}_2 = \frac{\Delta_{I_2}}{\Delta} = \frac{200 - j425}{212.5 + j100} = 2 \angle -90^\circ (A)$$

