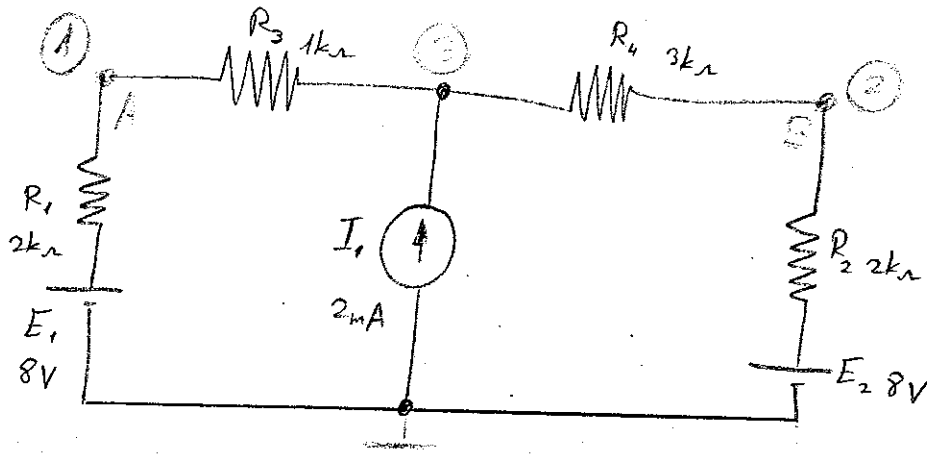


5

① פתור של שאלה מס' 5, חלק א' של מבחן הפיזיקה, חלק א' של מבחן הפיזיקה, חלק א' של מבחן הפיזיקה. חלק א' של מבחן הפיזיקה, חלק א' של מבחן הפיזיקה, חלק א' של מבחן הפיזיקה.



$$\begin{pmatrix} +G_{11} & -G_{12} & -G_{13} \\ -G_{21} & +G_{22} & -G_{23} \\ -G_{31} & -G_{32} & +G_{33} \end{pmatrix} \begin{pmatrix} V_1 \\ V_2 \\ V_3 \end{pmatrix} = \begin{pmatrix} I_{sc1} \\ I_{sc2} \\ I_{sc3} \end{pmatrix} \Rightarrow \begin{aligned} I_{sc1} &= \frac{E_1}{R_1} = 4 \text{ mA} \\ I_{sc2} &= \frac{E_2}{R_2} = 4 \text{ mA} \\ I_{sc3} &= I_1 = 2 \text{ mA} \end{aligned}$$

$$G_{11} = \frac{1}{R_1} + \frac{1}{R_3} = \frac{3}{2} \text{ mS}$$

$$G_{12} = G_{21} = 0 \text{ mS}$$

$$G_{22} = \frac{1}{R_2} + \frac{1}{R_4} = \frac{5}{6} \text{ mS}$$

$$G_{13} = G_{31} = \frac{1}{R_3} = 1 \text{ mS}$$

$$G_{33} = \frac{1}{R_3} + \frac{1}{R_4} = \frac{4}{3} \text{ mS}$$

$$G_{23} = G_{32} = \frac{1}{R_4} = \frac{1}{3} \text{ mS}$$



$$\begin{pmatrix} \frac{3}{2} & 0 & -1 \\ 0 & \frac{5}{6} & -\frac{1}{3} \\ -1 & -\frac{1}{3} & \frac{4}{3} \end{pmatrix} \begin{pmatrix} V_1 \\ V_2 \\ V_3 \end{pmatrix} = \begin{pmatrix} 4 \\ 4 \\ 2 \end{pmatrix} \Rightarrow \begin{aligned} V_1 &= \frac{21}{2} = 10.5 \text{ V} \\ V_2 &= \frac{19}{2} = 9.5 \text{ V} \\ V_3 &= \frac{47}{4} = 11.75 \text{ V} \end{aligned}$$



$$U_{AB} = V_1 - V_2 = 10.5 - 9.5 = 1 \text{ V}$$

$$\boxed{U_{AB} = 1 \text{ V}}$$

⑥

$$\omega_0 = 4\pi \cdot 10^4 \frac{\text{rad}}{\text{sec}}$$

$\Downarrow$

$$f_0 = \frac{\omega_0}{2\pi} = 20 \text{ kHz} \Rightarrow BW = 0.15 \cdot f_0 = 3 \text{ kHz}$$

$\Downarrow$

$$\boxed{BW = 3 \text{ kHz}} \\ \boxed{Q_0 = 6.666}$$

$$BW = \frac{f_0}{Q_0}$$

$$\Leftarrow 3 = \frac{20}{Q_0}$$

$$\textcircled{2} \quad f_0 = \frac{1}{2\pi\sqrt{LC}}$$

$$Q_0 = \frac{\omega_0 L}{R}$$

$$20 \cdot 10^3 = \frac{1}{2\pi\sqrt{3.98 \cdot 10^{-6} L}}$$

$$6.666 = \frac{4\pi \cdot 10^4 \cdot 15.91 \cdot 10^{-6}}{R}$$

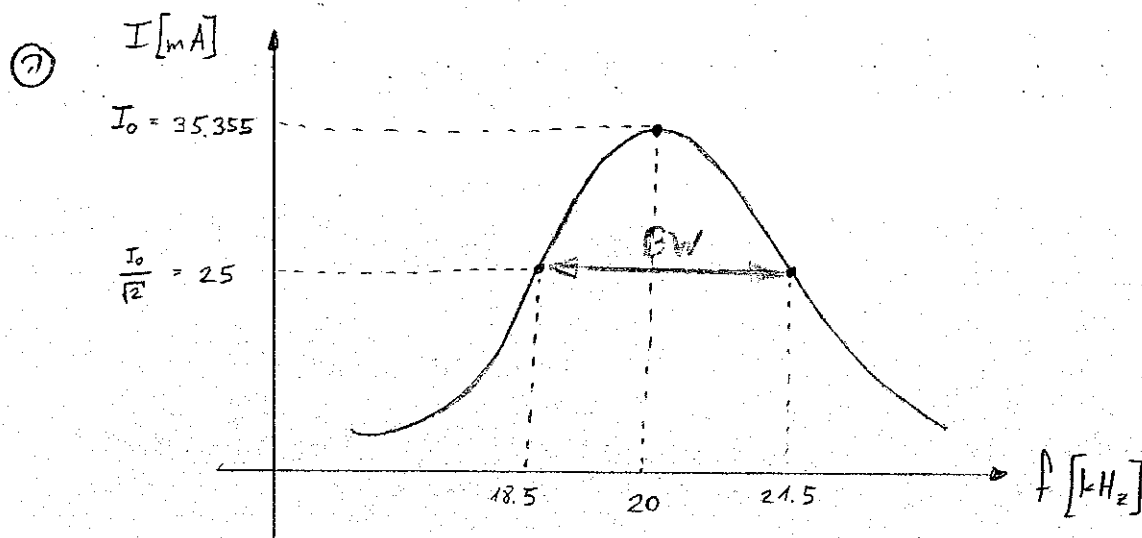
$$\boxed{L = 15.91 \mu\text{H}}$$

$$\boxed{R = 0.3 \Omega}$$

$I_{28 \text{ mV}}$

$$\textcircled{2} \quad \underline{U} = I \cdot R = \frac{50}{\sqrt{2}} \angle 0^\circ \cdot 0.3 = 35.355 \angle 0^\circ \cdot 0.3 = 10.6 \angle 0^\circ \text{ mV}$$

$$\textcircled{3} \quad f_{1,2} = f_0 \pm \frac{BW}{2} = 20 \pm \frac{3}{2} = \begin{cases} 18.5 \text{ kHz} \\ 21.5 \text{ kHz} \end{cases}$$



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$$\textcircled{b} \underline{Z}_T = [(X_L + R_2) \parallel X_C] + R_1 =$$

$$= \left[\frac{1}{20 + j50} + \frac{1}{-j50} \right]^{-1} + 25 = (150 - j50) \Omega = 158.113 \angle -18.4^\circ \Omega$$

$$\textcircled{a} \underline{I}_1 = \frac{U_1}{R_1} = \frac{1.58 \angle 18.4}{25} = 63.2 \angle 18.4^\circ \text{ mA}$$

$\Downarrow$

$$\underline{U} = \underline{I}_1 \cdot \underline{Z}_T = 63.2 \cdot 10^{-3} \angle 18.4 \cdot (150 - j50) \approx 10 \angle 0^\circ \text{ V}$$

$\underline{I}_2$ - $\underline{I}_3$ פ'אזיס פאזע פאזירט דא נאך נאך צו

$$\underline{U}_A = \underline{U} - \underline{U}_1 = 10 \angle 0 - 1.58 \angle 18.4 = 8.515 \angle -33.5^\circ \text{ V}$$

$\Downarrow$

$$\underline{I}_2 = \frac{\underline{U}_A}{R_2 + X_L} = \frac{8.515 \angle -3.35}{20 + j50}$$

$\Downarrow$

$$\underline{I}_3 = \frac{\underline{U}_A}{X_C} = \frac{8.515 \angle -3.35}{-j50}$$

$$\underline{I}_2 = 158.126 \angle -71.5^\circ \text{ mA}$$

$$\underline{I}_3 = 170.307 \angle 86.6^\circ \text{ mA}$$

$$\textcircled{c} \underline{S}_T = \underline{I}_1^* \cdot \underline{U} = 63.2 \cdot 10^{-3} \angle -18.4 \cdot 10 \angle 0 =$$

$$= (\underbrace{0.6}_{P_T} - j \underbrace{0.2}_{Q_T}) \text{ VA} = 0.632 \angle -18.4^\circ \text{ VA}$$

$$P_T = 0.6 \text{ W}$$