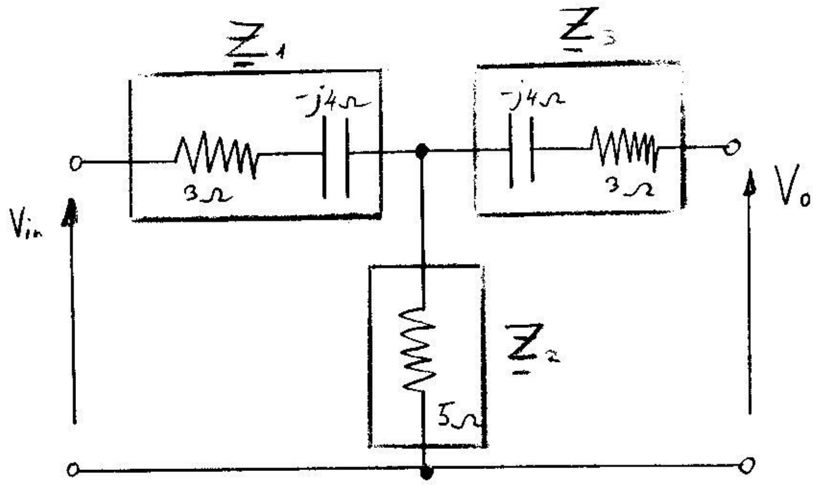
בס״ד, לק״י

(5)



(א) $Z_{11} = Z_1 + Z_2 = 3-4j+5 = (8-4j)\,\Omega$

$Z_{12} = Z_{21} = Z_2 = 5\Omega$

$Z_{22} = Z_2 + Z_3 = 5+3-j4 = (8-4j)\,\Omega$

בדטרמיננט

(ב) $|Z| = Z_{11}\cdot Z_{22} - Z_{12}\cdot Z_{21} = (8-4j)^2 - 5^2 = 68\angle -70.23^\circ$

$A = \dfrac{Z_{11}}{Z_{21}} = \dfrac{8-4j}{5} = 1.788\angle -26.56^\circ$

$B = \dfrac{|Z|}{Z_{21}} = \dfrac{68\angle -70.23^\circ}{5} = 13.60\angle -70.23^\circ$

$C = \dfrac{1}{Z_{21}} = \dfrac{1}{5} = 0.2$

$D = \dfrac{Z_{22}}{Z_{21}} = \dfrac{8-4j}{5} = 1.788\angle -26.56^\circ$

(ג) $Z_{sc} = Z_1 + (Z_2 \parallel Z_3) = (3-j4) + \left(\dfrac{1}{5} + \dfrac{1}{3-j4}\right)^{-1} =$

$= 7.603\angle -43.66^\circ\,\Omega$

(ד) $Z_0 = \sqrt{\dfrac{B}{C}} = \sqrt{\dfrac{13.6\angle -70.23^\circ}{0.2}} = 8.246\angle -35.1^\circ\,\Omega$

⑥ $R_0 = 50\Omega$

$f_c = \frac{10^6}{\pi}\ Hz$

⑥ $R_0 = \sqrt{\frac{L}{C}}$ | $f_c = \frac{1}{\pi\sqrt{LC}}$

$50 = \sqrt{\frac{L}{C}}$ | $\frac{10^6}{\pi} = \frac{1}{\pi\sqrt{LC}}$

$L = 50^2 C$ | $L = 10^{-12} \cdot \frac{1}{C}$

$$50^2 C = 10^{-12} \cdot \frac{1}{C}$$

$$50^2 C^2 = 10^{-12}$$

$$C = 0.4 \cdot 10^{-15} F$$

$$\frac{L}{2} = \frac{50^2 C}{2} = \frac{50^2 \cdot 0.4 \cdot 10^{-15}}{2} = 500 \cdot 10^{-15} H$$

⑦ $f_1 = \frac{10^5}{\pi}\ Hz < f_c \Rightarrow$ [illegible] $\Rightarrow \alpha_1 = 0$ neper

$f_2 = \frac{10^7}{\pi}\ Hz > f_c \Rightarrow \alpha_2 = 2 \cdot \cosh^{-1}\left(\frac{f_2}{f_c}\right) \approx 6$ neper

$$N_{1\,[dB]} = 20 \log e^{\alpha_1} = 0\ dB, \quad N_{2\,[dB]} = 20 \log e^{\alpha_2} = 52.115\ dB$$

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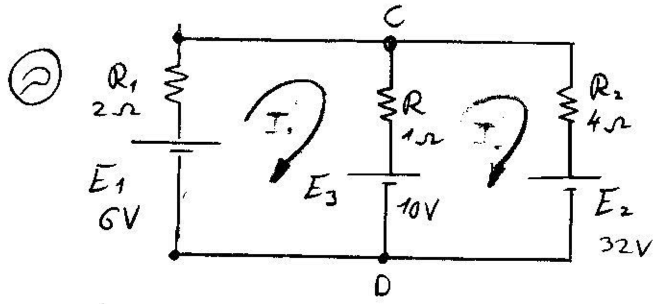
ב) $$U_{AB} = \frac{\frac{E_1}{R_1} + \frac{E_2}{R_2}}{\frac{1}{R_1} + \frac{1}{R} + \frac{1}{R_2}} = \frac{\frac{6}{2} + \frac{32}{4}}{\frac{1}{2} + \frac{1}{1} + \frac{1}{4}} = \frac{11}{1.75} =$$

$$= 6.285V$$

$$\Downarrow$$

$$\underset{[A\to B]}{I_R} = \frac{U_{AB}}{R} = \frac{6.285}{1} = 6.285A$$

ג)



$$\begin{cases} R_{11} I_1' - R_{12} I_2' = E_1' \\ -R_{21} I_1' + R_{22} I_2' = E_2' \end{cases}$$

$$\Downarrow$$

$$3 I_1' - 1 \cdot I_2' = 6 - 10$$
$$-1 \cdot I_1' + 5 \cdot I_2' = 10 - 32$$

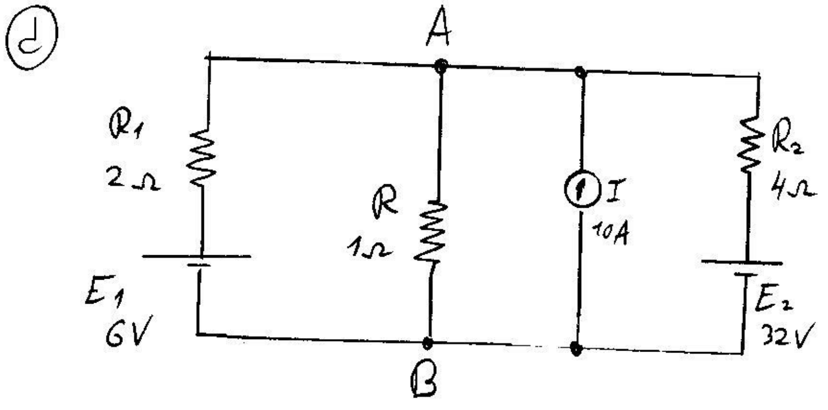
$$\Leftarrow$$

$$I_1' = -3A$$
$$I_2' = -5A$$

$$\Downarrow$$

$$\underset{[D\to C]}{I_{R_2}} = 0 - I_2' = 0 - (-5) = 5A$$

ד)



$$U_{AB} = \frac{\frac{E_1}{R_1} + I + \frac{E_2}{R_2}}{\frac{1}{R_1} + \frac{1}{R} + \frac{1}{R_2}} = \frac{11 + 10}{1.75} = 12V$$

$$\underset{[A\to B]}{I_R} = \frac{U_{AB}}{R} = \frac{12}{1} = 12A$$

(8) (c) $\underline{Z} = R_1 + \left[(R_2 + \underline{X}_L) \,||\, R_3 \right] =$

$= 5 + \left[(5 + j20) \,||\, 20 \right] =$

$= 5 + \left[(5+j20)^{-1} + 20^{-1} \right]^{-1} =$

$= \underbrace{(15.244 + j7.804)\,\Omega}_{X+jY} = \underbrace{17.126 \angle 27.11^\circ\ \Omega}_{|Z| \angle \alpha}$ //

(a) $\underline{I}_T = \dfrac{\underline{U}}{\underline{Z}} = \dfrac{100 \angle 45^\circ}{17.126 \angle 27.11^\circ} = 5.84 \angle 17.88^\circ\ A$

$\underline{U}_{R_1} = \underline{I}_T \cdot R_1 = 5.84 \angle 17.88^\circ \cdot 5 = 29.195 \angle 17.88^\circ\ V$

$\Downarrow$

$\underline{U}_{AB} = \underline{U} - \underline{U}_{R_1} = 100 \angle 45^\circ - 29.195 \angle 17.88^\circ = 75.2 \angle 55.2^\circ\ V$

(d) $\underline{S}_T = \underline{I}_T^* \cdot \underline{U} = 5.84 \angle -17.88^\circ \cdot 100 \angle 45 =$

$= \underbrace{(519.751}_{P_T\ [W]} + j\ 266.112)\ VA = 583.915 \angle 27.11^\circ\ VA$