سلم تصحيح مقترح لامتحان الكهرباء

حل تمرين الجزء الأول: (25 نقطة)

1- حساب سعة المكثفة المركبة على التوازي مع الوشيعة:

$$C_S = \frac{U \cdot R \cdot (tg\varphi - tg\varphi')}{Z = 20\Omega \Rightarrow ; \varphi = 60° \Rightarrow tg\varphi = 1,732}$$

$$\cos\varphi' = 0,9 \Rightarrow \varphi' = 25,84 \Rightarrow tg\varphi' = 0,484$$

$$\Rightarrow C_S = \frac{1}{2\pi \cdot 50 \cdot 10\,(1,732 - 0,484)} = 255\,\mu F$$

$$P = \frac{U_R^2}{R} = \frac{(U\cos\varphi)^2}{R} = \frac{(220)^2 (0,5)^2}{10} = 1210\,[W]$$

$$Q_L = \frac{U_X^2}{X_L} = \frac{(U\sin\varphi)^2}{17,32} = \frac{(220)^2 \cdot (0,866)^2}{17,32} = 2095,6\,[VAR]$$

$$S = \sqrt{P^2 + Q^2} = 2420\,[VA]$$

حساب الاستطاعات بعد تركيب المكثفة:

$$P' = \frac{U_R^2}{R} = \frac{(U\cdot\cos\varphi')^2}{10} = \frac{(220)^2 \cdot (0,9)^2}{10} = 3920,4\,[W]$$

$$Q' = \frac{U_X^2}{X_L'} = \frac{(U\cdot\sin\varphi')^2}{R\cdot tg\varphi'} = \frac{(220)^2 (0,436)^2}{10 \cdot 0,484} = 1900\,[VAR]$$

$$S' = \sqrt{P'^2 + Q'^2} = 4356,6\,[VA]$$

حل تمرين الجزء الثاني: (25 نقطة)

1) $\omega_0 = \frac{1}{\sqrt{L\cdot C}} = \frac{1}{\sqrt{5,05\cdot 10^{-3} \cdot 0,05\cdot 10^{-6}}} = 6,3\cdot 10^4\,rad/sec \Rightarrow f_0 = \frac{\omega_0}{2\pi} \simeq 10^4\,Hz$

2) $d = \frac{1}{Q} = \frac{R}{\rho} = \frac{100}{318} = 0,314$

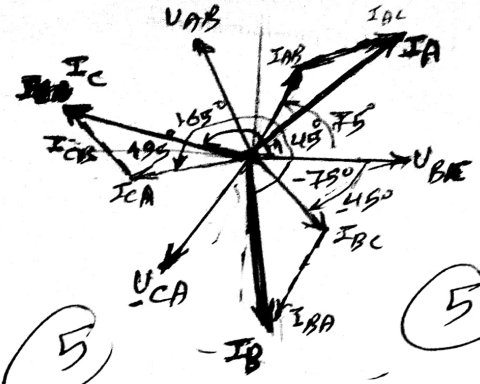
$$\rho = \sqrt{\frac{L}{C}} = \sqrt{\frac{5,05\cdot 10^{-3}}{0,05\cdot 10^{-6}}} = 318\,\Omega$$

$$U_{L_0} = U_{C_0} = QU = \frac{1}{d}U = \frac{1}{0,314}\cdot 10 = 31,8\,V$$

3) $\omega_L = \omega_0\sqrt{\frac{2}{2-d}} = 6,3\cdot 10^4\sqrt{\frac{2}{2-0,314}} = 6,45\cdot 10^4\,\frac{rad}{sec} \Rightarrow f_L = \frac{\omega_L}{2\pi} = \frac{6,45\cdot 10^4}{2\pi} = 10270\,Hz$

$$\omega_C = \omega_0\sqrt{\frac{2-d^2}{2}} = 6,3\cdot 10^4\sqrt{\frac{2-0,314^2}{2}} = 6,14\cdot 10^4\,\frac{rad}{sec} \Rightarrow f_C = \frac{\omega_C}{2\pi} = \frac{6,14\cdot 10^4}{2\pi}$$

$$\Rightarrow U_{L\max} = U_{C\max} = \frac{2U}{d\sqrt{4-d^2}} = \frac{2\cdot 10}{0,314\sqrt{4-0,314^2}} = 32,25\,[V]$$



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$$\underline{I}_{AB} = \frac{\underline{U}_{AB}}{\underline{Z}} = \frac{110 \cdot e^{j120^\circ}}{5 \cdot e^{j45}} = 22 e^{j75} \text{ [A]}$$

$$\underline{I}_{BC} = \frac{\underline{U}_{BC}}{\underline{Z}} = \frac{110 \cdot e^{j0^\circ}}{5 \cdot e^{j45^\circ}} = 22 \cdot e^{-j45^\circ} \text{ [A]}$$

$$\underline{I}_{CA} = \frac{\underline{U}_{CA}}{\underline{Z}} = \frac{110 \cdot e^{j240^\circ}}{5 \cdot e^{j45^\circ}} = 22 \cdot e^{j195^\circ} \text{ [A]}$$

$$\underline{I}_A = \underline{I}_{AB} - \underline{I}_{CA} = 38{,}1\, e^{j45^\circ} \text{ [A]}$$

$$\underline{I}_B = \underline{I}_{BC} - \underline{I}_{AB} = 38{,}1 \cdot e^{-j75^\circ} \text{ [A]}$$

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$$\underline{I}_C = \underline{I}_{CA} - \underline{I}_{BC} = 38{,}1 \cdot e^{j165^\circ} \text{ [A]}$$