SÈRIE 1

Exercici 1

Q1 d **Q2** c **Q3** a **Q4** b **Q5** c

Exercici 2

a) $Z = \sqrt{R^2 + X_L^2} = \sqrt{10^2 + 10^2} = 14{,}14\ \Omega$; $I_L = \dfrac{\dfrac{U}{\sqrt{3}}}{Z} = 16{,}33$ A

b) $P = 3\,R\,I_L^2 = 8$ kW

c) $Q = 3\,X\,I_L^2 = 8$ kvar

d) $fdp = \cos\varphi = \dfrac{P}{S} = \dfrac{P}{\sqrt{P^2 + Q^2}} = \dfrac{8}{\sqrt{8^2 + 8^2}} = 0{,}7071$

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Exercici 3

a) $V_1 = U\dfrac{R_1}{\sqrt{R_1^2 + X_L^2}} = 230\dfrac{20}{\sqrt{20^2 + 5^2}} = 223{,}1$ V

b) $P = \dfrac{V_1^2}{R_1} = 2489$ W

c) $R_{12} = \dfrac{R_1 R_2}{R_1 + R_2} = \dfrac{20 \cdot 10}{20 + 10} = 6{,}666\ \Omega$; $V_1' = U\dfrac{R_{12}}{\sqrt{R_{12}^2 + X_L^2}} = 230\dfrac{6{,}666}{\sqrt{6{,}666^2 + 5^2}} = 184$ V

d) $fdp = \cos\varphi = \dfrac{R_{12}}{\sqrt{R_{12}^2 + X_L^2}} = 0{,}8$

Exercici 4

a) $\eta(\%) = 100\dfrac{P}{\sqrt{3}UI\cos\varphi} = 100\dfrac{220.000}{\sqrt{3}693 \cdot 230 \cdot 0{,}85} = 93{,}75\ \%$

b) p = 3 parells de pols

c) $\Gamma = \dfrac{P}{\omega} = \dfrac{220 \cdot 10^3}{975\dfrac{2\pi}{60}} = 2155$ Nm

d) Triangle, $I_{\text{línia}} = 398$ A

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Exercici 3

a) $P_N = \Gamma_N \, \omega_N = 2 \cdot 1200 \frac{2\pi}{60} = 251{,}3 \text{ W}$

b) $\eta(\%) = 100 \frac{P_N}{U_N \, I_N} = 100 \frac{251{,}3}{50 \cdot 6} = 83{,}77\%$

c) $R_i = \frac{P_{elèc} - P_N}{I_N^2} = \frac{U_N \cdot I_N - P_N}{I_N^2} = \frac{50 \cdot 6 - 251{,}3}{6^2} = 1{,}353 \, \Omega$

d) $\frac{U_N}{E_N} = \frac{n_0}{n_N} \Rightarrow n_0 = n_N \frac{U_N}{E_N} = n_N \frac{U_N}{U_N - R_i \, I_N} = 1200 \frac{50}{50 - 1{,}353 \cdot 6} = 1433 \text{ min}^{-1}$

Exercici 4

a) $I = \frac{P}{U} = \frac{1000}{120} = 8{,}333 \text{ A}$

$\Delta U_{màx} = 2 R_{màx} I \Rightarrow R_{màx} = \frac{\Delta U_{màx}}{2I} = \frac{0{,}03 \cdot 120}{2 \cdot 8{,}333} = 0{,}216 \, \Omega$

$R_{màx} = \rho \frac{L}{S_{mín}} \Rightarrow S_{mín} = \rho \frac{L}{R_{màx}} = 0{,}01786 \frac{100}{0{,}216} = 8{,}268 \text{ mm}^2$

b) $S = 10 \text{ mm}^2$

c) $\Delta U = \Delta U_{màx} \frac{S_{mín}}{S} = 3 \frac{8{,}268}{10} = 2{,}48\%$

SÈRIE 3

Exercici 1

Q1 d **Q2** b **Q3** b **Q4** c **Q5** d

Exercici 2

a) $U_1 = V_1 \dfrac{R_1 + R_3}{R_3} = 10\dfrac{2+4}{4} = 15\ \text{V}$ $\qquad U_2 = V_2 \dfrac{R_2 + R_4}{R_4} = 10\dfrac{3+6}{6} = 15\ \text{V}$

b) $P_1 = \dfrac{U_1^2}{R_1 + R_3} = \dfrac{15^2}{6} = 37{,}5\ \text{W}$ $\qquad P_2 = \dfrac{U_2^2}{R_2 + R_4} = \dfrac{15^2}{9} = 25\ \text{W}$

c) Com la tensió de l'interruptor és nul·la, no canvia res si es tanca.

$I_1 = \dfrac{V_1}{R_3} = 2{,}5\ \text{A}$; $I_2 = \dfrac{V_2}{R_4} = 1{,}667\ \text{A}$

Alternativament

$$\left\{\begin{matrix} U_1 = R_1 I_1 + R_{34}(I_1 + I_2) \\ U_2 = R_3 I_2 + R_{34}(I_1 + I_2) \end{matrix}\right\} ; \left\{\begin{matrix} 15 = 2I_1 + R_{34}(I_1 + I_2) \\ 15 = 3I_2 + R_{34}(I_1 + I_2) \end{matrix}\right\} \Rightarrow \left\{\begin{matrix} I_1 = 2{,}5\ \text{A} \\ I_2 = 1{,}667\ \text{A} \end{matrix}\right\}$$

d) $V_1' = V_2' = R_3 I_1 = R_4 I_2 = R_{34}(I_1 + I_2) = 10\ \text{V}$

OPCIÓ A

Exercici 3

a) $I_\text{R} = \dfrac{U}{R} = \dfrac{400}{10} = 40\ \text{A}$; $I_\text{C} = \dfrac{U}{X_C} = \dfrac{400}{20} = 20\ \text{A}$; $I_\text{L} = \sqrt{3}\sqrt{I_\text{R}^2 + I_\text{C}^2} = \sqrt{3}\sqrt{40^2 + 20^2} = 77{,}46\ \text{A}$

b) $P = 3\dfrac{U^2}{R} = 3\dfrac{400^2}{10} = 48\ \text{kW}$

c) $Q = -3\dfrac{U^2}{X_\text{C}} = -3\dfrac{400^2}{20} = -24\ \text{kvar}$

d) $fdp = \cos\varphi = \dfrac{P}{S} = \dfrac{P}{\sqrt{P^2 + Q^2}} = \dfrac{48}{\sqrt{48^2 + 24^2}} = 0{,}8944$ (c)

Exercici 4

a) $U_2 = \dfrac{U_1}{r_\text{t}} = \dfrac{230}{10} = 23\ \text{V}$

b) $I_2 = \dfrac{U_2}{\sqrt{R^2 + X_\text{L}^2}} = \dfrac{23}{\sqrt{1 + 0{,}5^2}} = 20{,}57\ \text{A}$

c) $I_1 = \dfrac{I_2}{r_\text{t}} = \dfrac{20{,}57}{10} = 2{,}057\ \text{A}$

d) $P = RI_2^2 = 1 \cdot 20{,}57^2 = 423{,}1\,\text{W}$; $Q = X_L I_2^2 - \dfrac{U_1^2}{X_C} = 0{,}5 \cdot 20{,}57^2 - \dfrac{230^2}{196} = -58{,}33\,\text{var}$

$$S = \sqrt{P^2 + Q^2} = \sqrt{423{,}1^2 + 58{,}33^2} = 427{,}1\,\text{VA}$$

OPCIÓ B

Exercici 3

a) $U = V_1 \dfrac{\sqrt{R^2 + X_{C1}^2}}{X_{C1}} = 100 \dfrac{\sqrt{20^2 + 10^2}}{10} = 223{,}6\,\text{V}$

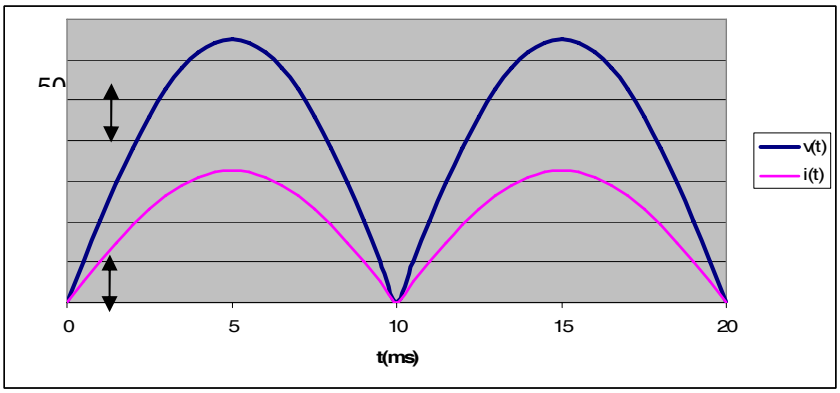
b) $P = RI^2 = R\left(\dfrac{U}{\sqrt{R^2 + X_{C1}^2}}\right)^2 = 20 \cdot \left(\dfrac{223{,}6}{\sqrt{20^2 + 10^2}}\right)^2 = 2000\,\text{W}$

c) $X_C = \dfrac{X_{C1} X_{C2}}{X_{C1} + X_{C2}} = \dfrac{10 \cdot 12}{10 + 12} = 5{,}455\,\Omega$

$$V_1' = U \frac{X_C}{\sqrt{R^2 + X_C^2}} = 223{,}6 \frac{5{,}455}{\sqrt{20^2 + 5{,}455^2}} = 58{,}84\,\text{V}$$

Exercici 4

a)



b) $I_{màx} = \dfrac{U_{màx}}{R} = \dfrac{\sqrt{2}U}{R} = \dfrac{\sqrt{2} \cdot 230}{100} = 3{,}253\,\text{A}$

c) $P = \dfrac{U^2}{R} = \dfrac{230^2}{100} = 529\,\text{W}$