

SÈRIE 1

Exercici 1

Q1 d Q2 c Q3 a Q4 b Q5 c

Exercici 2

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

b) $P = 3 R I_L^2 = 8 \text{ kW}$

c) $Q = 3 X I_L^2 = 8 \text{ kvar}$

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

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Exercici 3

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

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

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

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

Exercici 4

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

b) $p = 3$ parells de pols

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

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

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Exercici 3

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

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

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

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

Exercici 4

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

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

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

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

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

SÈRIE 3

Exercici 1

Q1 d Q2 b Q3 b Q4 c Q5 d

Exercici 2

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

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

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

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

Alternativament

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

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

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Exercici 3

$$a) I_R = \frac{U}{R} = \frac{400}{10} = 40 \text{ A}; \quad I_C = \frac{U}{X_C} = \frac{400}{20} = 20 \text{ A}; \quad I_L = \sqrt{3} \sqrt{I_R^2 + I_C^2} = \sqrt{3} \sqrt{40^2 + 20^2} = 77,46 \text{ A}$$

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

$$c) Q = -3 \frac{U^2}{X_C} = -3 \frac{400^2}{20} = -24 \text{ kvar}$$

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

Exercici 4

$$a) U_2 = \frac{U_1}{r_t} = \frac{230}{10} = 23 \text{ V}$$

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

$$c) I_1 = \frac{I_2}{r_t} = \frac{20,57}{10} = 2,057 \text{ A}$$

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

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

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Exercici 3

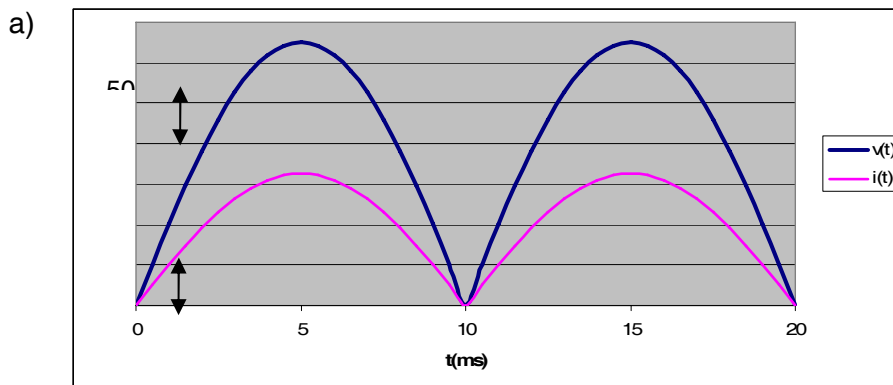
$$a) U = V_1 \frac{\sqrt{R^2 + X_{C1}^2}}{X_{C1}} = 100 \frac{\sqrt{20^2 + 10^2}}{10} = 223,6 \text{ V}$$

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

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

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

Exercici 4



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

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