

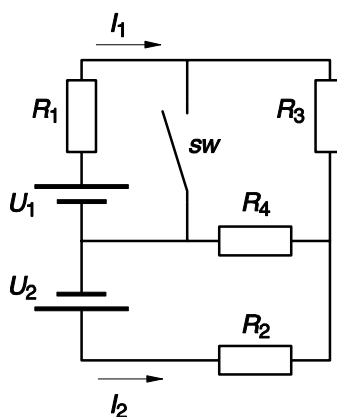
SÈRIE 1

Primera part

Exercici 1

Q1 a Q2 b Q3 b Q4 b Q5 a

Exercici 2



a) $P(R_4) = R_4 \cdot (I_1 + I_2)^2$

$$\begin{cases} U_1 = (R_1 + R_3) \cdot I_1 + R_4 \cdot (I_1 + I_2) \\ U_2 = R_2 \cdot I_2 + R_4 \cdot (I_1 + I_2) \end{cases} \Rightarrow \begin{cases} 44,4 = 12 \cdot I_1 + 10 \cdot (I_1 + I_2) \\ 25,4 = 2 \cdot I_2 + 10 \cdot (I_1 + I_2) \end{cases} \Rightarrow$$

$$\begin{cases} 44,4 = 22 \cdot I_1 + 10 \cdot I_2 \\ 25,4 = 10 \cdot I_1 + 12 \cdot I_2 \end{cases} \Rightarrow \begin{cases} I_1 = 1,7 \text{ A} \\ I_2 = 0,7 \text{ A} \end{cases}$$

$$P(R_4) = 10 \cdot (2,4)^2 = 57,6 \text{ W}$$

b) $P(U_2) = U_2 \cdot I_2 = 25,4 \cdot 0,7 = 17,78 \text{ W}$

c) $P(U_1) = U_1 \cdot I_1' = 44,4 \cdot \frac{44,4}{2} = 985,7 \text{ W}$

d) $P(R_2) = \frac{U_{R_2}^2}{R_2} = \frac{\left(\frac{2}{2+5} \cdot 25,4\right)^2}{2} = 26,33 \text{ W}$

OPCIÓ A

Exercici 3

- a) $X_L = 2 \cdot \pi \cdot f \cdot L = 100 \cdot \pi \cdot 100 \cdot 10^{-3} = 31,42 \Omega$ $A_1 = \frac{U}{X_L} = \frac{230}{31,42} = 7,32 \text{ A}$
- b) $X_C = \frac{1}{2 \cdot \pi \cdot f \cdot C} = \frac{1}{100 \cdot \pi \cdot 100 \cdot 10^{-6}} = 31,83 \Omega$ $A_2 = \frac{U}{\sqrt{R^2 + X_C^2}} = \frac{230}{\sqrt{50^2 + 31,83^2}} = 3,88 \text{ A}$
- c) $V_1 = R \cdot I(A_2) = 50 \cdot 3,88 = 194 \text{ V}$
- d) $V_2 = X_C \cdot I(A_2) = 31,83 \cdot 3,88 = 123,5 \text{ V}$

Exercici 4

- a) $\eta (\%) = 100 \cdot \frac{P_{\text{Mec.}}}{P_{\text{Elèc.}}} = 100 \cdot \frac{P_{\text{Mec.}}}{U \cdot I} = 100 \cdot \frac{34000}{470 \cdot 88} = 82,2 \%$
- b) $P_{\text{Pèrdues}} = P_{\text{Elèc.}} - P_{\text{Mec.}} = U \cdot I - P_{\text{Mec.}} = 470 \cdot 88 - 34000 = 7,36 \text{ kW}$
 $R_i = \frac{P_{\text{Pèrdues}}}{I^2} = \frac{7360}{88^2} = 0,95 \Omega$
- c) En condicions nominals: $E_n = U - R_i \cdot I = 470 - 0,95 \cdot 88 = 386,4 \text{ V}$
En les condicions actuals: $E = E_n \cdot \frac{n'}{n_n} = 386,4 \cdot \frac{720}{749} = 371,4 \text{ V}$
 $E = U' - R_i \cdot I' = 400 - 0,95 \cdot I' = 371,4 \text{ V} \Rightarrow I' = \frac{400 - 371,4}{0,95} = 30,06 \text{ A}$
 $\Gamma (\%) = 100 \cdot \frac{I'}{I} = 100 \cdot \frac{30,06}{88} = 34,16 \%$

OPCIÓ B

Exercici 3

$$a) \eta(\%) = 100 \cdot \frac{P}{\sqrt{3} \cdot U \cdot I \cdot \cos \varphi} = 100 \cdot \frac{45000}{\sqrt{3} \cdot 400 \cdot 77,4 \cdot 0,91} = 92,22 \%$$

$$b) \Gamma = \frac{P}{\omega} = \frac{45000}{2948 \cdot \frac{2 \cdot \pi}{60}} = 145,77 \text{ Nm}$$

$$c) P = \sqrt{3} \cdot U \cdot I \cdot \cos \varphi = \sqrt{3} \cdot 400 \cdot 77,4 \cdot 0,91 = 48,8 \text{ kW}$$

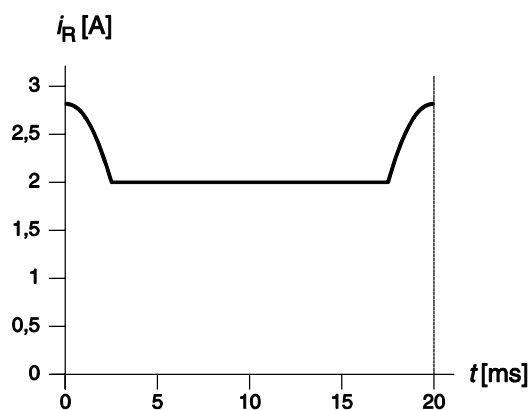
$$d) Q = \sqrt{S^2 - P^2} = \sqrt{(\sqrt{3} \cdot U \cdot I)^2 - (\sqrt{3} \cdot U \cdot I \cdot \cos \varphi)^2} = \sqrt{3} \cdot U \cdot I \cdot \sqrt{1 - (\cos \varphi)^2}$$

$$Q = \sqrt{3} \cdot 400 \cdot 77,4 \cdot \sqrt{1 - 0,91^2} = 22,23 \text{ kvar}$$

$$e) 400 \text{ V}$$

Exercici 4

a)



$$b) p(D_1 \text{ no condueix}) = \frac{U_2^2}{R} = \frac{10^2}{5} = 20 \text{ W}$$

$$c) P(R) > 20 \text{ W. Superior, ja que } p(D_1 \text{ condueix}) > 20 \text{ W}$$

SÈRIE 4

Primera part

Exercici 1

Q1 a Q2 d Q3 c Q4 d Q5 a

Exercici 2

- a) $X_C = \frac{1}{2 \cdot \pi \cdot 50 \cdot 50 \cdot 10^{-6}} = 63,66 \Omega$
- $$A_1 = \frac{\frac{400}{\sqrt{3}}}{\sqrt{R^2 + X_C^2}} = \frac{\frac{400}{\sqrt{3}}}{\sqrt{30^2 + 63,66^2}} = 3,28 \text{ A}$$
- b) $P = 3 \cdot R \cdot I_1^2 = 3 \cdot 30 \cdot 3,28^2 = 968,26 \text{ W}$
 $Q = 3 \cdot X_C \cdot I_1^2 = 3 \cdot 63,66 \cdot 3,28^2 = 2,055 \text{ kvar}$
 $S = \sqrt{3} \cdot U_{ab} \cdot I_1 = \sqrt{3} \cdot 400 \cdot 3,28 = 2,272 \text{ kVA}$
 $f_{dp} = \frac{P}{S} = \frac{968,26}{2272} = 0,4262 \text{ (capacitiu)}$
- c) $A_1 = 3,28 \text{ A}$ i $A_n = 0 \text{ A}$ per simetria

OPCIÓ A

Exercici 3

$$a) I_1 = \frac{U_1}{\frac{(R_1+R_2) \cdot (R_3+R_4)}{(R_1+R_2)+(R_3+R_4)}} = \frac{100}{\frac{(27+73) \cdot (50+50)}{(27+73)+(50+50)}} = 2 \text{ A}$$

$$b) I_{R_1} = I_{R_3} = \frac{I_1}{2} = 1 \text{ A} \quad (R_1 + R_2 = R_3 + R_4)$$

$$V_{FG} = V_{FH} + V_{HG} = V_{FH} - V_{GH} = R_2 \cdot \frac{I_1}{2} - R_4 \cdot \frac{I_1}{2} = 73 - 50 = 23 \text{ V}$$

$$c) V_{FH} = \frac{\frac{R_2 \cdot R_4}{R_2+R_4} + \frac{R_1 \cdot R_3}{R_1+R_3}}{\frac{R_2 \cdot R_4}{R_2+R_4} + \frac{R_1 \cdot R_3}{R_1+R_3}} \cdot U_1 = \frac{\frac{73 \cdot 50}{73+50} + \frac{27 \cdot 50}{27+50}}{\frac{73 \cdot 50}{73+50} + \frac{27 \cdot 50}{27+50}} \cdot 100 = 62,86 \text{ V}$$

$$I_{R_1} = \frac{U_1 - V_{FH}}{R_1} = \frac{100 - 62,86}{27} = 1,38 \text{ A} \quad I_{R_2} = \frac{V_{FH}}{R_2} = \frac{62,86}{73} = 0,86 \text{ A}$$

$$I_2 = I_{R_1} - I_{R_2} = 1,38 - 0,86 = 0,52 \text{ A}$$

Exercici 4

$$a) \Gamma = k \cdot I \Rightarrow k = \frac{\Gamma}{I} = \frac{600}{120} = 5 \frac{\text{Nm}}{\text{A}} \quad E = k \cdot \omega = 5 \cdot 831 \cdot \frac{2 \cdot \pi}{60} = 435,1 \text{ V}$$

$$b) U = R_i \cdot I + E \Rightarrow R_i = \frac{U - E}{I} = \frac{520 - 435,1}{120} = 0,71 \Omega$$

$$c) \eta(\%) = 100 \cdot \frac{P_{mec.}}{P_{elèc.}} = 100 \cdot \frac{\Gamma \cdot \omega}{U \cdot I} = 100 \cdot \frac{600 \cdot 831 \cdot \frac{2 \cdot \pi}{60}}{520 \cdot 120} = 83,68 \%$$

OPCIÓ B

Exercici 3

$$a) P = R \cdot I^2 \Rightarrow I = \sqrt{\frac{P}{R}} = \sqrt{\frac{250}{10}} = 5 \text{ A}$$

$$b) Z = \sqrt{R^2 + (X_L - X_C)^2} = \sqrt{10^2 + (10 - 20)^2} = 14,14 \Omega$$

$$U = Z \cdot I = 14,14 \cdot 5 = 70,7 \text{ V}$$

$$c) V_1 = X_L \cdot I = 10 \cdot 5 = 50 \text{ V}$$

$$d) Q = (X_L - X_C) \cdot I^2 = (10 - 20) \cdot 5^2 = -250 \text{ var}$$

Exercici 4

$$a) R_{estufa} = \frac{U_n^2}{P} = \frac{230^2}{1500} = 35,27 \Omega \quad R_{tram1} = \rho \cdot \frac{2 \cdot L}{S} = 0,0179 \cdot \frac{2 \cdot 60}{2,5} = 0,8592 \Omega$$

$$R_{tram2} = \rho \cdot \frac{2 \cdot L}{S} = 0,0179 \cdot \frac{2 \cdot 45}{1,5} = 1,074 \Omega$$

$$I = \frac{U}{R_{estufa} + R_{tram1} + R_{tram2}} = \frac{230}{35,27 + 0,8592 + 1,074} = 6,18 \text{ A}$$

$$b) U_{estufa} = U - (R_{tram1} + R_{tram2}) \cdot I = 230 - (0,8592 + 1,074) \cdot 6,18 = 218,05 \text{ V}$$

$$c) \Delta U_{tram1}(\%) = 100 \cdot \frac{\Delta U_{tram1}}{U} = 100 \cdot \frac{R_{tram1} \cdot I}{U} = 100 \cdot \frac{0,8592 \cdot 6,18}{230} = 2,31 \%$$

$$\Delta U_{tram2}(\%) = 100 \cdot \frac{\Delta U_{tram2}}{U} = 100 \cdot \frac{R_{tram2} \cdot I}{U} = 100 \cdot \frac{1,074 \cdot 6,18}{230} = 2,89 \%$$