



SÈRIE 5

Primera part

Exercici 1

Q1 b Q2 a Q3 a Q4 b Q5 c

Exercici 2

$$a) \begin{cases} R_1 (I_1 + I_2) + R_3 I_1 = U_1 \\ R_2 I_2 + R_1 (I_1 + I_2) = U_2 \end{cases} \rightarrow \begin{cases} (R_1 + R_3) I_1 + R_1 I_2 = U_1 \\ R_1 I_1 + (R_1 + R_2) I_2 = U_2 \end{cases}$$

$$\begin{bmatrix} R_1 + R_3 & R_1 \\ R_1 & R_1 + R_2 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} U_1 \\ U_2 \end{bmatrix} \rightarrow \begin{bmatrix} 10 + 30 & 10 \\ 10 & 10 + 20 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} 48 \\ 36 \end{bmatrix}$$

$$\begin{bmatrix} 40 & 10 \\ 10 & 30 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} 48 \\ 36 \end{bmatrix} \rightarrow \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} 0,982 \\ 0,873 \end{bmatrix} \text{ A}$$

$$b) P_{\text{Total}} = U_1 I_1 + U_2 I_2 = 48 \cdot 0,982 + 36 \cdot 0,873 = 78,56 \text{ W}$$

Alternativament,

$$P_{\text{Total}} = R_1 (I_1 + I_2)^2 + R_2 I_2^2 + R_3 I_1^2$$

$$P_{\text{Total}} = 10 \cdot (0,982 + 0,873)^2 + 20 \cdot 0,873^2 + 30 \cdot 0,982^2 = 78,58 \text{ W}$$

$$c) P_{R_2} = \frac{U_{R_2}^2}{R_2} = \frac{48^2}{20} = 115,2 \text{ W}$$

$$d) P_{R_3} = \frac{U_{R_3}^2}{R_3} = \frac{36^2}{30} = 43,2 \text{ W}$$

Segona part

OPCIÓ A

Exercici 3

$$a) V_1 = \frac{U}{\sqrt{3}} = \frac{100}{\sqrt{3}} = 57,735 \text{ V}$$

$$b) X_L = X_C = \frac{V_1}{A_2} = \frac{57,735}{2,721} = 21,218 \Omega$$

$$C = \frac{1}{\omega X_C} = \frac{1}{2 \pi f X_C} = \frac{1}{2 \pi 75 \cdot 21,218} = 100 \mu\text{F}$$

$$L = \frac{X_L}{\omega} = \frac{X_L}{2 \pi f} = \frac{21,218}{2 \pi 75} = 45,03 \text{ mH}$$

$$c) A_3 = A_2 = 2,721 \text{ A}$$

$$d) A_1 = 0 \text{ A}$$

$$e) A_4 = 0 \text{ A}$$



Exercici 4

$$a) f = \frac{1}{T} = \frac{1}{5 \text{ div} \cdot 10 \frac{\mu\text{s}}{\text{div}} \cdot \frac{1 \text{ s}}{10^6 \mu\text{s}}} = 20 \text{ kHz}$$

b) Quan condueix D_1 :

$$U_{R_1} = 4 \text{ div} \cdot 0,5 \frac{\text{V}}{\text{div}} = 2 \text{ V} \quad \rightarrow \quad I_{R_1} = I_{R_3} = \frac{U_{R_1}}{R_1} = \frac{2}{5} = 0,4 \text{ A}$$

$$U_{G_1 \text{ M\grave{a}x}} = (R_1 + R_3) I_{R_1} = (5 + 15) 0,4 = 8 \text{ V}$$

Quan condueix D_2 :

$$U_{R_1} = -4 \text{ div} \cdot 0,5 \frac{\text{V}}{\text{div}} = -2 \text{ V} \quad \rightarrow \quad I_{R_1} = I_{R_2} = \frac{U_{R_1}}{R_1} = \frac{-2}{5} = -0,4 \text{ A}$$

$$U_{G_1 \text{ M\grave{a}n}} = (R_1 + R_2) I_{R_1} = (5 + 5) (-0,4) = -4 \text{ V}$$

$$c) \overline{U_{G_1}} = \frac{1}{5 \text{ div}} (3 \text{ div} \cdot 8 \text{ V} + 2 \text{ div} \cdot (-4 \text{ V})) = 3,2 \text{ V}$$

OPCIÓ B

Exercici 3

$$a) P = \sqrt{3} U_N I_N \cos \varphi_N = \sqrt{3} \cdot 690 \cdot 139 \cdot 0,85 = 141,2 \text{ kW}$$

$$Q = \sqrt{3} U_N I_N \sin \varphi_N = \sqrt{3} \cdot 690 \cdot 139 \cdot \sqrt{1 - 0,85^2} = 87,51 \text{ kvar}$$

Alternativament,

$$P = \sqrt{3} U_N I_N \cos \varphi_N = \sqrt{3} \cdot 400 \cdot 241 \cdot 0,85 = 141,9 \text{ kvar}$$

$$Q = \sqrt{3} U_N I_N \sin \varphi_N = \sqrt{3} \cdot 400 \cdot 241 \cdot \sqrt{1 - 0,85^2} = 87,96 \text{ kvar}$$

$$b) \Gamma = \frac{P_N}{\omega_N} = \frac{132000}{985 \frac{2\pi}{60}} = 1,28 \text{ kN m}$$

$$c) \eta(\%) = 100 \frac{P_N}{P} = 100 \frac{132000}{141200} = 93,48 \%$$

Alternativament,

$$\eta(\%) = 100 \frac{P_N}{P} = 100 \frac{132000}{141900} = 93,02 \%$$

$$d) p = 3$$

$$e) U_{\text{xarxa}} = 400 \text{ V i } I_N = 241 \text{ A}$$



Exercici 4

$$a) W_3 = \frac{U_{R_3}^2}{R_3} \rightarrow U_{R_3} = \sqrt{W_3 R_3} = \sqrt{67,5 \cdot 30} = 45 \text{ V}$$

$$W_2 = \frac{U_{R_3}^2}{R_2} + W_3 = \frac{45^2}{25} + 67,5 = 148,5 \text{ W}$$

$$b) I_L = \frac{U_{R_3}}{X_L} = \frac{45}{10} = 4,5 \text{ A}$$

$$L = \frac{X_L}{\omega} = \frac{X_L}{2 \pi f} = \frac{10}{2 \pi 50} = 31,83 \text{ mH}$$

$$c) I_{R_1} = \sqrt{I_L^2 + (I_{R_2} + I_{R_3})^2} = \sqrt{I_L^2 + \left(\frac{U_{R_3}}{R_2} + \frac{U_{R_3}}{R_3}\right)^2} = \sqrt{4,5^2 + \left(\frac{45}{25} + \frac{45}{30}\right)^2} = 5,58 \text{ A}$$

$$W_1 = R_1 I_{R_1}^2 + W_2 = 10 \cdot 5,58^2 + 148,5 = 459,86 \text{ W}$$