

SERIE 1

Primera part

Exercici 1

Q1 c Q2 a Q3 c Q4 a Q5 b

Exercici 2

$$a) X_C = \frac{V_C}{I_1} = \frac{140}{10} = 14 \Omega \quad C = \frac{1}{\omega X_C} = \frac{1}{100 \cdot \pi \cdot 14} = 227,4 \mu\text{F}$$

$$b) X_L = \frac{V_L}{I_1} = \frac{40}{10} = 4 \Omega \quad L = \frac{X_L}{\omega} = \frac{4}{100 \cdot \pi} = 12,73 \text{ mH}$$

$$c) Z = \frac{V_X}{I_1} = \frac{120}{10} = 12 \Omega$$

$$Z = \sqrt{R^2 + (X_L - X_C)^2} \rightarrow R = \sqrt{Z^2 - (X_L - X_C)^2} = \sqrt{12^2 - (4 - 14)^2} = 6,633 \Omega$$

$$d) \text{fdp} = \cos \varphi = \frac{R}{Z} = \frac{6,633}{12} = 0,5528 \text{ (c)}$$

OPCIÓ A

Exercici 3

$$a) I_R = \frac{U_{rs}}{\sqrt{3} R} = \frac{400}{\sqrt{3} \cdot 6} = 38,49 \text{ A} \quad I_X = \frac{U_{rs}}{\sqrt{3} X} = \frac{400}{\sqrt{3} \cdot 10} = 23,09 \text{ A}$$

$$I_r = A_1 = \sqrt{I_R^2 + I_X^2} = \sqrt{38,49^2 + 23,09^2} = 44,88 \text{ A}$$

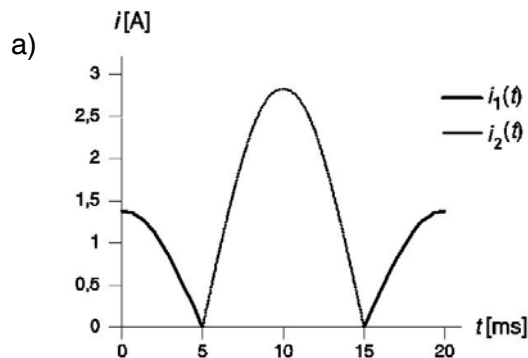
$$b) P = 3 \frac{\left(\frac{U_{rs}}{\sqrt{3}}\right)^2}{R} = 3 \frac{\left(\frac{400}{\sqrt{3}}\right)^2}{6} = 26,67 \text{ kW}$$

$$Q = 3 \frac{\left(\frac{U_{rs}}{\sqrt{3}}\right)^2}{X} = 3 \frac{\left(\frac{400}{\sqrt{3}}\right)^2}{10} = 16 \text{ kvar}$$

$$S = \sqrt{3} \cdot U_{rs} \cdot I_r = \sqrt{3} \cdot 400 \cdot 44,88 = 31,093 \text{ kVA}$$

c) $A_2 = 0$ per simetria, corrent de neutre nul.

Exercici 4



b)

$$U = \frac{V_{\text{pic}}}{\sqrt{2}} = \frac{\sqrt{2} \cdot 24}{\sqrt{2}} = 24 \text{ V}$$

$$P_1 = \frac{1}{2} \frac{U^2}{R_1} = \frac{1}{2} \frac{24^2}{24} = 12 \text{ W}$$

$$P_2 = \frac{1}{2} \frac{U^2}{R_2} = \frac{1}{2} \frac{24^2}{12} = 24 \text{ W}$$

OPCIÓ B

Exercici 3

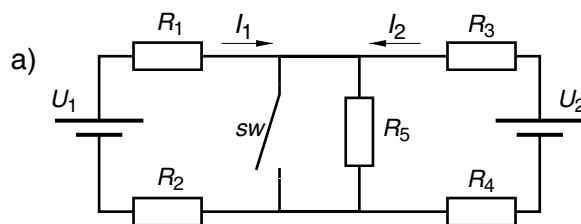
a) $\eta(\%) = 100 \frac{P}{\sqrt{3}UI \cos \varphi} = \frac{75000}{\sqrt{3} \cdot 3400 \cdot 135 \cdot 0,85} = 94,34\%$

b) $p = 2$ parells de pols

c) $\Gamma = \frac{R_N}{\omega_N} = \frac{75000}{1480 \frac{2\pi}{60}} = 483,92 \text{ Nm}$

d) $Q = S \sin \varphi = \sqrt{3}UI \sqrt{1 - \cos^2 \varphi} = \sqrt{3} \cdot 3400 \cdot 135 \cdot \sqrt{1 - 0,85^2} = 49,27 \text{ kvar}$

Exercici 4



$$\begin{cases} U_1 = (R_1 + R_2)I_1 + R_5(I_1 + I_2) \\ U_2 = (R_3 + R_4)I_2 + R_5(I_1 + I_2) \end{cases} \rightarrow \begin{cases} 24 = 4I_1 + 6(I_1 + I_2) \\ 10 = 2I_2 + 6(I_1 + I_2) \end{cases} \rightarrow \begin{cases} I_1 = 3 \text{ A} \\ I_2 = -1 \text{ A} \end{cases} \quad I_1 + I_2 = 2 \text{ A}$$

b) $P_1 = U_1 I_1 = 24 \cdot 3 = 72 \text{ W}$ $P_2 = U_2 I_2 = 10 \cdot (-1) = -10 \text{ W}$

c) $I_1' = \frac{U_1}{R_1 + R_2} = \frac{24}{4} = 6 \text{ A}$ (R_1 i R_2) $I_2' = \frac{U_2}{R_3 + R_4} = \frac{10}{2} = 5 \text{ A}$ (R_3 i R_4)

$I(R_5) = 0$

SERIE 4

Primera part

Exercici 1

Q1 b Q2 c Q3 d Q4 c Q5 d

Exercici 2

$$a) Z = \sqrt{R^2 + X^2} = \sqrt{10^2 + 5^2} = 11,18 \Omega \qquad I_1 = \frac{U_{rs}}{Z} = \frac{400}{11,18} = 20,66 \text{ A}$$

$$b) P = 3RI_1^2 = 3 \cdot 10 \cdot 20,66^2 = 12,8 \text{ kW}$$
$$Q = 3XI_1^2 = 3 \cdot 5 \cdot 20,66^2 = 6,4 \text{ kvar}$$
$$S = \sqrt{3}U_{rs}I_1 = \sqrt{3} \cdot 400 \cdot 20,66 = 14,31 \text{ kVA}$$
$$fdp = \frac{P}{S} = \frac{12,8}{14,31} = 0,8945$$

c) $I_N = 0$ per simetria.

OPCIÓ A

Exercici 3

$$a) I_1 = I_2 = \frac{U_1 + U_2}{R_1 + R_2 + R_3} = \frac{36}{24} = 1,5 \text{ A} \qquad I(R_1) = I(R_2) = I(R_3) = I_1 = 1,5 \text{ A}$$

$$b) P_1 = U_1 I_1 = 24 \cdot 1,5 = 36 \text{ W} \qquad P_2 = U_2 I_2 = 12 \cdot 1,5 = 18 \text{ W}$$

$$c) I_1 = \frac{U_1}{R_2} = \frac{24}{12} = 2 \text{ A} \qquad I_2 = \frac{U_2}{R_1 + R_3} = \frac{12}{12} = 1 \text{ A}$$

$$d) P_1 = U_1 I_1 = 24 \cdot 2 = 48 \text{ W} \qquad P_2 = U_2 I_2 = 12 \cdot 1 = 12 \text{ W}$$

Exercici 4

$$a) \eta(\%) = 100 \frac{P}{\sqrt{3}UI \cos \varphi} = \frac{30000}{\sqrt{3}400 \cdot 52 \cdot 0,9} = 92,52\%$$

$$b) p = 1 \text{ parell de pols}$$

$$c) \Gamma = \frac{R_N}{\omega_N} = \frac{30000}{2950 \frac{2\pi}{60}} = 97,11 \text{ Nm}$$

$$d) \text{ Sí que es pot, atès que en triangle necessita 230 V.}$$

OPCIÓ B

Exercici 3

$$a) I_R = \frac{U_1}{R} = \frac{230}{100} = 2,3 \text{ A} \quad I_L = \frac{U_1}{X_L} = \frac{230}{200} = 1,15 \text{ A}$$

$$I_1 = \sqrt{I_R^2 + I_L^2} = \sqrt{2,3^2 + 1,15^2} = 2,572 \text{ A}$$

$$b) P = \frac{U_1^2}{R} = \frac{230^2}{100} = 529 \text{ W}$$

$$Q = \frac{U_1^2}{X_L} = \frac{230^2}{200} = 264,5 \text{ var}$$

$$c) fdp' = 1 \rightarrow Q' = 0 = Q + Q_C \rightarrow Q_C = -Q = -264,5 \text{ var}$$

$$X_C = \frac{-U_1^2}{Q_C} = \frac{230^2}{264,5} = 200 \Omega$$

Exercici 4

$$a) \Delta V = 0,02 \cdot 230 = 4,6 \text{ V} \quad I = \frac{P}{V} = \frac{2000}{230} = 8,696 \text{ A}$$

$$\Delta V = 2 \cdot R_{\text{màx}} \cdot I \rightarrow R_{\text{màx}} \leq \frac{\Delta V}{2I} = \frac{4,6}{2 \cdot 8,696} = 0,2645 \Omega$$

$$b) R_{\text{màx}} = \rho \frac{l}{S_{\text{min}}} \rightarrow S_{\text{min}} = \rho \frac{l}{R_{\text{màx}}} = 0,0179 \frac{50}{0,2645} = 3,384 \text{ mm}^2$$

$$c) 4 \text{ mm}^2$$

$$d) \Delta V' = \Delta V \frac{S_{\text{min}}}{S} = 4,6 \frac{3,384}{4} = 3,89 \text{ V} \quad (1,69\%)$$