

**SÈRIE 3****Primera part****Exercici 1**

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

**Exercici 2**

a) Per simetria,  $A_3 = 0$  A

Alternativament,

$$\begin{cases} U_1 = (R_1 + R_4) I_{U_1} + R_2 (I_{U_1} - I_{U_2}) \\ U_2 = -R_2 (I_{U_1} - I_{U_2}) + (R_3 + R_5) I_{U_2} \end{cases} \rightarrow \begin{cases} U_1 = (R_1 + R_2 + R_4) I_{U_1} - R_2 I_{U_2} \\ U_2 = -R_2 I_{U_1} + (R_2 + R_3 + R_5) I_{U_2} \end{cases}$$

$$\begin{bmatrix} R_1 + R_2 + R_4 & -R_2 \\ -R_2 & R_2 + R_3 + R_5 \end{bmatrix} \begin{bmatrix} I_{U_1} \\ I_{U_2} \end{bmatrix} = \begin{bmatrix} U_1 \\ U_2 \end{bmatrix}$$

$$\begin{bmatrix} 35 & -10 \\ -10 & 35 \end{bmatrix} \begin{bmatrix} I_{U_1} \\ I_{U_2} \end{bmatrix} = \begin{bmatrix} 24 \\ 24 \end{bmatrix} \rightarrow \begin{bmatrix} I_{U_1} \\ I_{U_2} \end{bmatrix} = \begin{bmatrix} 0,96 \\ 0,96 \end{bmatrix} \text{ A}$$

$$A_3 = I_{U_2} - I_{U_1} = 0 \text{ A}$$

b) Com que  $A_3 = 0$  A,  $W_1 = \frac{U_1^2}{R_1 + R_4} = \frac{24^2}{25} = 23,04$  W

Alternativament,

$$W_1 = U_1 I_{U_1} = 24 \cdot 0,96 = 23,04 \text{ W}$$

c) Per simetria,  $P_{\text{total}} = 2 W_1 = 2 \cdot 23,04 = 46,08$  W

Alternativament,

$$P_{\text{total}} = (R_1 + R_4) I_{U_1}^2 + (R_3 + R_5) I_{U_2}^2 + R_2 (I_{U_1} - I_{U_2})^2$$

$$P_{\text{total}} = 25 \cdot 0,96^2 + 25 \cdot 0,96^2 + 10 \cdot 0^2 = 46,08 \text{ W}$$

**Segona part**

## OPCIÓ A

**Exercici 3**

$$a) r_t = \frac{U_{\text{nom. primari}}}{U_{\text{nom. secundari}}} = \frac{240}{24} = 10$$

$$U_2 = R_2 I_2 = 1,5 \cdot 15 = 22,5 \text{ V}$$

$$V_1 = r_t U_2 = 10 \cdot 22,5 = 225 \text{ V}$$

$$b) I = I_{R_1} = I_{\text{primari}} + I_{R_3} = \frac{I_{\text{secundari}}}{r_t} + \frac{V_1}{R_3} = \frac{15}{10} + \frac{225}{100} = 3,75 \text{ A}$$

$$c) R_1 = \frac{U_{R_1}}{I_{R_1}} = \frac{U - V_1}{I_{R_1}} = \frac{400 - 225}{3,75} = 46,67 \Omega$$

$$d) R_{\text{Eq}} = \frac{U}{I} = \frac{400}{3,75} = 106,67 \Omega$$

Alternativament,

$$R_{\text{Eq}} = R_1 + \frac{R_3 r_t^2 R_2}{R_3 + r_t^2 R_2} = 46,67 + \frac{100 \cdot 10^2 \cdot 1,5}{100 + 10^2 \cdot 1,5} = 106,67 \Omega$$

**Exercici 4**

$$a) \eta (\%) = 100 \frac{P_N}{U_N I_N + \frac{U_{eN}^2}{R_e}} = 100 \frac{30000}{500 \cdot 69 + \frac{300^2}{45}} = 82,19 \%$$

$$b) \Gamma = \frac{P_N}{\omega_N} = \frac{P_N}{n_N \frac{2\pi}{60}} = \frac{30000}{1750 \frac{2\pi}{60}} = 163,7 \text{ N m}$$

$$c) E_N = \frac{P_N}{I_N} = \frac{30000}{69} = 434,78 \text{ V} \quad \rightarrow \quad R_i = \frac{U_N - E_N}{I_N} = \frac{500 - 434,78}{69} = 0,945 \Omega$$

$$d) I_{eN} = \frac{U_{eN}}{R_e} = \frac{300}{45} = 6,67 \text{ A}$$

e) En el punt de funcionament:

$$E' = \frac{U_N}{2} - R_i 0,3 I = \frac{500}{2} - 0,945 \cdot 0,3 \cdot 69 = 230,44 \text{ V}$$

$$n' = \frac{E'}{E_N} n_N = \frac{230,44}{434,78} 1750 = 927,5 \text{ min}^{-1}$$

## OPCIÓ B

**Exercici 3**

$$a) U^2 = V_1^2 + V_2^2 \quad \rightarrow \quad V_1 = \sqrt{U^2 - V_2^2} = \sqrt{400^2 - 100^2} = 387,3 \text{ V}$$

$$b) P = 3 R I_R^2 = 3 \frac{V_1^2}{R} = 3 V_1 I_R = 3 V_1 \frac{A_1}{\sqrt{3}} = 3 \cdot 387,3 \cdot \frac{27,71}{\sqrt{3}} = 18,59 \text{ kW}$$

$$c) S = \sqrt{3} U A_1 = \sqrt{3} \cdot 400 \cdot 27,71 = 19,2 \text{ kVA}$$

$$Q = \sqrt{S^2 - P^2} = \sqrt{19,2^2 - 18,59^2} = 4,8 \text{ kvar}$$

Alternativament,

$$Q = Q_L - Q_C = 3 \frac{V_2^2}{X_L} - 3 \frac{V_2^2}{X_C} = 3 \frac{100^2}{5} - 3 \frac{100^2}{25} = 4,8 \text{ kvar}$$

$$d) fdp = \frac{P}{S} = \frac{18,59}{19,2} = 0,968$$

**Exercici 4**

$$a) U_2 = 1,4 \operatorname{div} \frac{5 \text{ V}}{\operatorname{div}} = 7 \text{ V}$$

$$b) U_{1\text{pic}} = \frac{R_1 + R_2}{R_2} U_{1\text{picSonda}} = \frac{5+10}{10} 4 \operatorname{div} \cdot \frac{5 \text{ V}}{\operatorname{div}} = 30 \text{ V}$$

$$U_1 = \frac{U_{1\text{pic}}}{\sqrt{2}} = \frac{30}{\sqrt{2}} = 21,21 \text{ V}$$

$$c) f = \frac{1}{T} = \frac{1}{4 \cdot 2 \cdot 10^{-3}} = 125 \text{ Hz}$$