

SÈRIE 1**Primera part****Exercici 1**

Q1 d Q2 d Q3 b Q4 c Q5 b

Exercici 2

$$a) V_1 = \frac{U}{\sqrt{3}} = \frac{400}{\sqrt{3}} = 230,9 \text{ V}$$

$$b) A_1 = \frac{V_1}{R_1} = \frac{230,9}{20} = 11,55 \text{ A}$$

$$c) A_2 = \frac{V_1}{\sqrt{R_2^2 + X_{L2}^2}} = \frac{230,9}{\sqrt{10^2 + 10^2}} = 16,33 \text{ A}$$

$$d) V_2 = R_2 A_2 = 10 \cdot 16,33 = 163,3 \text{ V}$$

$$e) V_2 = X_{L2} A_2 = 10 \cdot 16,33 = 163,3 \text{ V}$$

Segona part

OPCIÓ A

Exercici 3

$$a) p = 3$$

$$b) \Gamma = \frac{P}{\omega} = \frac{90000}{948 \frac{2\pi}{60}} = 906,6 \text{ N m}$$

$$c) \eta_N = 0,9425 = \frac{P_N}{\sqrt{3} U_N I_N \cos \varphi_N} = \frac{90000}{\sqrt{3} \cdot 400 \cdot I_N \cdot 0,85} \rightarrow I_N = \frac{90000}{\sqrt{3} \cdot 400 \cdot 0,9425 \cdot 0,85} = 162,2 \text{ A}$$

$$d) P = \sqrt{3} U_N I_N \cos \varphi_N = \sqrt{3} \cdot 400 \cdot 162,2 \cdot 0,85 = 95,52 \text{ kW}$$

$$Q = \sqrt{3} U_N I_N \sin \varphi = \sqrt{3} \cdot 400 \cdot 162,2 \cdot \sqrt{1 - 0,85^2} = 59,2 \text{ kvar}$$

$$S = \sqrt{3} U_N I_N = \sqrt{3} \cdot 400 \cdot 162,2 = 112,38 \text{ kVA}$$

Exercici 4

$$a) R_{34} = \frac{R_3 R_4}{R_3 + R_4} = \frac{10 \cdot 15}{10 + 15} = 6 \Omega$$

$$U_1 = R_1 I_1 + R_{34} (I_1 + I_2) = (R_1 + R_{34}) I_1 + R_{34} I_2$$

$$I_1 = \frac{U_1 - R_{34} I_2}{R_1 + R_{34}} = \frac{48 - 6 \cdot 0,96}{10 + 6} = 2,64 \text{ A}$$

$$b) U_1 - R_1 I_1 = U_2 - R_2 I_2 \quad \rightarrow \quad R_2 = \frac{U_2 - U_1 + R_1 I_1}{I_2} = \frac{36 - 48 + 10 \cdot 2,64}{0,96} = 15 \Omega$$

$$c) P_{\text{Total}} = R_1 I_1^2 + R_2 I_2^2 + R_{34} (I_1 + I_2)^2$$

$$P_{\text{Total}} = 10 \cdot 2,64^2 + 15 \cdot 0,96^2 + 6 \cdot (2,64 + 0,96)^2 = 161,28 \text{ W}$$

Alternativament,

$$P_{\text{Total}} = U_1 I_1 + U_2 I_2 = 48 \cdot 2,64 + 36 \cdot 0,96 = 161,28 \text{ W}$$

OPCIÓ B

Exercici 3

$$a) W_1 = R A_1^2 = 500 \text{ W} = 10 A_1^2 \quad \rightarrow \quad A_1 = \sqrt{\frac{500}{10}} = 7,071 \text{ A}$$

$$b) U = Z I = I \sqrt{R^2 + (X_L - X_C)^2} = 7,071 \sqrt{10^2 + (10 - 20)^2} = 100 \text{ V}$$

$$c) Q_{\text{Consumida}} = X I^2 = (X_L - X_C) I^2 = (10 - 20) 7,071^2 = -500 \text{ var}$$

d) En resonància, $X_L = X_C$ i, per tant,

$$W_1 = R A_1^2 = R \left(\frac{U}{Z}\right)^2 = \frac{U^2}{R} = \frac{100^2}{10} = 1000 \text{ W}$$

$$e) X_C = \frac{1}{\omega C} \quad \rightarrow \quad C = \frac{1}{2 \pi f X_C} = \frac{1}{2 \pi 50 \cdot 20} = 159,15 \mu\text{F}$$

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

$$f_r = \frac{1}{2 \pi \sqrt{LC}} = \frac{1}{2 \pi \sqrt{31,83 \cdot 10^{-3} \cdot 159,15 \cdot 10^{-6}}} = 70,71 \text{ Hz}$$

Exercici 4

a)

$$R_{\text{cond.}} = 2 \frac{\Omega}{\text{km}} 0,2 \text{ km} = 0,4 \Omega$$

$$L_{\text{cond.}} = 5 \frac{\text{mH}}{\text{km}} 0,2 \text{ km} = 1 \text{ mH}$$

$$X_{L \text{ cond.}} = \omega L = 2 \pi f L_{\text{cond.}} = 2 \pi 50 \cdot 1 \cdot 10^{-3} = 0,314 \Omega$$

$$U_X = Z_{\text{Eq.}} I_N = \sqrt{(2 R_{\text{cond.}} + R_M)^2 + (2 X_{L \text{ cond.}} + X_M)^2} I_N$$

$$U_X = \sqrt{(2 \cdot 0,4 + 44)^2 + (2 \cdot 0,314 + 13)^2} \cdot 5 = 234,1 \text{ V}$$

b)

$$\Delta U(\%) = \frac{U_X - U_N}{U_N} 100 = \frac{234,1 - 230}{230} 100 = 1,78 \%$$

c)

$$\eta(\%) = 100 \frac{P_{\text{Consumida Motor}}}{P_{\text{Inici Línia}}} = 100 \frac{P_{\text{Consumida Motor}}}{P_{\text{Consumida Motor}} + 2 R I_N^2}$$

$$\eta(\%) = 100 \frac{U_N I_N \cos \varphi_N}{U_N I_N \cos \varphi_N + 2 R I_N^2} = 100 \frac{230 \cdot 5 \cdot 0,96}{230 \cdot 5 \cdot 0,96 + 2 \cdot 0,4 \cdot 5^2} = 98,22 \%$$