## SÈRIE 4

### Primera part

### Exercici 1

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

### Exercici 2

a) $A_1 = \frac{U_1}{\frac{R_1R_3}{R_1+R_3}+\frac{R_2R_4}{R_2+R_4}+R_5} = \frac{100}{\frac{37{,}5\cdot 75}{37{,}5+75}+\frac{75\cdot 37{,}5}{75+37{,}5}+50} = 1\ \text{A}$

b) $V_1 = \frac{R_1R_3}{R_1+R_3}A_1 = \frac{37{,}5\cdot 75}{37{,}5+75}1 = 25\ \text{V}$

c) $V_2 = U_1 - V_1 = 100 - 25 = 75\ \text{V}$

d) $V_{R2} = V_2 - R_5A_1 = 75 - 50\cdot 1 = 25\ \text{V}$

$I_{R1} = \frac{V_1}{R_1} = \frac{25}{37{,}5} = 0{,}667\ \text{A}; \quad I_{R2} = \frac{V_{R2}}{R_2} = \frac{25}{75} = 0{,}333\ \text{A}$

$W_1 = V_{R2}(I_{R1} - I_{R2}) = 25(0{,}667 - 0{,}333) = 8{,}35\ \text{W}$

OPCIÓ A

### Exercici 3

a) $P = 3RI_B^2 \quad \rightarrow \quad I_B = \sqrt{\frac{P}{3R}} = \sqrt{\frac{3780}{3\cdot 35}} = 6\ \text{A}$

b) $I_L = \sqrt{3}I_B = 10{,}39\ \text{A}$

c) $Z = \frac{U}{I_B} = \sqrt{R^2 + X_L^2} \quad \rightarrow \quad X_L = \sqrt{\left(\frac{U}{I_B}\right)^2 - R^2} = \sqrt{\left(\frac{400}{6}\right)^2 - 35^2} = 56{,}74\ \Omega$

d) $Q = 3X_LI_B^2 = 3\cdot 56{,}74\cdot 6^2 = 6128\ \text{var}$

### Exercici 4

a) $\eta(\%) = \frac{P}{\sqrt{3}UI\cos\varphi} = \frac{10000}{\sqrt{3}\cdot 230\cdot 32\cdot 0{,}82} = 95{,}66\ \%$

b) $p = 1$

c) $\Gamma = \frac{P}{\omega} = \frac{10000}{2920\frac{2\pi}{60}} = 32{,}7\ \text{Nm}$

d) $Q = \sqrt{3}UI\sin\varphi = \sqrt{3}UI\sqrt{1-\cos\varphi^2} = \sqrt{3}\cdot 230\cdot 32\cdot\sqrt{1-0{,}82^2} = 7296\ \text{var}$

OPCIÓ B

**Exercici 3**

a) $P_{R2} = W_1 - R_1 A_1^2 = R_2 A_2^2 \quad \rightarrow \quad A_2 = \sqrt{\frac{W_1 - R_1 A_1^2}{R_2}} = \sqrt{\frac{490 - 10 \cdot 5^2}{15}} = 4\ \text{A}$

b) $V_2 = R_2 A_2 = 15 \cdot 4 = 60\ \text{V}; \quad A_3 = \frac{V_2}{X_3} = \frac{60}{20} = 3\ \text{A}$

c) $Q = X_3 A_3^2 = 20 \cdot 3^2 = 180\ \text{var}$

**Exercici 4**

a) Formalment, el rendiment té en compte la potència útil a la sortida i la potència útil (activa) total d'entrada:

$$\eta(\%) = 100 \frac{P}{UI + U_e I_e} = 100 \frac{43000}{420 \cdot 121 + 200 \cdot 6} = 82{,}66\ \%$$

Malgrat això, en màquines de corrent continu d'excitació independent hi ha bibliografia que per al càlcul del rendiment només té en consideració la part de l'induït (rotor) i, llavors

$$\eta(\%) = 100 \frac{P}{UI} = 100 \frac{43000}{420 \cdot 121} = 84{,}61\ \%$$

que també es considera vàlid.

b) $\Gamma = \frac{P}{\omega} = \frac{43000}{1133 \frac{2\pi}{60}} = 362{,}4\ \text{Nm}$

c) $E = \frac{P}{I} = \frac{43000}{121} = 355{,}4\ \text{V}; \quad R_i I = U - E = 420 - 355{,}4 = 64{,}6\ \text{V}$

$E' = U' - R_i I = 470 - 64{,}6 = 405{,}4\ \text{V}$

$n' = n \frac{E'}{E} = 1133 \frac{405{,}4}{355{,}4} = 1292{,}4\ \text{min}^{-1}$

## SÈRIE 3

### Primera part

### Exercici 1

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

### Exercici 2

a) $A_1 = \frac{U_1}{\frac{R_1 R_3}{R_1+R_3}+R_2} = \frac{36}{\frac{12\cdot 12}{12+12}+30} = 1\ \text{A}$

b) $A_2 = \frac{A_1}{2} = \frac{1}{2} = 0{,}5\ \text{A}$

c) $V_{\text{FH}} = R_2 A_1 = 30 \cdot 1 = 30\ \text{V}$

d) $A_1 = \frac{U_1}{\frac{R_1 R_3}{R_1+R_3}+\frac{R_2 R_4}{R_2+R_4}} = \frac{36}{\frac{12\cdot 12}{12+12}+\frac{30\cdot 120}{30+120}} = 1{,}2\ \text{A}$

e) $V_{\text{FH}} = \frac{R_2 R_4}{R_2+R_4} A_1 = \frac{30\cdot 120}{30+120} 1{,}2 = 28{,}8\ \text{V}$

### Segona part

OPCIÓ A

### Exercici 3

a) $R = \frac{U_1^2}{P} = \frac{100^2}{1000} = 10\ \Omega$

b) $I_{\text{R}} = \frac{U_1}{R} = \frac{100}{10} = 10\ \text{A}$

$I_{\text{C}} = \sqrt{A_1^2 - I_{\text{R}}^2} = \sqrt{12^2 - 10^2} = 6{,}63\ \text{A}$

$X_{\text{C}} = \frac{U_1}{I_{\text{C}}} = \frac{100}{6{,}63} = 15{,}08\ \Omega$

c) $I_{\text{L}} = \frac{U_1}{X_{\text{L}}} = \frac{100}{10} = 10\ \text{A}$

$A_2 = \sqrt{I_{\text{R}}^2 + (I_{\text{L}} - I_{\text{C}})^2} = \sqrt{10^2 + (10 - 6{,}63)^2} = 10{,}55\ \text{A}$

### Exercici 4

a) $\eta(\%) = 100\frac{P}{UI} = 100\frac{75}{24\cdot 4} = 78{,}13\ \%$

b) $\Gamma = \frac{P}{\omega} = \frac{75}{2200\frac{2\pi}{60}} = 0{,}3255\ \text{Nm}$

c) $E = \frac{P}{I} = \frac{75}{4} = 18{,}75\ \text{V}; \quad R_{\text{i}} I = U - E = 24 - 18{,}75 = 5{,}25\ \text{V}$

$E' = U' - R_{\text{i}} I = 22 - 5{,}25 = 16{,}75\ \text{V}$

$n' = n\frac{E'}{E} = 2200\frac{16{,}75}{18{,}75} = 1965{,}3\ \text{min}^{-1}$

OPCIÓ B

## Exercici 3

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

b) $A_1 = \frac{V_1}{Z} = \frac{V_1}{\sqrt{R^2+X_L^2}} = \frac{230{,}9}{\sqrt{100^2+200^2}} = 1{,}03 \text{ A}$

c) $P = 3RA_1^2 = 3 \cdot 100 \cdot 1{,}03^2 = 318{,}27 \text{ W}$
$Q = 3X_L A_1^2 = 3 \cdot 200 \cdot 1{,}03^2 = 636{,}54 \text{ var}$

d) $V_1 = \frac{U}{2} = \frac{400}{2} = 200 \text{ V}$

e) $A_1 = \frac{V_1}{Z} = \frac{V_1}{\sqrt{R^2+X_L^2}} = \frac{200}{\sqrt{100^2+200^2}} = 0{,}894 \text{ A}$

## Exercici 4

a) $P(R_1) = \frac{U_{R1}^2}{R_1} = \frac{(U_1-U_{D1})^2}{R_1} = \frac{(24-0{,}5)^2}{10} = 55{,}225 \text{ W}$

b) $P(D_1) = U_{D1} I = U_{D1} \frac{U_1-U_{D1}}{R_1} = 0{,}5 \frac{24-0{,}5}{10} = 1{,}175 \text{ W}$

c) $P(R_2) = \frac{U_{R2}^2}{R_2} = \frac{(U_1-U_{D1}-U_{D2}-U_2)^2}{R_2} = \frac{(24-0{,}5-0{,}5-12)^2}{20} = 6{,}05 \text{ W}$

d) $P(U_1) = U_1 I = U_1 \frac{U_1-U_{D1}-U_{D2}-U_2}{R_2} = 24 \frac{24-0{,}5-0{,}5-12}{20} = 13{,}2 \text{ W}$