

**SÈRIE 4****Primera part****Exercici 1**

Q1 b    Q2 c    Q3 a    Q4 b    Q5 d

**Exercici 2**

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

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

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

$$d) V_{R2} = V_2 - R_5 A_1 = 75 - 50 \cdot 1 = 25 \text{ V}$$

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

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

**OPCIÓ A****Exercici 3**

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

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

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

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

**Exercici 4**

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

$$b) p = 1$$

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

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

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

#### Segona part

##### OPCIÓ A

##### Exercici 3

- a)  $R = \frac{U_1^2}{P} = \frac{100^2}{1000} = 10 \text{ } \Omega$
- b)  $I_R = \frac{U_1}{R} = \frac{100}{10} = 10 \text{ A}$
- $I_C = \sqrt{A_1^2 - I_R^2} = \sqrt{12^2 - 10^2} = 6,63 \text{ A}$
- $X_C = \frac{U_1}{I_C} = \frac{100}{6,63} = 15,08 \text{ } \Omega$
- c)  $I_L = \frac{U_1}{X_L} = \frac{100}{10} = 10 \text{ A}$
- $A_2 = \sqrt{I_R^2 + (I_L - I_C)^2} = \sqrt{10^2 + (10 - 6,63)^2} = 10,55 \text{ A}$

##### 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)  $E = \frac{P}{I} = \frac{75}{4} = 18,75 \text{ V}; \quad R_i I = U - E = 24 - 18,75 = 5,25 \text{ V}$
- $E' = U' - R_i I = 22 - 5,25 = 16,75 \text{ V}$
- $n' = n \frac{E'}{E} = 2200 \frac{16,75}{18,75} = 1965,3 \text{ min}^{-1}$

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