SÈRIE 1

Exercici 1

Q1 d

Q2 a

Q3 d

Q4 b

Q5 c

Exercici 2

a)

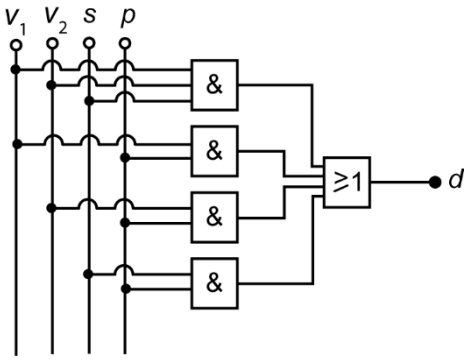
v_1	v_2	s	p	d
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	1
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	1
1	0	0	0	0
1	0	0	1	1
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

b)

$$d = \bar{v}_1\bar{v}_2sp + \bar{v}_1v_2\bar{s}p + \bar{v}_1v_2sp + v_1\bar{v}_2\bar{s}p + v_1\bar{v}_2sp + v_1v_2\bar{s}p + v_1v_2s\bar{p} + v_1v_2sp$$

$$d = v_1v_2s + sp + v_1p + v_2p$$

c)



Exercici 3

a)

$$P_{\text{mec}} = mgv = \frac{mg\left(h_2 - h_1\right)}{t}; \quad P_{\text{elèctr}} = \frac{P_{\text{mec}}}{\eta_{\text{mot}}} = 4,631\,\text{W}$$

b)

$$\omega_{\text{mot}} = \frac{v}{d/2} = 1,7\,\text{rad/s}; \quad \Gamma_{\text{mot}} = \frac{P_{\text{mec}}}{\omega_{\text{mot}}} = 2,452\,\text{Nm}$$

c)

$$\tilde{P}_{\text{elèctr}} = \frac{mg\left(h_2 - h_1\right)}{\eta_{\text{mot}}t/2} = 2\,P_{\text{elèctr}}$$

$$Inc = \frac{\tilde{P}_{\text{elèctr}} - P_{\text{elèctr}}}{P_{\text{elèctr}}} = 100\,\%$$

Exercici 4

a)

$$ce_{\text{pèl}} = \frac{c_{\text{pèl}}}{p_{c\_\text{pèl}}} = 83{,}33 \times 10^{-3}\ €/\text{kWh}; \quad ce_{\text{gas}} = \frac{c_{\text{gas}}}{\rho\, p_{c\_\text{gas}}} = 122{,}9 \times 10^{-3} €/\text{kWh}$$

b)

$$E_{\text{pèl}} = \frac{E_{\text{cons}}}{\eta_{\text{pèl}}}; \quad m_{\text{pèl}} = \frac{E_{\text{pèl}}}{p_{c\_\text{pèl}}} = 3324\ \text{kg}$$

c)

$$E_{\text{gas}} = \frac{E_{\text{cons}}}{\eta_{\text{gas}}};\ V_{\text{gas}} = \frac{E_{\text{gas}}}{\rho\, p_{c\_\text{gas}}} = 1729\ \text{L}$$

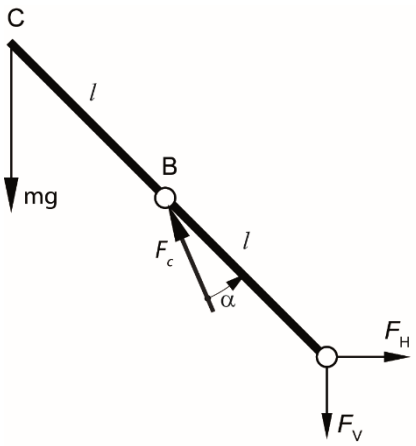
d)

diferència anual en el cost del combustible: $\Delta \text{c}_{\text{comb}} = V_{\text{gas}} c_{\text{gas}} - m_{pel} c_{\text{pel}}$

$$t = \frac{c_{\text{inv\_pèl}} - c_{\text{inv\_gas}}}{\Delta \text{c}_{\text{comb}}} = 5{,}444\ \text{anys}$$

Exercici 5

a)



b)

A partir del triangle OPB es pot veure que: $\varphi + 90 + 2\alpha = 180;\ \alpha = \dfrac{90-\varphi}{2}$

c)

$$\sum M(\mathrm{O}) = 0; \quad F_c \sin(\alpha)\, l - m\, g\, 2l \cos(\varphi) = 0;$$

$$\left.\begin{array}{l}\varphi = 30^\circ \\ \alpha = 30^\circ\end{array}\right\} \rightarrow \quad F_c = 2548\ \mathrm{N}$$

d)

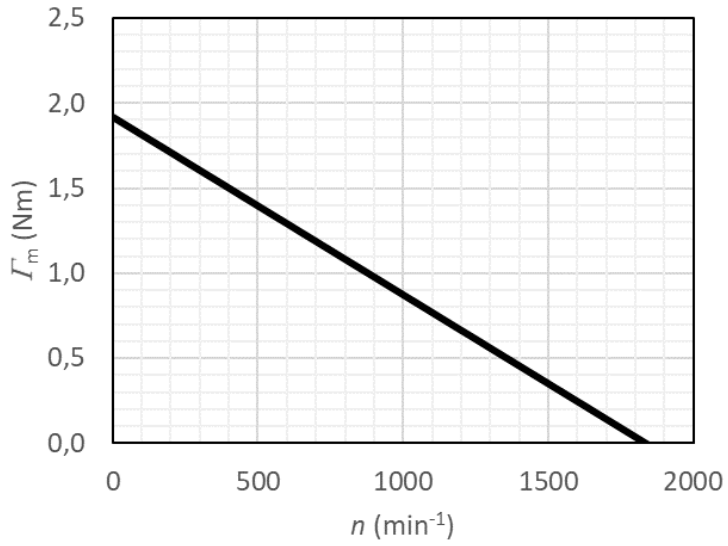
$$p_{\mathrm{int}} = \frac{F_c}{\frac{\pi d_{\mathrm{int}}^2}{4}} = 2{,}028\ \mathrm{MPa}$$

Exercici 6

a)

$$\tau = \frac{z_p}{z_r} = 0{,}1452$$

b)



La velocitat de gir és màxima quan el parell és nul: $n_{màx} = 192{,}0\,\text{rad/s} = 1833\,\text{min}^{-1}$

c)

$$\omega_{mot} = n_{mot}\frac{2\pi}{60}$$

$$I = \frac{P_{elèctr}}{U} = \frac{P_{mec}}{\eta U} = \frac{\Gamma_{mot}\omega_{mot}}{\eta U} = \frac{\left(0{,}08U - 0{,}01\omega_{mot}\right)\omega_{mot}}{\eta U} = 6{,}924\ \text{A}$$

d)

$$\omega_{con} = \tau\omega_{mot} = 15{,}20\ \text{rad/s}$$

SÈRIE 5

Exercici 1

Q1 d

Q2 a

Q3 c

Q4 a

Q5 d

Exercici 2

a)

v	g	r	a
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

b)

$$a = (\bar{v} \cdot \bar{g} \cdot \bar{r}) + (\bar{v} \cdot g \cdot r) + (v \cdot \bar{g} \cdot r) + (v \cdot g \cdot r)$$

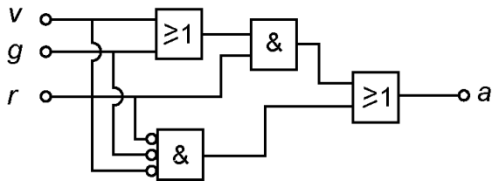
o també

$$a = (v + g + \bar{r}) \cdot (v + \bar{g} + r) \cdot (\bar{v} + g + r) \cdot (\bar{v} + \bar{g} + r)$$

simplificant:

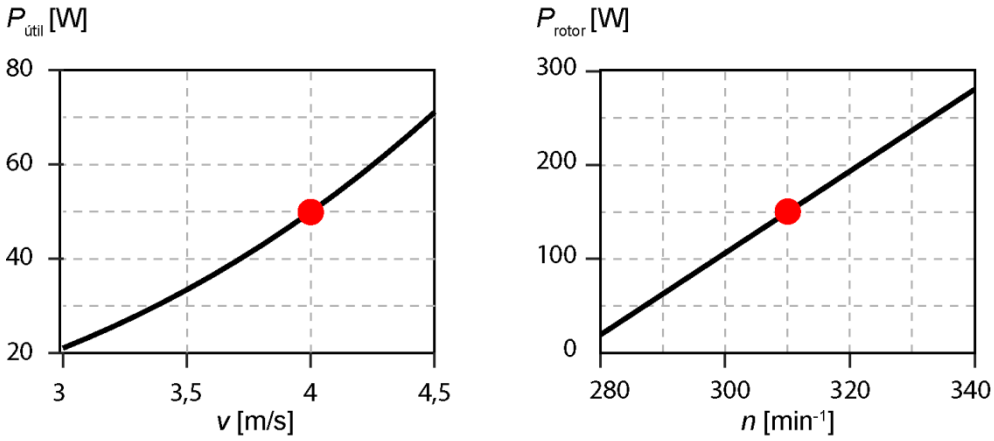
$$a = r(v + g) + \bar{v} \cdot \bar{g} \cdot \bar{r}$$

c)



Exercici 3

a)



del gràfic $P_{\text{útil}} = 50$ W

$$P_{\text{rot}} = \frac{P_{\text{útil}}}{\eta} = 150 \text{ W}$$

b)

$$P_{\text{rot}} = 150 \text{ W} \rightarrow \text{del gràfic } n = 310 \text{ min}^{-1} \quad \rightarrow \quad \omega = n\frac{2\pi}{60} = 32{,}46 \text{ rad/s}$$

$$\Gamma = \frac{P_{\text{rot}}}{\omega} = 4{,}621 \text{ Nm}$$

c)

$$E_{\text{subm}} = P_{\text{útil}}\, t = 175 \text{ kW·h} = 630{,}0 \text{ MJ}$$

d)

$$q = \frac{E_{\text{casa}}}{E_{\text{subm}}} = 2{,}857 \text{ aerogeneradors} \rightarrow 3 \text{ aerogeneradors}$$

Exercici 4

a)

$$E_{\text{cons}} = m_{\text{b}}\, p;\ \rightarrow\ \eta = \frac{E_{\text{útil}}}{E_{\text{cons}}} = \frac{m_{\text{b}}\, p}{E_{\text{cons}}} = 0{,}6$$

b)

$$m_{\text{a}} = \frac{E_{\text{útil}}}{c_e\, \Delta T} = 2{,}067 \cdot 10^{6}\ \text{kg}$$

c)

$$t = 24\frac{\text{h}}{\text{dia}} \cdot 3600\frac{\text{s}}{\text{h}}\ ;\ \rightarrow\ q = \frac{m}{\rho\, t} = 23{,}92\ \text{L/s}$$

Exercici 5

a)

$$E_{\text{subm}} = \eta_{\text{gasoil}}\, p_{\text{gasoil}}\, V_{\text{gasoil}}\, \rho_{\text{gasoil}} = 33{,}89 \cdot 10^{3}\text{MJ} = 9{,}414\ \text{MW·h}$$

b)

$$E_{\text{cons\_GN}} = \frac{E_{\text{subm}}}{\eta_{\text{GN}}} = 36{,}05 \cdot 10^{3}\text{MJ} = 10{,}02\ \text{MW·h}$$

$$V_{\text{GN}} = \frac{E_{\text{cons\_GN}}}{p_{\text{GN}}} = 856{,}0\ \text{m}^3$$

c)

$$\Delta m_{\text{CO2}} = FE_{\text{gasoil}}\, V_{\text{gasoil}} - FE_{\text{GN}}\, E_{\text{cons\_GN}} = 756{,}9\ \text{kg}$$

Exercici 6

a)

α = atan(10/100) = 5,711°;

$$P_{mec} = \frac{m\ g\ v\ sin(\alpha)}{2} = 130{,}1\ \text{W}$$

b)

$$\omega = \frac{v}{d/2};\ \rightarrow\ \Gamma = \frac{P_{mec}}{\omega} = 17{,}56\ \text{Nm}$$

d)

$$P_{\text{cons}} = \frac{2\ P_{\text{mec}}}{\eta} = 329{,}4\ \text{W}$$