



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

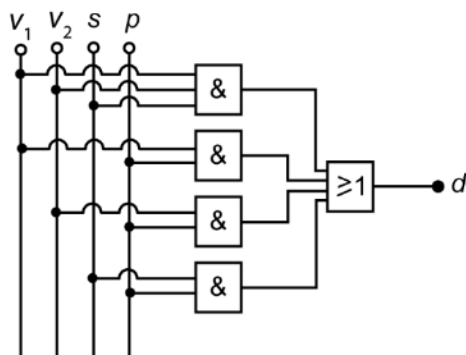


b)

$$d = \bar{v}_1 \bar{v}_2 s p + \bar{v}_1 v_2 \bar{s} p + \bar{v}_1 v_2 s \bar{p} + v_1 \bar{v}_2 \bar{s} p + v_1 \bar{v}_2 s \bar{p} + v_1 v_2 \bar{s} \bar{p} + v_1 v_2 s p$$

$$d = v_1 v_2 s + s p + v_1 p + v_2 p$$

c)



Exercici 3

a)

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

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)

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

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



Exercici 4

a)

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

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)

$$E_{\text{gas}} = \frac{E_{\text{cons}}}{\eta_{\text{gas}}}; \quad V_{\text{gas}} = \frac{E_{\text{gas}}}{\rho p_{c_{\text{gas}}}} = 1729 \text{ L}$$

d)

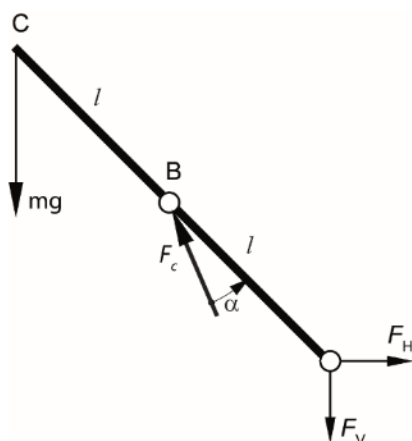
diferència anual en el cost del combustible: $\Delta c_{\text{comb}} = V_{\text{gas}} c_{\text{gas}} - m_{\text{pel}} c_{\text{pel}}$

$$t = \frac{c_{\text{inv}_{\text{pèl}}} - c_{\text{inv}_{\text{gas}}}}{\Delta c_{\text{comb}}} = 5,444 \text{ anys}$$



Exercici 5

a)



b)

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

c)

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

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

d)

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

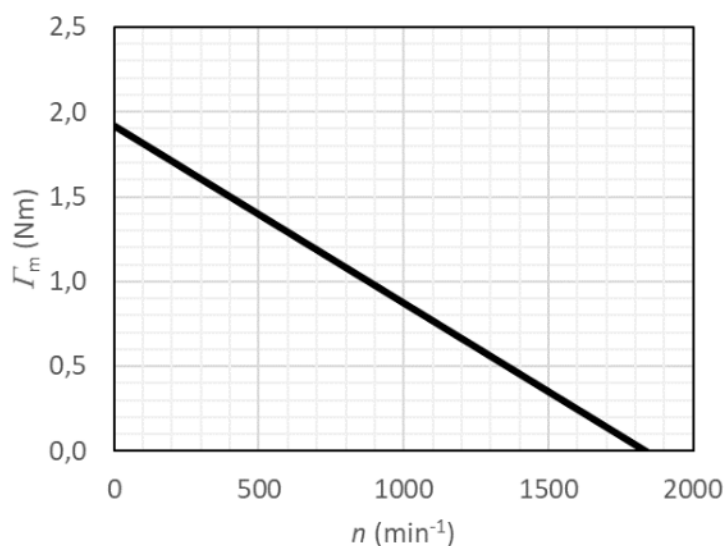


Exercici 6

a)

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

b)



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

c)

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

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

d)

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



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

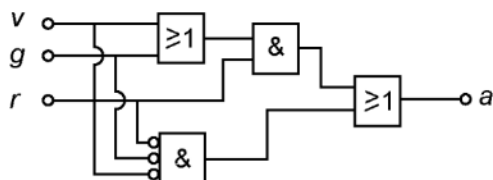
$$a = (v + g + \bar{r}) \cdot (v + \bar{g} + r) \cdot (\bar{v} + g + r) \cdot (\bar{v} + \bar{g} + r)$$

simplificant:

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

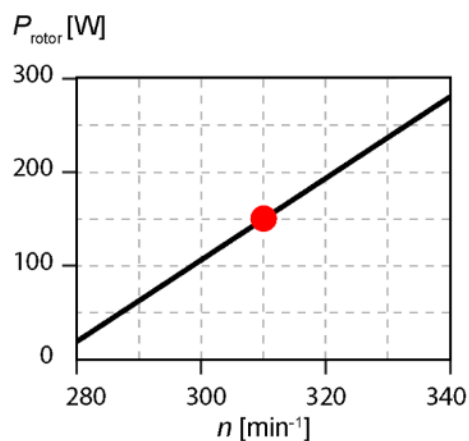
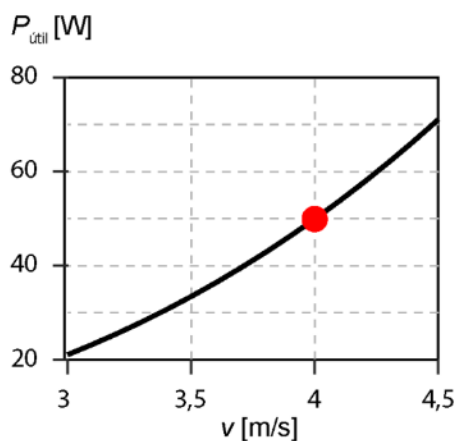


c)



Exercici 3

a)



del gràfic $P_{\text{útil}} = 50 \text{ W}$

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

b)

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

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

c)

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



d)

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



Exercici 4

a)

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

b)

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

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)

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

b)

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

$$V_{\text{GN}} = \frac{E_{\text{cons_GN}}}{\rho_{\text{GN}}} = 856,0 \text{ m}^3$$

c)

$$\Delta m_{\text{CO}_2} = FE_{\text{gasoil}} V_{\text{gasoil}} - FE_{\text{GN}} E_{\text{cons_GN}} = 756,9 \text{ kg}$$



Exercici 6

a)

$$\alpha = \arctan(10/100) = 5,711^\circ;$$

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

b)

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

d)

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