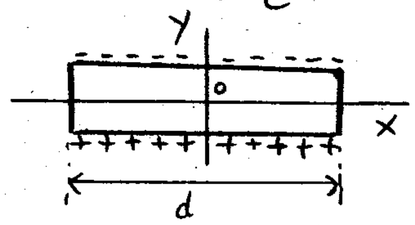
SOLUCIONS de l'EXAMEN PARCIAL FÍSICA
1r QUADRIMESTRE 2002/3

P1. (a) $\vec{E} = \overbrace{-400}^{E_y}\,\hat{j}\ \frac{N}{C}$; $V_B - V_A = -\int_A^B \vec{E}\cdot d\vec{\ell} = -\int_A^B (E_x\,dx + E_y\,dy + E_z\,dz) = -\int_A^C E_y\,dy - \int_C^B E_y\,dy = 400\,[y]_{-0.6}^{0.7} + 400\,[y]_{0.7}^{0} = 520\ V$

$V_B > V_A$

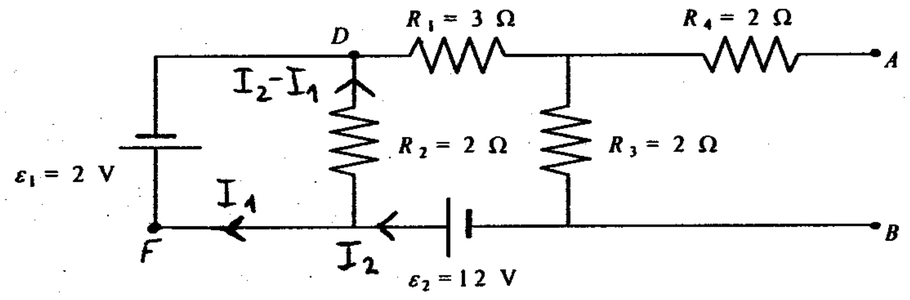
(b)



En equilibri, $\vec{E} = -\vec{E}_{2\,plans} \Rightarrow +400\,\hat{j} = +\frac{\sigma}{\varepsilon_0}\,\hat{j} \Rightarrow \sigma = 400\,\varepsilon_0 = 3.536\ nC/m^2$

$q = \sigma \cdot S = \sigma\,\pi\left(\frac{d}{2}\right)^2 = 3.9\ pC$; $\vec{E}_{interior} = 0$; $\vec{E}_{exterior} = \vec{E}$

P2.



(a) Equacions del circuit:
$$\left.\begin{aligned} \mathcal{E}_1 &= R_2\,(I_2 - I_1) \\ \mathcal{E}_2 &= R_2\,(I_2 - I_1) + (R_1 + R_3)\,I_2 \end{aligned}\right\} \Rightarrow$$

$\Rightarrow\ I_1 = 1\ A$, $I_2 = 2\ A$, $I_2 - I_1 = 1\ A$

(b) $V_D - V_B = (R_1 + R_3)\,I_2 = 10\ V$

(c) $V_{Th} = V_A - V_B = I_2\,R_3 = 4\ V$

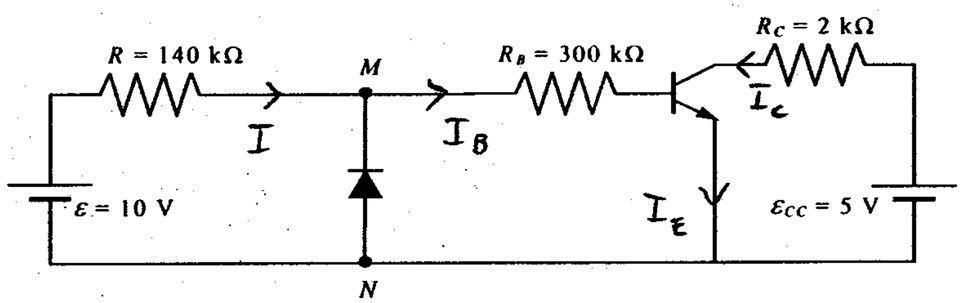
$R_{Th} = (R_1 \,//\, R_3) + R_4 = 3.2\ \Omega$, donat que es curtcircuita R_2

(d) $Q = q(\infty) = C\,(V_A - V_B) = C \cdot V_{Th} = 16\ \mu C$

on $q(t) = Q\,(1 - e^{-t/RC}) = 16\cdot 10^{-6}\left(1 - e^{-t/12.8\cdot 10^{-6}}\right) C \Rightarrow 0.9\,Q = Q\,(1 - e^{-t/RC}) \Rightarrow t = -RC\,\ln 0.1 = 2.95\cdot 10^{-5}\ s$

(e) $\mathcal{P}_{sub.} = (V_D - V_F)\,I_1 + (V_F - V_B)\,I_2 = -\mathcal{E}_1\,I_1 + \mathcal{E}_2\,I_2 = 22\ W$

P3.



(a) Díode en polarització inversa, $I_D = 0$; $I_B = I = 21.1\ \mu A$

$$\left.\begin{aligned} \mathcal{E} &= I\,R + V_M - V_N \\ V_M - V_N &= I_B\,R_B + V_{BE} \\ &\quad\ \shortparallel \\ &\quad 0.7\,V \end{aligned}\right\} I = \frac{\mathcal{E} - V_{BE}}{R + R_B} = 21.1\ \mu A$$

Suposem zona activa... $I_C = \beta\,I_B = 3.17\ mA \Rightarrow V_{CE} = \mathcal{E}_{CC} - I_C R_C = -1.34\ V$ ↯

2. saturació

En saturació: $V_{CE} = 0.2\ V$; $I_C = \frac{\mathcal{E}_{CC} - V_{CE}}{R_C} = 2.4\ mA$

$I_E = I_B + I_C = 2.42\ mA$

(b) Si invertim el díode, fa que $V_M - V_N = V_\gamma = 0.6\ V \Rightarrow$

$\Rightarrow$ es curtcircuita la part d'entrada del transistor $\Rightarrow I_B = 0$, $I_D = I = \frac{\mathcal{E} - V_\gamma}{R} = 67.1\ \mu A$

$\Rightarrow I_C = 0$, $I_E = 0$, $V_{CE} = 5\ V$, $V_{DE} = V_M - V_N = 0.6\ V$