Universidade Federal do Rio de Janeiro
Escola Politécnica

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Aluno(a): Gabarito da Prova Parcial #2

Disciplina: Eletrônica I — EEL315

Turma: 2018/2

Professor(a): José Gabriel

Questão (1)

a) $(1+\sqrt{3}\times 0.1)\,V_{DC} = 16.3 \Rightarrow V_{DC} = 13.9\ V$

$I_{DC} = (13.9 - 8.2)/220 = 26\ mA$

$C = (26\times10^{-3})/(2\times1.7\times60\times0.1\times16.3) = 0.026/(3.4\times6\times16.3) = 0.026/333$

$C = 78\ \mu F \Rightarrow$ Usamos valor comercial $\boxed{C = 100\ \mu F}$

(Obs.: o fator de ripple será aproximadamente $26/(3.4\times6\times16.3) = 7.8\%$)

b) Com $C = 220\ \mu F$: $r = (26\times10^{-3})/(2\times1.7\times60\times0.22\times10^{-3}\times16.3) = 26/732 = 3.6\%$

$(1+\sqrt{3}\times0.036)\,V_{DC} = 16.3 \Rightarrow V_{DC} = 15.4\ V$

$I_{DC} = (15.4 - 8.2)/220 = 33\ mA$

Segunda iteração: $r = 33/732 = 4.5\%$

$(1+\sqrt{3}\times0.045)\,V_{DC} = 16.3 \Rightarrow V_{DC} = 15.1\ V \Rightarrow I_{DC} = 31.3\ mA$

Terceira iteração: $r = 31.3/732 = 4.3\%$

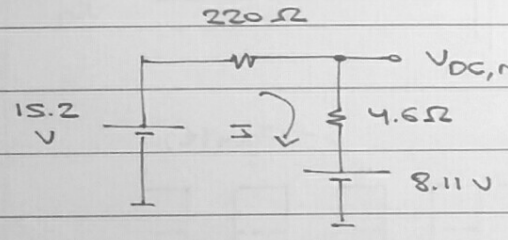
$(1+\sqrt{3}\times0.043)\,V_{DC} = 16.3 \Rightarrow V_{DC} = 15.2\ V$

— O diodo zener opera com corrente máxima em torno de 33 mA ($R_L \to \infty$) e com corrente mínima em torno de 2 mA ($R_L = 270\ \Omega \to I_L = 30.4\ mA$).

Olhando a Tabela 1, temos: $V_z = 8.117\ V \longrightarrow I_z = 2\ mA$

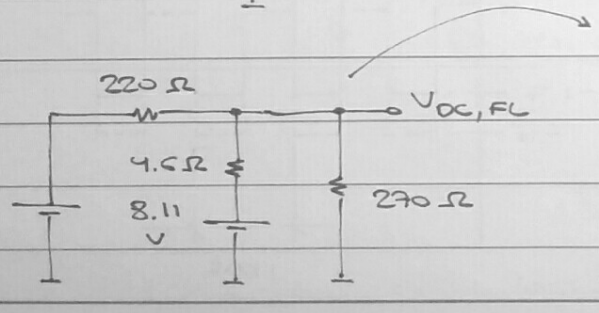
$V_z = 8.2\ V \longrightarrow I_z = 20\ mA$

$r_z = \Delta V/\Delta I = 83/18 = 4.6\ \Omega \longrightarrow V_{z0} + 4.6\times0.02 = 8.2 \Rightarrow V_{z0} = 8.11\ V$



$I = 31.6\ mA \Rightarrow V_{DC,NL} = 8.11 + 4.6\times0.0316$

$V_{DC,NL} = 8.255\ V$



$$\frac{15.2 - V_{DC,FL}}{220} = \frac{V_{DC,FL} - 8.11}{4.6} + \frac{V_{DC,FL}}{270}$$

$$V_{DC,FL} = \frac{8.11\times220\times270 + 15.2\times4.6\times270}{4.6\times270 + 220\times270 + 4.6\times220}$$

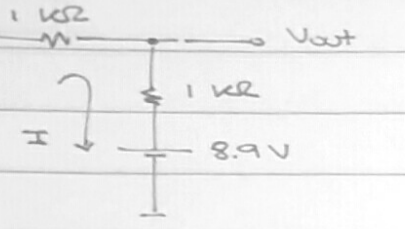
$V_{DC,FL} = 8.120$ (volts)

Fator de regulação: $(8.255 - 8.120)/8.255 = \boxed{1.6\%}$

Questão (2)

a) Se $-8.9\,V < V_{in} < 8.9\,V$, os diodos estão desligados. Desprezando o resistor de $10^6\,\Omega$, temos $V_{out} = V_{in}$.

Se $V_{in} > 8.9\,V$, os diodos estão ligados. Desprezando o resistor de $10^6\,\Omega$:

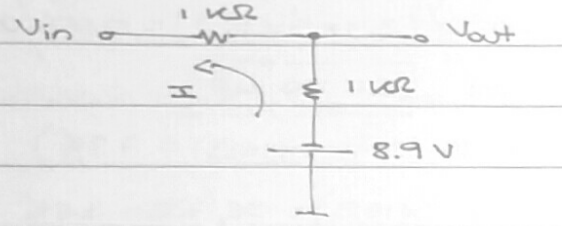


$$I = (V_{in} - 8.9)/2000$$

$$V_{out} = 8.9 + 1000\,I = 8.9 + V_{in}/2 - 8.9/2$$

$$V_{out} = (V_{in} + 8.9)/2$$

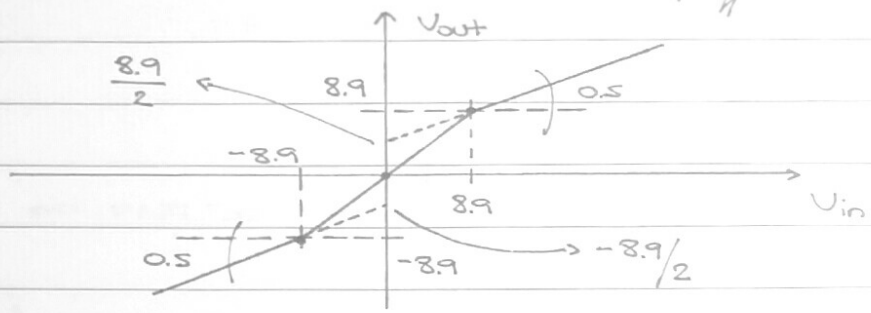
Se $V_{in} < 8.9\,V$, os diodos estão ligados. Desprezando o resistor de $10^6\,\Omega$:



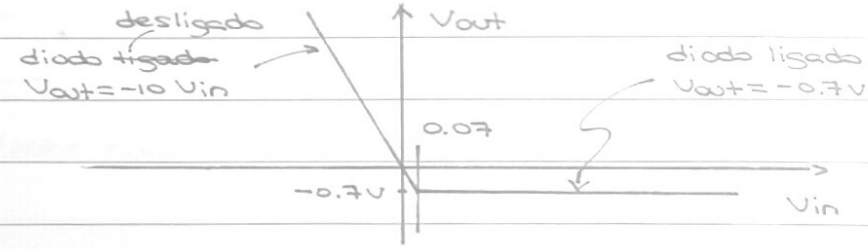
$$I = (-8.9 - V_{in})/2000$$

$$V_{out} = -8.9 - 1000\,I = -8.9 + 8.9/2 + V_{in}/2$$

$$V_{out} = (V_{in} - 8.9)/2$$

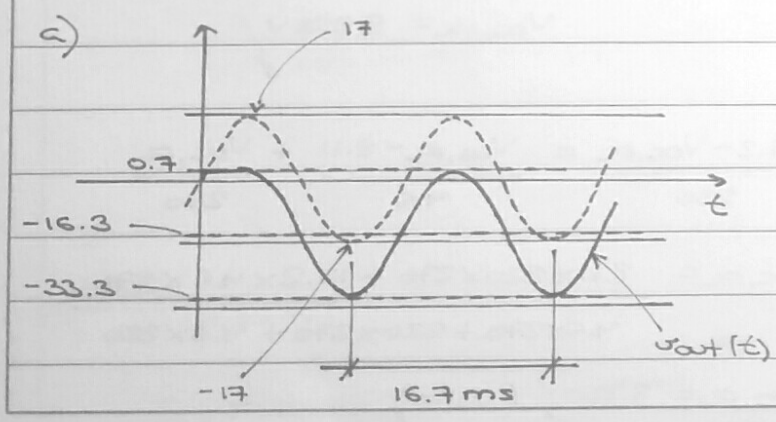


b) Com o diodo desligado, temos $V_{out} = -10\,V_{in}$ (configuração inversora com $R_2 = 10\,R_1$). A relação $V_{out} = -10\,V_{in}$ vale desde que $V_{out} > -0.7\,V$, ou seja, desde que $V_{in} < 0.07\,V$. Quando $V_{in} > 0.07\,V$, temos o diodo ligado e $V_{out} = -0.7\,V$.

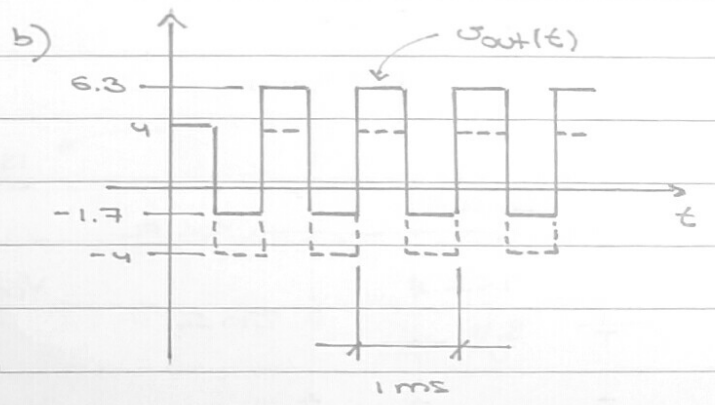


Questão (3)

a)

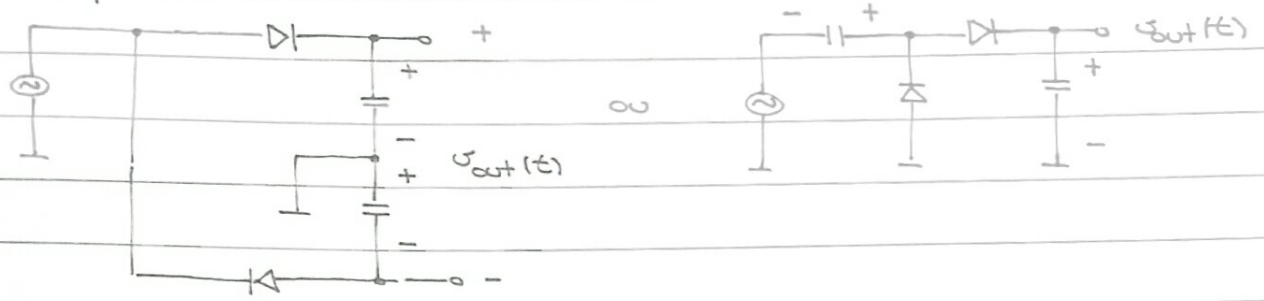


b)

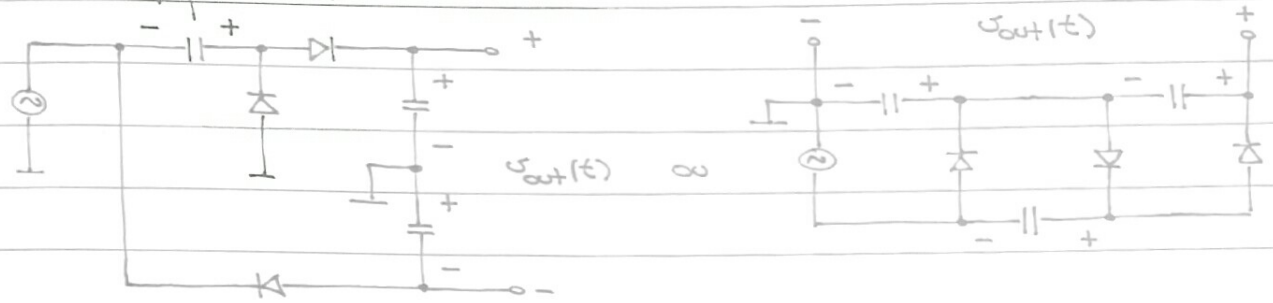


Questão (4)

a) Duas opções são:

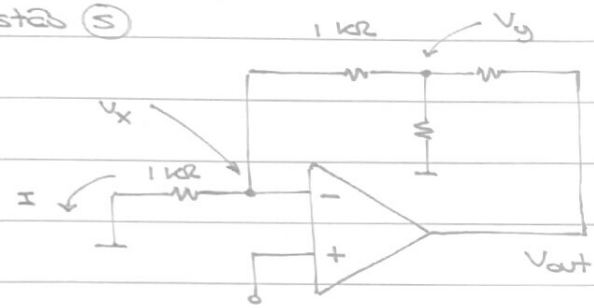


b) Duas opções são:



Questão (5)

a)



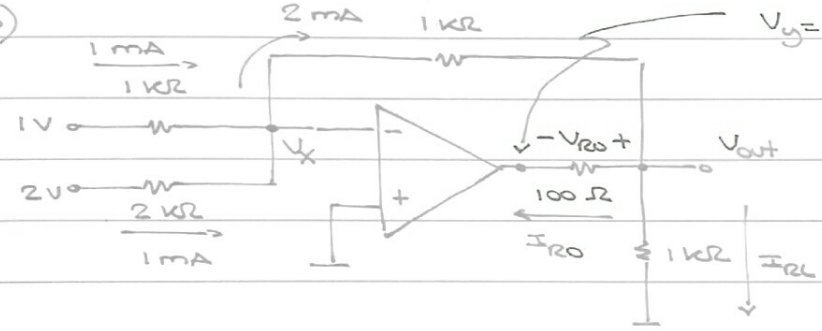
$V_x = 1\ V \Rightarrow I = 1\ mA$

$V_y = V_x + 1000 \times I$

$V_y = 1 + \underbrace{1000 \times 1\ mA}_{1}$

$\boxed{V_y = 2\ V}$ (Obs.: $V_{out} = V_y + 1000 \times 3\ mA = 5\ V$)

b)



$V_y = V_{out} - V_{RO}$

$V_x = 0 \Rightarrow V_{out} = V_x - 1000 \times 2\ mA = -2\ V$

Então: $I_{RL} = -V_{out}/1000 = -2\ mA$

Então: $I_{RO} = 2\ mA + 2\ mA \Rightarrow I_{RO} = 4\ mA$

E portanto $V_{RO} = 100 \times 4\ mA = 0.4\ V \Rightarrow V_y = -2\ V - 0.4\ V$

$\boxed{V_y = -2.4\ V}$

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