Universidade Federal do Rio de Janeiro
Escola Politécnica

DATA	01/7/2019
Aluno(a):	Prova Parcial #2 — Gabarito
Disciplina:	Eletrônica I
Turma:	2019/1
Professor(a):	José Gabriel

GRAUS	
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Questão 1

a) Assumindo $r = 10\%$ (chute inicial), temos $(1+\sqrt{3}\times 0.1)V_{DC} = 16.3$.

Então: $V_{DC} = 13.9\ V \longrightarrow I_{DC} = (13.9-5.6)/120 = 8.3/120 = 69\ mA$

($V_Z = 5.6\ V$ quando $I_Z \simeq 20\ mA$)

$$r = \frac{69\times 10^{-3}}{4\times 1.7\times 60\times 0.1\times 10^{-3}\times 16.3} = \frac{69}{665.04} = \boxed{10.4\%}$$

(Recalculando: $(1+\sqrt{3}\times 0.104)V_{DC} = 16.3 \longrightarrow V_{DC} = 13.8\ V \longrightarrow I_{DC} = 68\ mA$

$\longrightarrow r = 68/665.05 \longrightarrow r = 10.2\%$

$(1+\sqrt{3}\times 0.102)V_{DC} = 16.3 \longrightarrow V_{DC} = 13.85\ V \longrightarrow I_{DC} = 68.8\ mA$

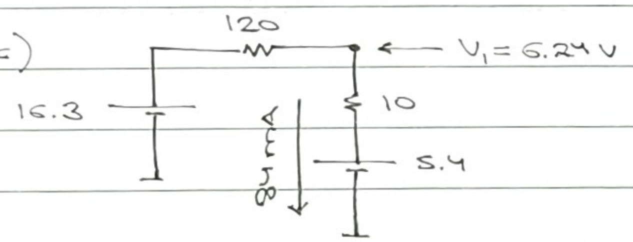
$\longrightarrow r = 68.8/665.05 \longrightarrow r = 10.3\%$

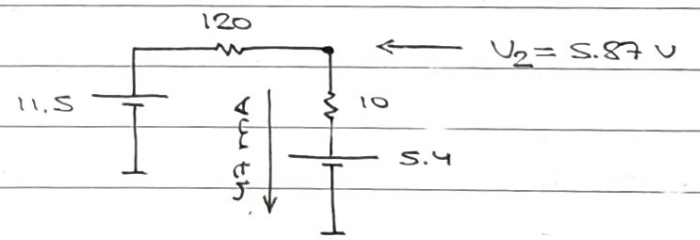
Se removermos R_L, então a corrente de 69 mA é toda aplicada ao diodo Zener $\longrightarrow \boxed{I_Z = 69\ mA}$

(Obs.: $V_Z = 5.4 + 10\times 0.069 = 6.1\ V \longrightarrow I_{DC} = (13.9-6.1)/120 = 65\ mA$, então a corrente I_Z está 6% abaixo de 69 mA, por causa do aumento em V_Z (de 5.6 V para 6.1 V), mas este refinamento não é necessário).

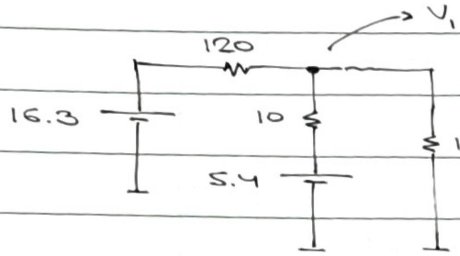
b) $r_{RL} = 0.104 \times \frac{10}{120+10} \times \frac{13.9}{5.6} = 0.0199 \longrightarrow \boxed{r \simeq 2\%}$

c)





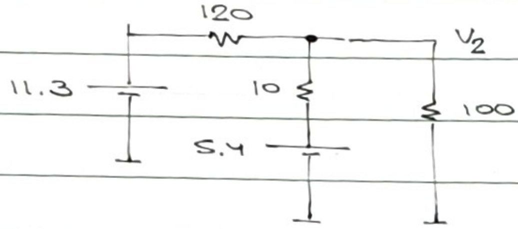
Então $V_{DC,NL} = 6.055\ V$ (sem R_L)



$$\frac{16.3 - V_1}{120} = \frac{V_1 - 5.4}{10} + \frac{V_1}{100}$$

$$80 - 5V_1 = 60V_1 - 324 + 6V_1$$

$$V_1 = (80 + 324)/71 \longrightarrow V_1 = 5.69\ V$$



$$\frac{11.3 - V_2}{120} = \frac{V_2 - 5.4}{10} + \frac{V_2}{100}$$

$$56.5 - 5V_2 = 60V_2 - 324 + 6V_2$$

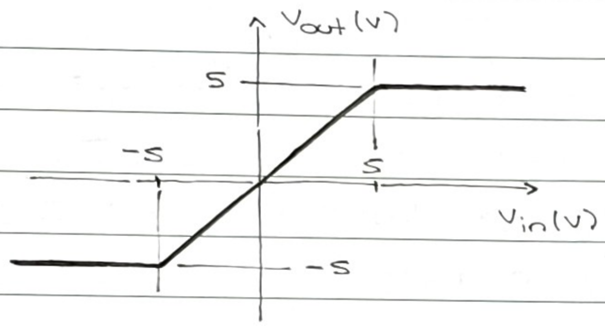
$$V_2 = (56.5 + 324)/71 \longrightarrow V_2 = 5.36\ V$$

Então $V_{DC,FL} = 5.525\ V$ (R_{Lmin})

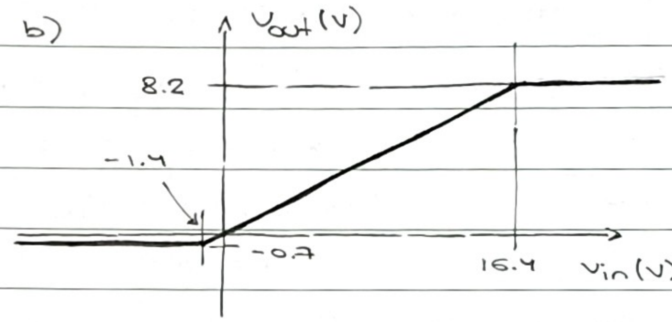
Fator de regulação : $(6.055 - 5.525)/6.055 = \boxed{8.8\%}$

Questão 2

a)

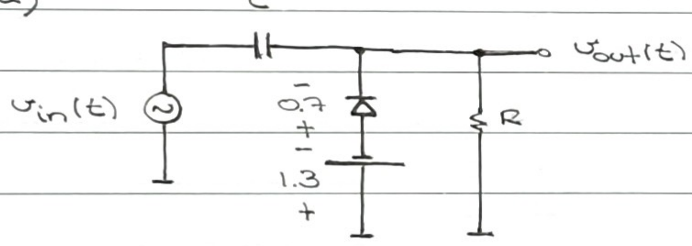


b)

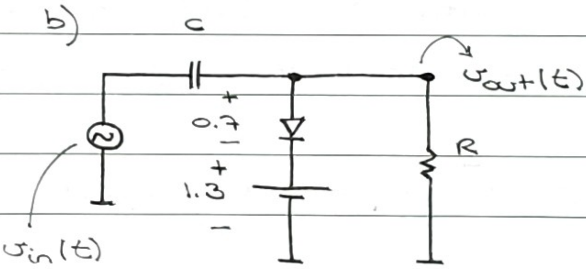


Questão 3

a)



b)



Obs.: o valor de C deve ser especificado de acordo com a frequência da onda $v_{in}(t)$, levando-se em conta o valor de R.

Questão 4

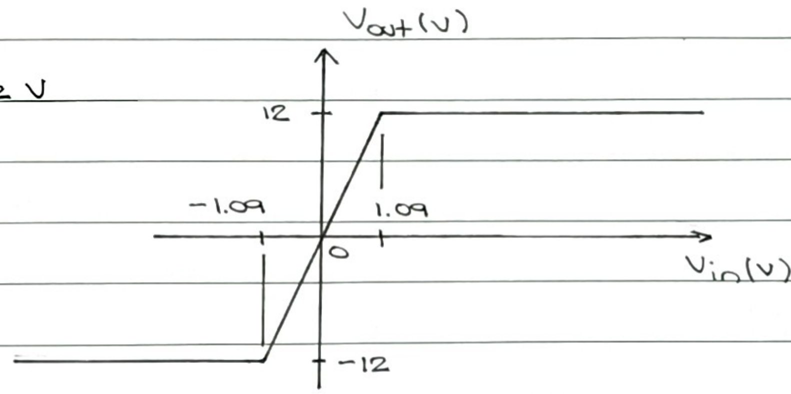
a) $\lim_{t \to \infty} v_{C2}(t) = 2 \times 10 = 20\ V$; b) $\lim_{t \to \infty} v_{C3}(t) = -10\ V$

Questão (5)

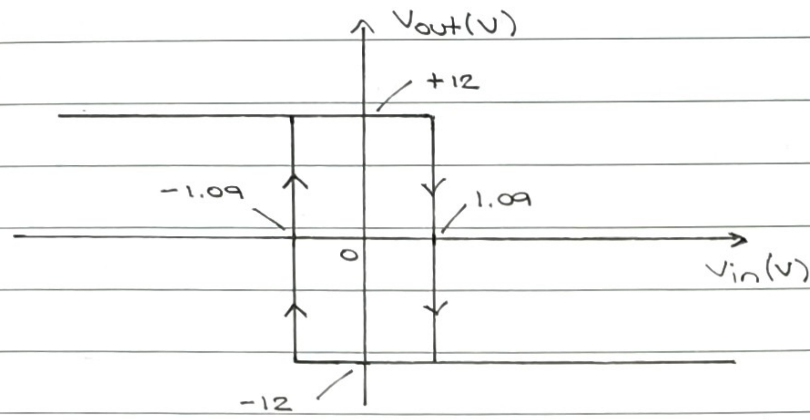
a) $V_{out} = 11\,V_{in}$, se $|V_{out}| < 12\ V$

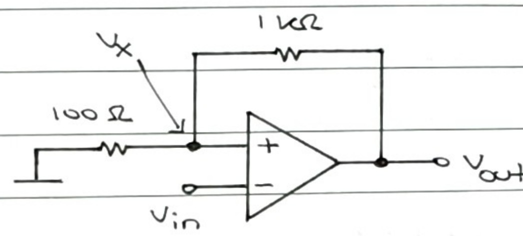
$V_{out} = 12\ V$, se $V_{in} > \frac{12}{11}\ V$

$V_{out} = -12\ V$, se $V_{in} < \frac{-12}{11}\ V$



b)

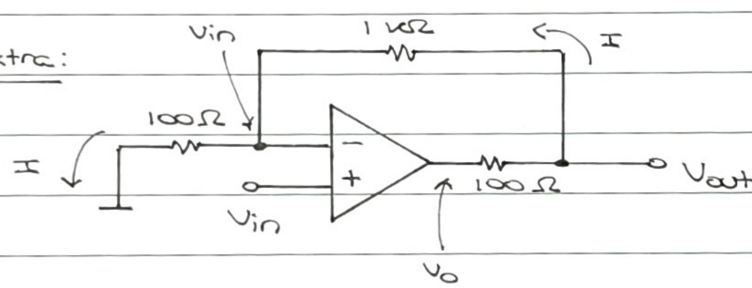




Se $V_{out} = 12\,V$, então $V_x = \frac{12}{11}\,V$ ⟶ $\begin{cases} V_{out} = 12\ V, \text{ se } V_{in} < \frac{12}{11}\ V \\ V_{out} = -12\ V, \text{ se } V_{in} > \frac{12}{11}\ V \end{cases}$

Se $V_{out} = -12\,V$, então $V_x = \frac{-12}{11}\,V$ ⟶ $\begin{cases} V_{out} = 12\ V, \text{ se } V_{in} < \frac{-12}{11}\ V \\ V_{out} = -12\ V, \text{ se } V_{in} > \frac{-12}{11}\ V \end{cases}$

Item Extra:



Por causa da alimentação ±12 V, temos $|V_{omax}| = 12\ V$.

Então:

$$I = \frac{V_{in}}{100} \longrightarrow V_{out} = V_{in} + \frac{1000\,V_{in}}{100} = 11\,V_{in}$$

$$V_o = V_{out} + 100\,I = V_{out} + V_{in} = V_{out} + \frac{V_{out}}{11} = \frac{12\,V_{out}}{11}$$

$$|V_{outmax}| = \frac{11}{12}|V_{omax}|$$

$$|V_{outmax}| = 11\ V$$