Universidade Federal do Rio de Janeiro
Escola Politécnica

DATA 30/9/2019

GRAUS

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Aluno: Prova Parcial #3 — Gabarito

Disciplina: Eletrônica I

Turma: 2019/2

Professor: José Gabriel

Questão (1)

a) $n_i = \underbrace{5.2\times10^{15}\times350^{1.5}}_{3.405\times10^{19}} \times \underbrace{\exp\left(-1.12\times1.6\times10^{-19}/\left(2\times1.38\times10^{-23}\times350\right)\right)}_{8.781\times10^{-9}} = 2.99\times10^{11}\ cm^{-3}$

$p = 2.99^2\times10^{22}/10^{17} = 8.94\times10^{5}$ lacunas/cm^3

b) $J = 1.6\times10^{-19}\times(1350\times10^{17} + \underbrace{480\times8.94\times10^{5}}_{\text{desprezível}})\times10^{5} = 2.16\times10^{6}\ A/cm^2$

Questão (2)

$n_i = \underbrace{1.66\times10^{15}\times300^{1.5}}_{8.626\times10^{18}} \times \underbrace{\exp\left(-0.66\times1.6\times10^{-19}/\left(2\times1.38\times10^{-23}\times300\right)\right)}_{2.892\times10^{-6}} = 2.49\times10^{13}\ cm^{-3}$

$p_n = 2.49^2\times10^{26}/10^{16} = 6.222\times10^{10}$ lacunas/cm^3

$V_0 = \underbrace{1.38\times10^{-23}\times300}_{0.0259}/(1.6\times10^{-19})\ \underbrace{\ln\left(10^{15}/(6.222\times10^{10})\right)}_{9.685} = 0.251\ V$

Questão (3)

a) 1. $(V_D = 0.7\ V) \longrightarrow I_D = (10 - 2\times0.7)/1000 = 8.6\ mA$

$V_D = 1.98\times0.026\times\ln(8.6\times10^{-3}/(14.1\times10^{-9})) = 0.6858\ V$

2. $I_D = (10 - 2\times0.6858)/1000 = 8.63\ mA$

$V_D = 1.98\times0.026\times\ln(8.63\times10^{-3}/(14.1\times10^{-9})) = 0.6859\ V$

3. $I_D = (10 - 2\times0.6859)/1000 = 8.63\ mA$

b) 656 mV — 5 mA $\quad r_d = \Delta V/\Delta I = 36/5 = 7.2\ \Omega$

692 mV — 10 mA $\quad V_{D0} = 0.692 - 7.2\times0.01 = 0.62\ V$

$I_D = (10 - 2\times0.62)/(1000 + 2\times7.2) = 8.64\ mA$

$V_D = 0.62 + 7.2\times8.64\times10^{-3} = 0.682\ V$

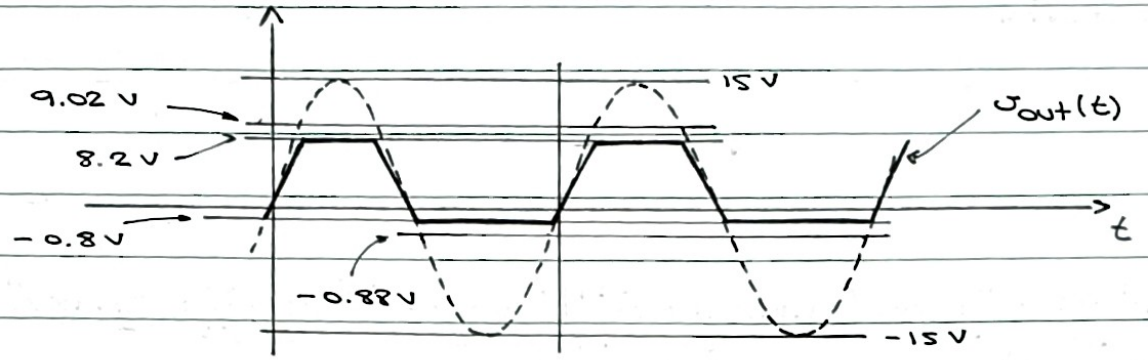
Questão (4)

Se o diodo DSN756 estiver desligado ($-0.8\,V < v_{out}(t) < 8.2\,V$), então

$$v_{out}(t) = v_{in}(t) \times 1000/(1000+100) = 10\,v_{in}(t)/11.$$

Se $10\,v_{in}(t)/11 \geq 8.2\,V$, ou seja, $v_{in}(t) \geq 9.02\,V$, então $v_{out}(t) = 8.2\,V$.

Se $10\,v_{in}(t)/11 \leq -0.8\,V$, ou seja, $v_{in}(t) \leq -0.88\,V$, então $v_{out}(t) = -0.8\,V$.



Questão (5)

a) $V_{AC,RMS} = 1/\sqrt{2} = 0.707\,V$

$V_{RMS} = \sqrt{10^2 + 0.707^2} = 10.025\,V$

$r = V_{AC,RMS}/V_{DC} = 0.0707$ (ou seja, 7.1%)

Para que $r = 15\%$, precisamos de $V_{DC} = V_{AC,RMS}/0.15 = 0.707/0.15 = 4.71\,V$

b) $V_{AC,RMS} = 1\,V$

$V_{RMS} = \sqrt{10^2 + 1} = 10.05\,V$

$r = V_{AC,RMS}/V_{DC} = 0.10$ (ou seja, 10%)

Para que $r = 15\%$, precisamos de $V_{DC} = V_{AC,RMS}/0.15 = 1/0.15 = 6.67\,V$

Questão (6)

a) $(1+\sqrt{3}r)\,V_{DC} = V_m \longrightarrow r = ((19.3/18)-1)/\sqrt{3} = 0.0417$

$I_{DC} = 2\sqrt{3} \times 60 \times 100 \times 10^{-6} \times 19.3 \times 0.0417 = 0.0167\,A$

$R = 18/I_{DC} = 1076\,\Omega$. Valor comercial imediatamente superior: $R = 1.2\,k\Omega$

b) $I_{DC} = 18/1200 = 0.015$

$r = I_{DC}/(2\sqrt{3} \times 60 \times 100 \times 10^{-6} \times 19.3) = 0.0374$

$V_{DC} = 19.3/(1+\sqrt{3} \times 0.0374) = 18.13\,V$

$I_{DC} = 18.3/1200 = 0.0151$

$r = 0.0151/(2\sqrt{3} \times 60 \times 100 \times 10^{-6} \times 19.3) = 0.0377$

$V_{DC} = 19.3/(1+\sqrt{3} \times 0.0377) = 18.12\,V$ (e, novamente, $I_{DC} = 0.0151\,V$)