

2019255 EXAM

by Will Henry Noakes

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WILLIAM NOAKES

2019255

ACDA 4006 ELECTRONICS EXAM

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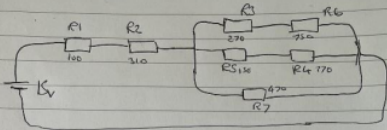
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William Noakes 2019265

OME - ACDA 4006 Exam

Q1

a)



$$R_1 + R_2 = 100 + 300 = 400 \Omega$$

$$R_{3-7} = \frac{1}{\frac{1}{1000} + \frac{1}{480} + \frac{1}{470}} = 191.902 \Omega$$

$$R_3 + R_6 = 1000$$

$$R_4 + R_5 = 480$$

$$R_7 = 470$$

$$400 + 191.902 = 601.902 \Omega = R_t$$

b) $I = \frac{V}{R}$

$$\frac{15}{601.902} = 0.024921 \text{ A}$$

$$24.921 \text{ mA}$$

c) $V_{R5} = 15 \times \left(\frac{191.902}{601.902} \right) = 4.78239 \text{ V}$

$$I_{R5} = \frac{V_{R5}}{R_5} = \frac{4.78239}{270} = 0.017713 \text{ A}$$

$$17.713 \text{ mA}$$

Q1

d) $P = IV$

$$0.024921 \times 15 = 0.373815$$

$$373.815 \text{ mW}$$

e) $V_{R4} = 15 \times \left(\frac{191.902}{601.902} \right) = 4.78239 \text{ V}$

$$I_{R4} = \frac{V_{R4}}{R_{R4}} = \frac{4.78239}{330} = 0.0144921 \text{ A}$$

$$P_{R4} = I_{R4} \times V_{R4} = 4.78239 \times 0.0144921 = 0.0693069 \text{ W}$$

$$69.307 \text{ mW}$$

f) $R7$ replaced by wire $\therefore$

$$R_T = \left(\frac{1}{\frac{1}{100} + \frac{1}{310}} \right) + \left(\frac{1}{\frac{1}{1000} + \frac{1}{480}} \right)$$

$$\left(\frac{1}{\frac{1}{1000} + \frac{1}{480}} \right) = 324.324 \Omega$$

$$324.324 + 410 = 734.324 \Omega$$

$$I = \frac{V}{R} = \frac{15}{734.324} = 0.0204259 \text{ A}$$

$$20.427 \text{ mA}$$

2)

a) $T = 400 \text{ ms}$

b) $f = \frac{1}{T} = \frac{1}{400 \times 10^{-3}} = 2.5 \text{ Hz}$

c) $4 \times 0.5 = 2 \text{ V}$

d) $V_{\text{rms}} = V_{\text{pk}} \left(\frac{1}{\sqrt{2}} \right) = 1 \times \left(\frac{1}{\sqrt{2}} \right) = 0.7071068 \text{ V}$

$$707.107 \text{ mV}$$

3)

a) $V_A = V_R = 40 \times (10 \times 10^{-6}) = 4 \text{ V}$

~~$$V_A = V_R = 40 \times (10 \times 10^{-6}) = 4 \text{ V}$$~~

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$$V = 40000 \times (10 \times 10^{-6}) = 0.4$$

$$12 \times \left(e^{\frac{-11.6}{0.5}} \right) = 0.21978767 \text{ V}$$

4

Q3

Diode

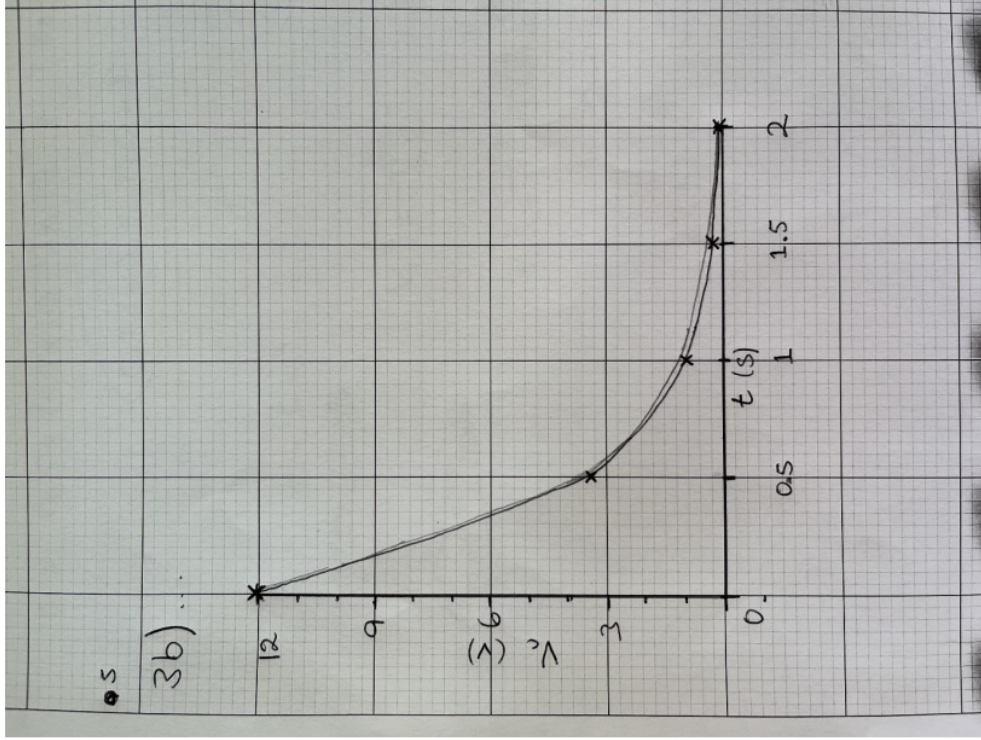
$$V_c @ 0.5s = 12 \times \left(e^{\frac{0.5}{0.001}} \right) = 34381 \text{ V}$$

$$V_c @ 1s = 12 \times \left(e^{\frac{1}{0.001}} \right) = 0.98502 \text{ V}$$

$$V_c @ 1.5s = 12 \times \left(e^{\frac{1.5}{0.001}} \right) = 0.28221 \text{ V}$$

$$V_c @ 2s = 12 \times \left(e^{\frac{2}{0.001}} \right) = 0.080855 \text{ V}$$

$$V_c @ 0s = 12 \times \left(e^{\frac{0}{0.001}} \right) = 12 \text{ V}$$



Q3)

c) $E = \frac{1}{2} \times C V_c^2$

$E = 0.5 \times (10 \times 10^{-6}) \times 12^2 = 7.2 \times 10^{-4}$

$0.72 \text{ mJ} = 720 \mu\text{J}$

d)

$E = \frac{1}{2} \times C V_c^2$

$V_c^2 = \frac{E}{\frac{1}{2} C}$

$= \frac{0.1}{0.5 \times (10 \times 10^{-6})}$

$= 20000$

$V_c = \sqrt{V_c^2} = \sqrt{20000} = 141.42133$

4

 $\frac{1}{a}$

20V, 100k Ω R=200 Ω L=200mH C=5 μ F

$$X_L = 2 \times 17 \times 100 \times (200 \times 10^{-3}) = 125.66371$$

$$X_c = \frac{1}{2\pi \times 100 \times (5 \times 10^{-6})} = 318.30989$$

$$|Z| = \sqrt{200^2 + (125.66371 - 318.30981)^2} = 277.69147 \Omega$$

b) $I = \frac{V}{Z} = \frac{20}{277.69147} = 0.072022 \text{ A}$

$$c) \theta = \tan^{-1} \left(\frac{x}{R} \right)$$

2

$$\theta = \tan^{-1} \left(\frac{125.66371 - 318.30989}{200} \right) = -43.927^\circ$$

4

$$d) V_{R1} = I \times R_1$$

$$(72.022 \times 10^{-3}) \times 200 = 14.4044 \text{ V}$$

e)

$$V_L = I \times X_L$$

$$V_L = (72.022 \times 10^{-3}) \times 318.30981 = 22.925 \text{ V}$$

f)

$$V_C = I \times X_C$$

$$V_C = (72.022 \times 10^{-3}) \times 125.66371 = 9.0506 \text{ V}$$

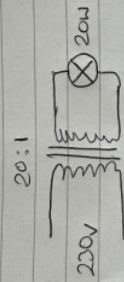
g)

$$P_r = \frac{1}{2\pi\sqrt{LC}} = \frac{1}{2\pi \times \sqrt{200 \times 10^{-3}} \times 15 \times 10^{-6}}$$

$$= 159.15494 \text{ Hz}$$

9

5)



b)

$$230 \times \frac{1}{20} = 11.5 \text{ V}$$

$$\frac{20}{11.5} = 1.739 \text{ A}$$

c)

$$I_p = \frac{P}{V}$$

$$I_p = \frac{20}{230} = 87 \text{ mA}$$

6)

(+) Anode | Cathode (-)



Electron flow

P-type | N-type

Majority Carriers | Minority Carriers



$$220 \times \frac{1}{20} = 11.5 \text{ V}$$

$$\frac{20}{11.5} = 1.739 \text{ A}$$

c) $I_p = \frac{P}{V}$

$$I_p = \frac{20}{230} = 87 \text{ mA}$$

6) (+) Anode, Cathode (-)

a) 

P-Type N-Type
Holes Electrons
Electron flow

b) When diode is forward biased, current flows, so electrons flow from cathode to anode. ~~When diode is reverse biased, electrons don't flow.~~ When reverse bias, current / electrons don't flow up to the threshold for breakdown of the diode.

FINAL GRADE

73/100

GENERAL COMMENTS

Instructor

Total 51 Marks out of 70

$51/70 \times 100\% = 73\%$

Q1 - 10 Marks total

- a) - 2 Marks (incorrect circuit used - R7 only in parallel with R4, not R4+R5)
- b) - 2 Marks (Error Carried Forward)
- c) - 1 Mark (should have included R6 in last line)
- d) 2 Marks - ECF
- e) - 1 Mark (voltage on R5 should be taken into account)
- f) - 2 Marks (R7 as a wire link would short circuit R3, R4, R5 & R6 in your diagram leaving only R1 & R2.)

Q2 - 5 Marks total

- a) 1 Mark
- b) 1 Mark
- c) 1 Mark
- d) 2 Marks

Q3 - 12 Marks total

- a) 3 Marks
- b) 5 Marks

c) 3 Marks

d) 1 Mark - incomplete answer, used J instead of mj

Q4 - 14 Marks total

a) 2 Marks

b) 2 Marks

c) 2 Marks

d) 2 Marks

e) 2 Marks

f) 2 Marks

g) 2 Marks

Q5 - 6 Marks total

a) 2 Marks

b) 2 Marks

c) 2 Marks

Q6 - 4 Marks total

a) 2 Marks

b) 2 Marks

PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5



Comment 1

numerator here should be 0.1×10^{-3} , and not 0.1 as you have it. It was in mJ not J