

S Parker 2023507

by Samuel Dylan Parker

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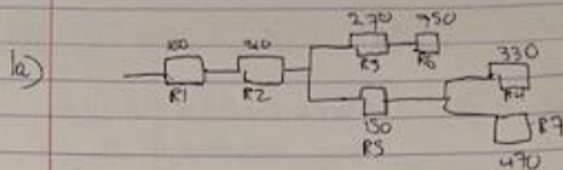
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L4- Electrical and Electronic Principles (OME)
(ACDA4006) - Exam

Sam Parker - 2023507

14/01/2022

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$$\frac{1}{R_{4/7}} = \frac{1}{R_4} + \frac{1}{R_7} = \frac{8}{1951} \Rightarrow R_{4/7} = 193.88\Omega$$

$$R_{4/7} + R_5 = 343.88\Omega, \quad R_{3/6} = 270 + 750 = 1020\Omega$$

$$\frac{1}{R_x} = \frac{1}{343.88} + \frac{1}{1020} = 3.882 \times 10^{-3}, \quad R_x = 257.18\Omega$$

$$R_T = 257.18 + 310 + 100 = 667.18\Omega$$

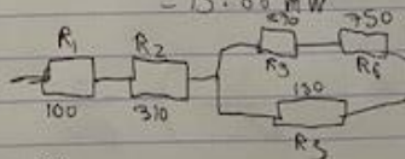
b) $P = \frac{15}{667.18} = 0.022488A, 22.483mA$

c) $I_{R3} = 22.482mA \times \left(\frac{343.875}{1020 + 343.875} \right) = 5.669mA$

d) $0.022483 \times 15 = 0.3372W, 337.24mW$

e) $I_{R5} = I - I_{R6} = 16.814mA$
 $I_{R4} = 16.814 \times \left(\frac{330}{470 + 330} \right) = 6.936mA$
 $P_{R4} = I_{R4}^2 \times R_4 = (6.936 \times 10^{-3})^2 \times 330 = 0.1588W = 15.88mW$

5) Removing R_7 shorts R_4 ∴



$$\frac{1020 \times 150}{1020 + 150} = 130.77\Omega$$

$$410 + 130.77 = 540.77\Omega$$

~~21~~

2a) $4 \times 100 = 400 \text{ m/s}$

b) $f = 1/t = 1/400 \text{ m/s} = 2.5 \times 10^{-3} \text{ Hz}$

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

d) $V_{\text{RMS}} = \frac{V_{\text{PK}}}{\sqrt{2}} = \frac{2}{\sqrt{2}} = 1.414 \text{ V}$

$$3a) V_c = V_0(e^{-t/\tau}) \quad \tau = RC, \quad RC = 40000 \times 0.00001 F \\ = 0.4$$

$$12(e^{-\frac{1.6}{0.4}}) = 0.220 V$$

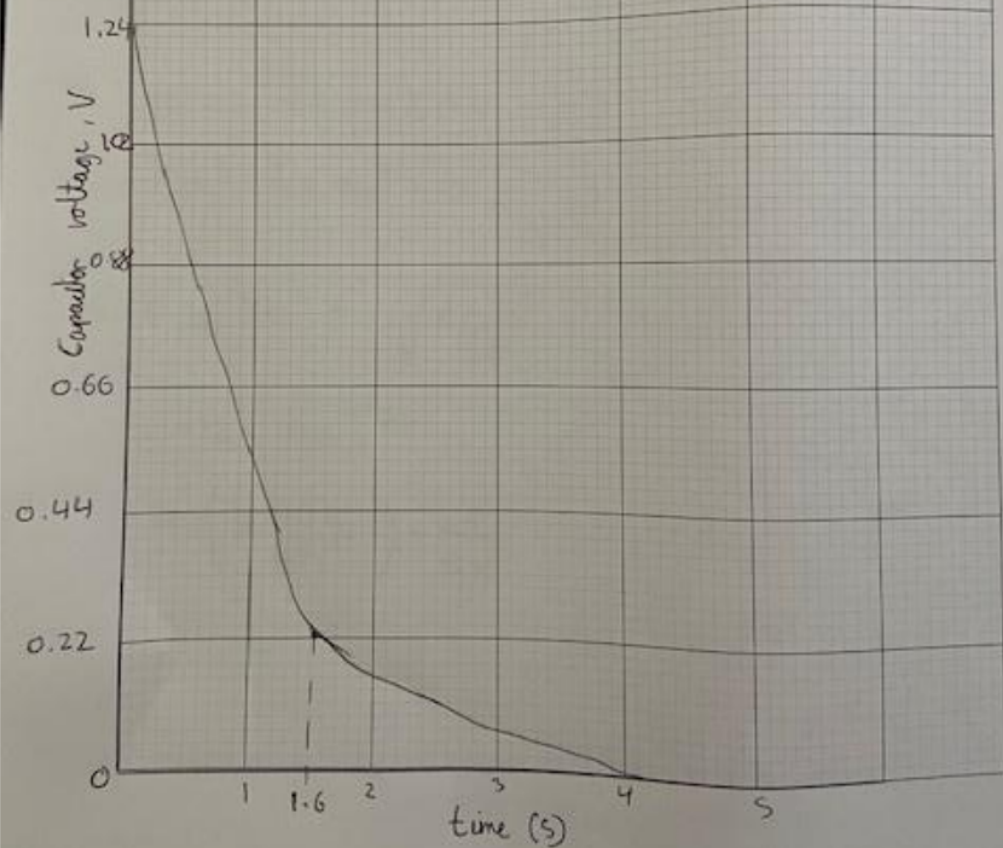
$$c) \frac{1}{2} CV^2 = \frac{1}{2} \times 10 \mu F \times 12^2 = 7.2 \times 10^{-4} J \\ 720 \mu J$$

$$d) 0.1 mJ = \frac{1}{2} CV^2 \Rightarrow \sqrt{\frac{0.1 \times 10^{-3}}{\frac{1}{2} C}} = 4.472 V$$

$$4.472 = 12e^{-t/0.4}$$

$$\ln\left(\frac{4.472}{12}\right) = \frac{-t}{0.4} \quad , \quad -0.4 \times \ln\left(\frac{4.472}{12}\right) \\ = t \quad , \quad t = 0.395 s$$

3b)



$$4a) X_L = 2\pi f L, X_C = \frac{1}{2\pi f C} \quad \frac{1}{2\pi \times 100 \times 5 \times 10^{-6}}$$

$$X_L = 2\pi \times 100 \times 200 \times 10^{-3} \quad X_C = 318.31 \Omega$$

$$= 125.66 \Omega$$

$$Z = \sqrt{R^2 + (X_L - X_C)^2} = 277.69 \Omega$$

$$b) I = \frac{V}{Z} = \frac{20}{277.69 \Omega} = 0.0720 A, 72.02 mA$$

$$c) \phi = \tan^{-1}\left(\frac{X}{R}\right) = \tan^{-1}\left(\frac{125.66 - 318.31}{200}\right) = 43.93^\circ$$

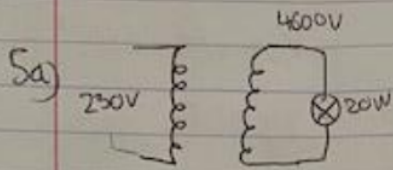
$$d) V_R = I R = 0.0720 \times 200 = 14.4 V$$

$$e) V_C = I \times X_C = 0.0720 \times 318.31 = 22.92 V$$

$$f) V_L = I \times X_L = 0.0720 \times 125.66 = 9.048 V$$

$$g) f_r = \frac{1}{2\pi \sqrt{LC}} = \frac{1}{2\pi \sqrt{200 \times 10^{-3} \times 5 \times 10^{-6}}}$$

$$= 159.15 Hz$$



b) $230 \times 20 > 4600 \text{ V}$ $I = \frac{P}{V}$ $I = \frac{20}{4600} = 0.00435 \text{ A}$
 $= 4.35 \text{ mA}$

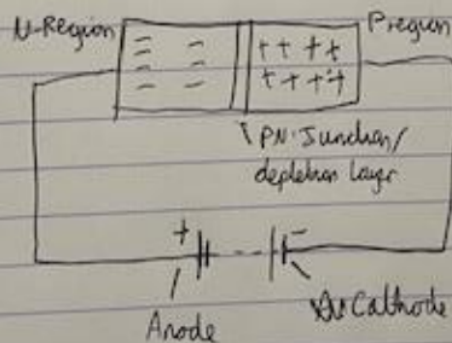
c) $\frac{20}{230} = 0.0870 \text{ A}$
 $= 8.70 \text{ mA}$

6a)

6a) Cathode (-)  Anode (+)

b) ~~Forward bias~~ A diode is made up of type N and P material. When there is a forward bias there is a positive voltage on P material, and a negative voltage on N material. When the voltage barrier is met, current will flow. The negative voltage will cause electrons to cross the junction, and so getting in the holes that have been created as electrons are drawn towards the cathode.

In a reverse bias, the same happens, but the other way around. Positive voltage is applied to the N-type material which causes electrons to move towards the anode, away from the depletion layer. The holes created will then be filled by electrons moving across the depletion layer (when sufficient voltage is applied) from the p-region.



FINAL GRADE

83 / 100

GENERAL COMMENTS

Instructor

58 Marks total out of 70

$58 / 70 \times 100 = 83\%$

Q1 - 15 Marks total

a) 4 Marks

b) 2 Marks

c) 2 Marks

d) 2 Marks

e) 3 Marks - resistors wrong way around on 2nd part of calc.

f) 2 Marks - needed current.

Q2 - 4 Marks total

a) 1 Mark

b) 1 Mark

c) 1 Mark

d) 1 Mark - should be peak voltage not peak to peak voltage

Q3 - 12 Marks total

a) 3 Marks

b) 2 Mark - incorrect values and scales, t should be 0 to 2 sec, V should be 0 to 12V

c) 3 Marks

d) 4 Marks

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 - 4 Marks

a) 1 Mark - winding ratio wrong

b) 1 Mark

c) 2 Marks

Q6 - 9 Marks total

a) 2 Marks

b) 7 Marks

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Comment 1

87 mA - watch your decimal places and SI Prefixes