

Electrical and Electronic Principles Exam

by Ryan Thomas Garry

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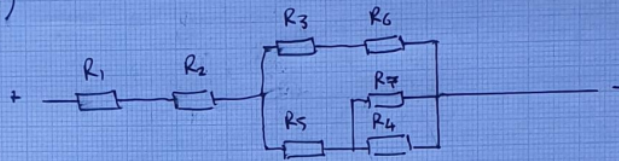
ACDA4006- Electronics Exam

Friday, 14 January 2022

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S2024366

Q1 a)



$$R_T = R_1 + R_2 + \left(\frac{(R_3 + R_6) + \left(R_5 + \left(\frac{R_7 + R_4}{R_7 \times R_4} \right) \right)}{(R_3 + R_6) \times \left(R_5 + \left(\frac{R_7 + R_4}{R_7 \times R_4} \right) \right)} \right)$$

$$R_T = 100 + 310 + \left(\frac{(270 + 750) + \left(150 + \left(\frac{470 + 330}{470 \times 330} \right) \right)}{(270 + 750) \times \left(150 + \left(\frac{470 + 330}{470 \times 330} \right) \right)} \right)$$

$$R_T = 411 \Omega$$

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

$$I_T = \frac{15}{411 \Omega}$$

$$I = 3.6496 \times 10^{-3} \text{ A (4.d.p.)}$$

$$I_{R3} = \frac{R_T}{R_3 \times R_T} I_T$$

$$I_{R3} = \frac{R_1 + R_2 + \left(\frac{(R_6 + \left(R_5 + \left(\frac{R_7 + R_4}{R_7 \times R_4} \right) \right))}{(R_6 \times \left(R_5 + \left(\frac{R_7 + R_4}{R_7 \times R_4} \right) \right))} \right)}{R_3 \times \left(R_1 + R_2 + \left(\frac{(R_6 + \left(R_5 + \left(\frac{R_7 + R_4}{R_7 \times R_4} \right) \right))}{(R_6 \times \left(R_5 + \left(\frac{R_7 + R_4}{R_7 \times R_4} \right) \right))} \right)} \right)} I_T$$

$$I_{R3} = \frac{100 + 310 + \left(\frac{(750 + \left(150 + \left(\frac{470 + 330}{470 \times 330} \right) \right))}{(750 \times \left(150 + \left(\frac{470 + 330}{470 \times 330} \right) \right))} \right)}{270 \times \left(100 + 310 + \left(\frac{(750 + \left(150 + \left(\frac{470 + 330}{470 \times 330} \right) \right))}{(750 \times \left(150 + \left(\frac{470 + 330}{470 \times 330} \right) \right))} \right)} \right)} \times 3.6496 \times 10^{-3}$$

$$\begin{aligned}
 Q_1 \text{ c) } I_{R3} &= 100 + 310 + \left(\frac{750 + \left(150 + \frac{470 + 330}{470 \times 330} \right)}{750 \times \left(150 + \frac{470 + 330}{470 \times 330} \right)} \right) \times 3.6496 \\
 &= 270 \left(100 + 310 + \left(\frac{750 + \left(150 + \frac{470 + 330}{470 \times 330} \right)}{750 \times \left(150 + \frac{470 + 330}{470 \times 330} \right)} \right) \right) \\
 &= \left(\frac{410.008}{270 \times 410.008} \right) \times 3.6496 \\
 &= \cancel{0} 1.3517 \times 10^{-3} \text{ A (3 d.p.)}
 \end{aligned}$$

$$d) P = V \times I_T$$

$$P = 0.054 \text{ W}$$

Q2 a) Approx 800 ms

b) $\text{Period} = \frac{1}{f}$

$$f = \frac{1}{\text{Period}}$$

$$f = 1.25 \text{ Hz}$$

c) $P_k - P_k = 4 \times 500 \text{ mV}$
 $= 2 \text{ V}$

d) $V_{\text{RMS}} = \frac{V_{\text{pk-pk}}}{\sqrt{2}}$

$$V_{\text{RMS}} = 1.414 \text{ V}$$

Q3

$$a) \quad V_c = V_0 (e^{-\frac{t}{\tau}}) \rightarrow \tau = \frac{1}{R} RC$$

$$\tau = 40k\Omega \times 10\mu F$$

$$V_c = 12V (e^{-\frac{1.6}{0.4}}) \leftarrow \tau = 0.4$$

$$V_c = -130.477V$$

$$\text{Q4 a) } |Z| = \sqrt{R^2 + (X_L - X_C)^2}$$

$$X_C = \frac{1}{2\pi fC}$$

$$X_C = 318.309 \, \Omega \quad (3 \text{ dp})$$

$$X_L = 2\pi fL$$

$$X_L = 125.663 \, \Omega \quad (3 \text{ dp})$$

$$\therefore |Z| = \sqrt{200^2 + (125.663 - 318.309)^2}$$

$$Z = 277.691 \, \Omega \quad (3 \text{ dp})$$

$$\text{b) } I = \frac{V}{Z}$$

$$I = \cancel{0} 7.202 \times 10^{-3} \, \text{A} \quad (3 \text{ dp})$$

c)

$$Q4 \ d) \quad V_R = V \frac{R}{R+Z}$$

$$V_R = 20 \times \frac{200}{277.691}$$

$$V_R = 14.404 \text{ v}$$

$$e) \quad V_C = I \frac{X_C}{Z}$$

$$V_C = 20 \times \frac{318.309}{277.691}$$

$$V_C = 22.925 \text{ v}$$

$$\left[\begin{aligned} V_C &= I \times X_C \\ &= 0.07202 \times 318.309 \\ &= 22.925 \text{ v} \end{aligned} \right]$$

$$f) \quad V_L = I \times X_L$$

$$= 0.07202 \times 125.663$$

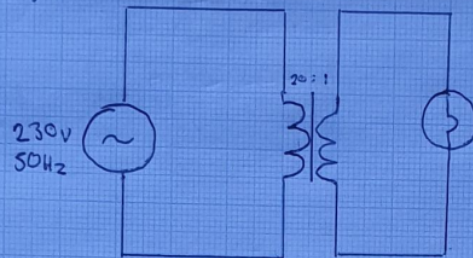
$$V_L = 9.0502 \text{ v}$$

$$g) \quad f_{res} = \frac{1}{2\pi\sqrt{LC}}$$

$$= \frac{1}{2\pi\sqrt{200\text{mH} \times 5\mu\text{F}}}$$

$$f_{res} = 159.154 \text{ Hz}$$

Q5 a)



$$b) \quad I_L = \frac{W}{(V/20)}$$

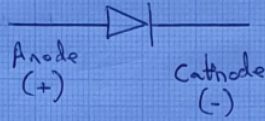
$$= \frac{20}{(230:20)}$$

$$= 1.7391 \text{ A} \quad (3 \text{ dp})$$

$$c) \quad I_s = \frac{W}{V}$$

$$= 0.0869 \text{ A} \quad (3 \text{ dp})$$

Q6 a) Rectifier Diode



b)

Describe what happens to the distribution of electrons within the diode when it is forward biased and reverse biased. Consider using a diagram to aid your explanations.

A diode consists of two material regions doped with positive and negative charge respectively, separated by a depletion region. A diode can be considered to be forward biased when voltage is applied across the terminals in a way that allows current to pass through (from the anode to the cathode). If the diode prohibits current flow (i.e from cathode to anode) then the diode can be considered reverse biased.

When a voltage is applied to a positively charged region, the number of positively charged electrons outnumbers the amount of holes available, pushing the holes towards the depletion zone and allowing charge to pass as the depletion zone becomes narrower.

Electrical and Electronic Principles Exam

GRADEMARK REPORT

FINAL GRADE

51 / 100

GENERAL COMMENTS

Instructor

Total 36 out of 70

$36 / 70 \times 100 = 51\%$

Q1 - 7 Marks

a) 3 Marks

b) 1 Mark (Error Carried Forwards)

c) 1 Mark (ECF)

d) 2 Marks (ECF)

e) 0 Marks

f) 0 Marks

Q2 - 3 Marks

a) 0 Marks

b) 1 Mark (ECF)

c) 1 Mark

d) 1 Mark

Q3 - 2 Marks

a) 2 Marks

b) 0 Marks

c) 0 Marks

d) 0 Marks

Q4 - 11 Marks

a) 2 Marks

b) 1 Mark

c) 0 Marks

d) 2 Marks

e) 2 Marks

f) 2 Marks

g) 2 Marks

Q5 - 6 Marks

a) 2 Marks

b) 2 Marks

c) 2 Marks

Q6 - 7 Marks

a) 2 Marks

b) 5 Marks

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Comment 1

Should be product over sum, not sum over product



Comment 2

Need to take R3 (270R) into account