

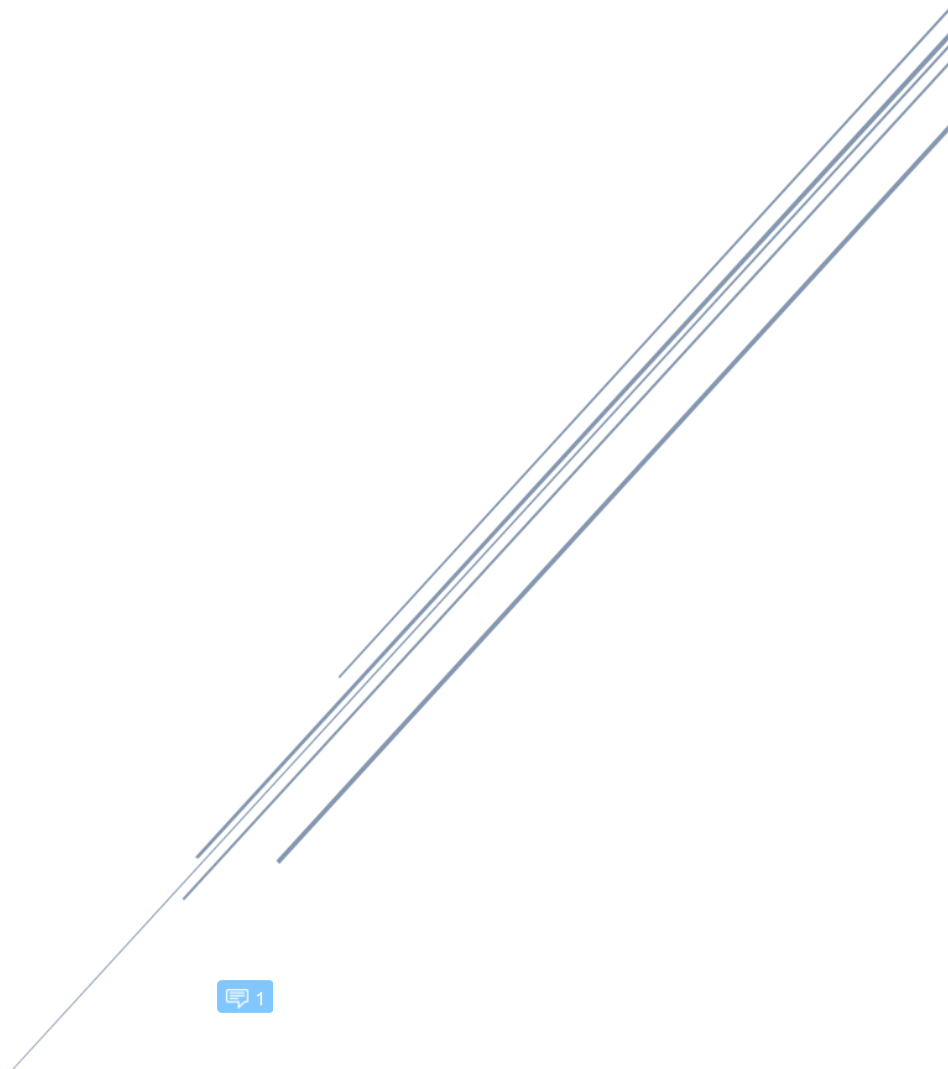
20200515 - EEP Exam

by Frazer Graham

FILE	17972_FRAZER_GRAHAM_20200515_- _EEP_EXAM_246301_1361580267.PDF (1.02M)		
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ACDA4006

Electrical and Electronic Principles Exam 15/05/2020

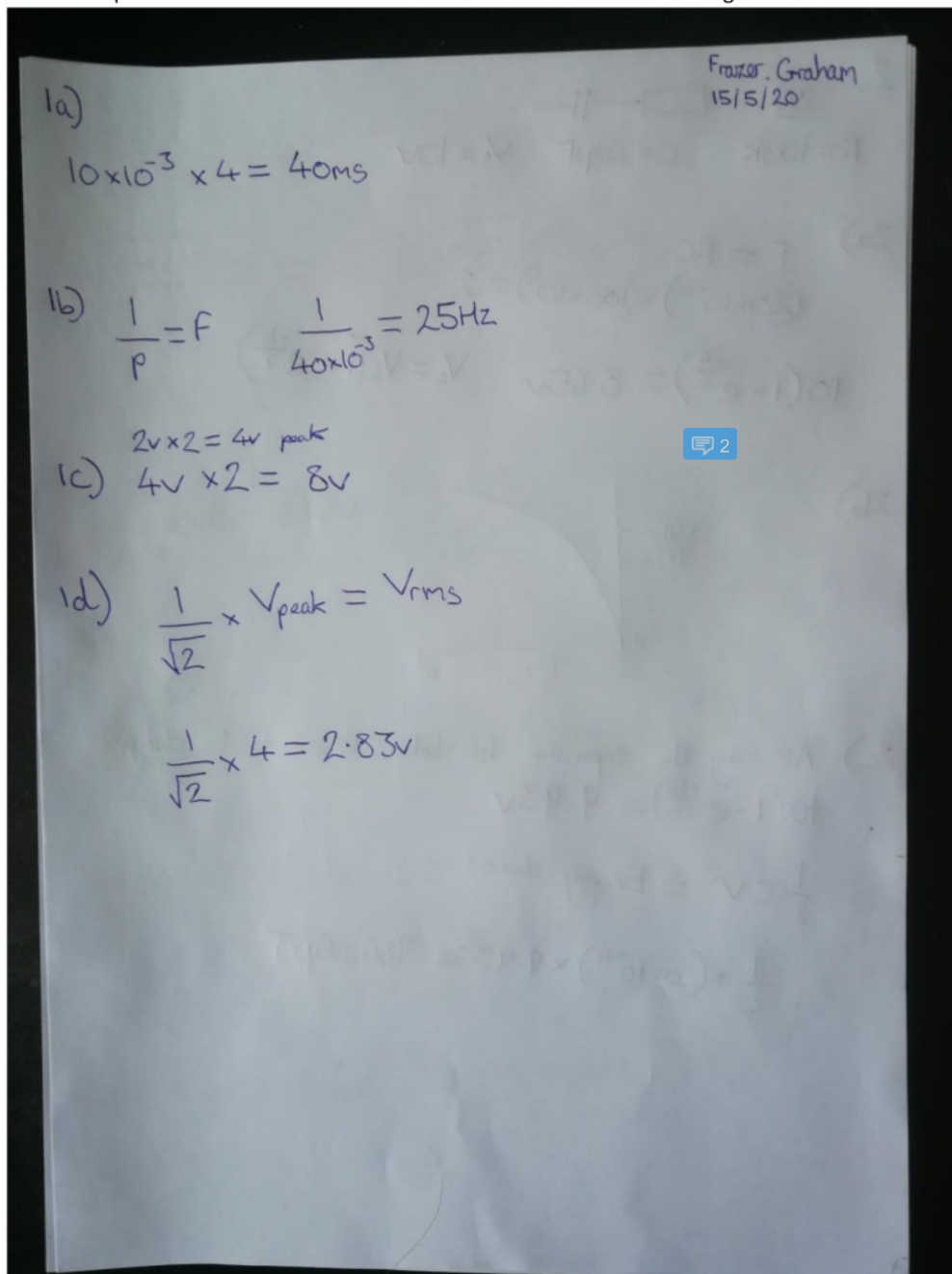


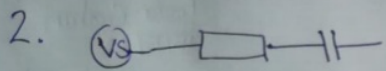
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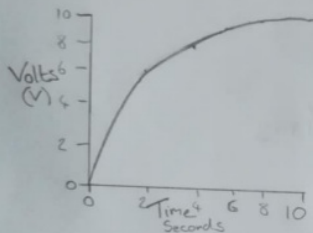
$R = 100k$ $C = 20\mu F$ $V_s = 10V$

2a) $\tau = RC$

$(20 \times 10^{-6}) \times (100 \times 10^3) = 2$

$10(1 - e^{-\frac{4}{2}}) = 8.65V$ $V_c = V_s(1 - e^{-\frac{t}{\tau}})$

2b)



Capacitor charging

2c) Assuming the capacitor has taken 10 seconds to charge.

$10(1 - e^{-\frac{10}{2}}) = 9.93V$

$\frac{1}{2} CV^2 = \text{Energy stored}$

$\frac{1}{2} \times (20 \times 10^{-6}) \times 9.93^2 = 986.05\mu J$

2d)

$$\frac{1}{2} C V^2 = 0.25 \text{ mJ}$$

$$\sqrt{\frac{2 \times 0.25 \text{ mJ}}{C}} = V = \sqrt{\frac{2 \times 0.25 \times 10^{-3}}{(20 \times 10^{-6})}} = 5 \text{ V}$$

$$V_C = V_S (1 - e^{-\frac{t}{T}})$$

$$\frac{V_C}{V_S} = 1 - e^{-\frac{t}{T}} \quad \frac{V_C}{V_S} - 1$$

$$e^{-\frac{t}{T}} = 1 - \frac{V_C}{V_S}$$

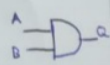
$$\frac{-t}{T} = \ln\left(1 - \frac{V_C}{V_S}\right) \quad -t = \ln\left(1 - \frac{V_C}{V_S}\right) \times T$$

$$\ln\left(1 - \frac{5}{10}\right) \times 2 = -1.39 \quad -t = -1.39$$

$$t = 1.39$$

$$10\left(1 - e^{-\frac{1.39}{2}}\right) = 5.009 \text{ V}$$

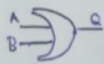
The time it takes is 1.39 seconds.



AND

$$AB = Q$$

A	B	Q
0	0	0
0	1	0
1	0	0
1	1	1



OR

$$A+B = Q$$

A	B	Q
0	0	0
0	1	1
1	0	1
1	1	1



NOT

$$\bar{A} = Q$$

A	Q
0	1
1	0

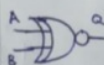
$$\bar{A} = Q$$



NAND

$$\overline{AB} = Q$$

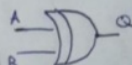
A	B	Q
0	0	1
0	1	1
1	0	1
1	1	0



XOR
XNOR

A	B	Q
0	0	0
0	1	1
1	0	1
1	1	0

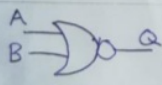
$$A \oplus B = Q$$



XOR

A	B	Q
0	0	0
0	1	1
1	0	1
1	1	0

$$A \oplus B = Q$$



NOR

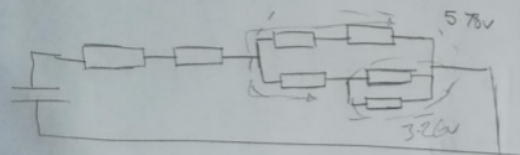
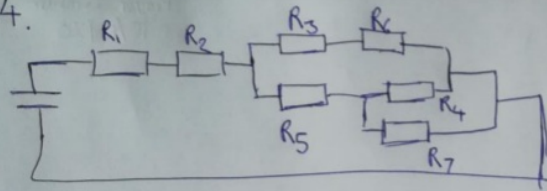
$$\overline{A+B} = Q$$

A	B	Q
0	0	1
0	1	0
1	0	0
1	1	0

*

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4.



$$R_1 = 100\Omega \quad R_2 = 310\Omega \quad R_3 = 270\Omega \quad R_6 = 750\Omega$$

$$R_7 = 470\Omega \quad R_5 = 150\Omega \quad R_4 = 330\Omega$$

~~R₂~~ 4a.)

$$\frac{1}{470} + \frac{1}{330} = \text{ans}' = ~~193.88\Omega~~ 193.88\Omega \quad \frac{1}{R_4} + \frac{1}{R_7} = \frac{1}{R_{4+7}}$$

$$150\Omega + 193.88\Omega = 343.88\Omega$$

$$270 + 750 = 1020\Omega$$

$$\frac{1}{343.88} + \frac{1}{1020} = \text{ans}' = 257.18\Omega$$

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

$$R_T = 667.18\Omega$$

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$$4b) V=IR \quad \frac{V}{R}=I$$

$$15 \div 667.18 = 22.48 \text{mA}$$

4c)

$$(100 \times 22.48 \text{mA}) + (310 \times 22.48 \text{mA}) = 9.22 \text{V}$$

$$15 - 9.22 \text{V} = 5.78 \text{V}$$

$$V=IR \quad \frac{V}{R}=I \quad \frac{5.78}{1020} = \cancel{5.67} \text{mA} \quad 5.67 \text{mA}$$

$$\frac{5.78}{343.88} = 16.81 \text{mA} \quad 5.67 + 16.81 = 22.48$$

Current flowing through R_6 is 5.67mA.

$$4d) P=I^2R \text{ or } \frac{V^2}{R}$$

$$\frac{(15)^2}{667.18} = 337.24 \text{mW}$$

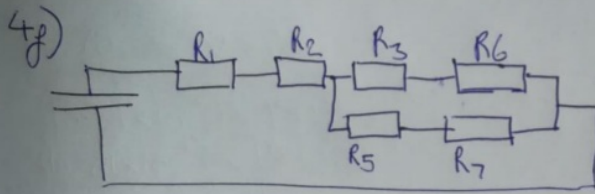
$$4e) P=I^2R = \frac{V^2}{R} = VI$$

$$5.78 \text{V} \quad 16.81 \text{mA} \times 150 = 2.52 \text{V}$$

$$5.78 \text{V} - 2.52 = 3.26 \text{V}$$

$$P = \frac{V^2}{R} \quad \frac{3.26^2}{470} = 22.61 \text{mW}$$

Power dissipated by
 $R_7 = \cancel{22.61 \text{mW}}$
22.61mW



15V

~~$\frac{1}{150} + \frac{1}{470}$~~

$$R_5 + R_7$$

$$150 + 470 = 620 \Omega$$

$$R_3 + R_6$$

$$270 + 750 = 1020 \Omega$$

$$\frac{1}{620} + \frac{1}{1020} = \text{ans}^{-1} = 385.61 \Omega$$

$$100 + 310 + 385.61 = 795.61 \Omega$$

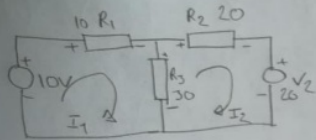
$$795.61 \Omega = R_T$$

$$\frac{15}{795.61} = 18.85 \text{mA}$$

$$\frac{V}{R_T} = I$$

The new current is 18.85mA

Q5)



$$V_1 - R_1 I_1 - R_3(I_1 - I_2) = 0$$

$$+R_3(I_1 - I_2) - R_2 I_2 - V_2 = 0$$

$$10 - 10I_1 - 30I_1 + 30I_2 = 0$$

$$30I_1 - 30I_2 - 20I_2 - 20 = 0$$

$$-40I_1 + 30I_2 = -10 \quad (1) \quad \text{Simplify by } \div 10$$

$$30I_1 - 50I_2 = 20 \quad (2)$$

$$\div 5 \Rightarrow -4I_1 + 3I_2 = -1 \quad (1)$$

$$3I_1 - 5I_2 = 2 \quad (2)$$

$$(1) \times 5 = -20I_1 + 15I_2 = -5$$

$$(2) \times 3 = 9I_1 - 15I_2 = 6$$

Add (2) to (1)

$$-20I_1 + 15I_2 = -5$$

$$+ \quad 9I_1 - 15I_2 = 6$$

$$-11I_1 = 1$$

$$\frac{1}{-11} = I_1$$

$$I_1 = -90.91 \text{ mA}$$

Putting I_1 back into ①

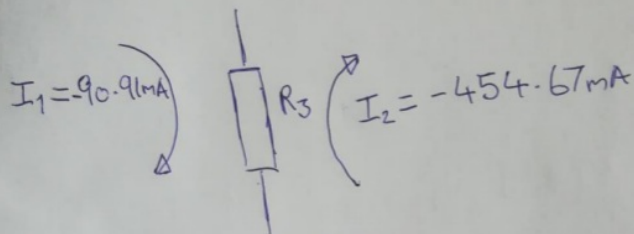
Q5

$$-40 \times (-90.91 \times 10^{-3}) + 30I_2 = -10$$

$$3.64 + 30I_2 = -10$$

$$30I_2 = -13.64$$

$$I_2 = \frac{-13.64}{30} \quad I_2 = -454.67 \text{ mA}$$



$$I_T = I_1 - I_2$$

$$-90.91 \text{ mA} - -454.67 \text{ mA}$$

$$-90.91 \text{ mA} + 454.67 \text{ mA} = 363.76 \text{ mA}$$

The current flowing through the 30Ω resistor is 363.76 mA

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GRADEMARK REPORT

FINAL GRADE

GENERAL COMMENTS

Instructor

96/100

PAGE 1



Comment 1

total Marks 48

Marks available 50

$48/50 \times 100 = 96\%$

PAGE 2



Comment 2

Question 1

a) 1 Mark

b) 1 Mark

c) 1 Mark

d) 2 Marks

Q1 total 5 Marks

PAGE 3

PAGE 4



Comment 3

Question 2

a) 3 Marks

b) 5 Marks

c) 3 Marks

d) 4 Marks

Q2 total 15 Marks

PAGE 5



Comment 4

Question 3 - 7 Marks

PAGE 6

PAGE 7

PAGE 8



Comment 5

Question 4

a) 4 Marks

b) 2 Marks

c) 2 Marks

d) 2 Marks

e) 4 Marks

f) 2 Marks - if R4 is shorted, so would R7

Q4 total 16 Marks

PAGE 9

PAGE 10



Comment 6

Question 5 - 5 Marks