

Exam answers

by Nathan Rowe

FILE	17993_NATHAN_ROWEXAM_ANSWERS_246301_2062044261.DOCX (4.98M)		
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SUBMISSION ID	127785907	CHARACTER COUNT	52

Exam Submission. Let me know if the pictures don't work again.



Q1a

$$4 \times 10 \text{ m/s} = 40 \text{ ms}$$

b,

$$1/40 = 25 \text{ Hz}$$

c,

$$V_{pk} - pk = 4 \times 2 = 8 \text{ V}$$

d,

$$V_{RMS} = V_{pk} \times 0.7071 = 2.828 \text{ V}$$

Q2a

$$V_c = V_s (1 - e^{-t/\tau})$$

$$R = 100 \text{ k}$$

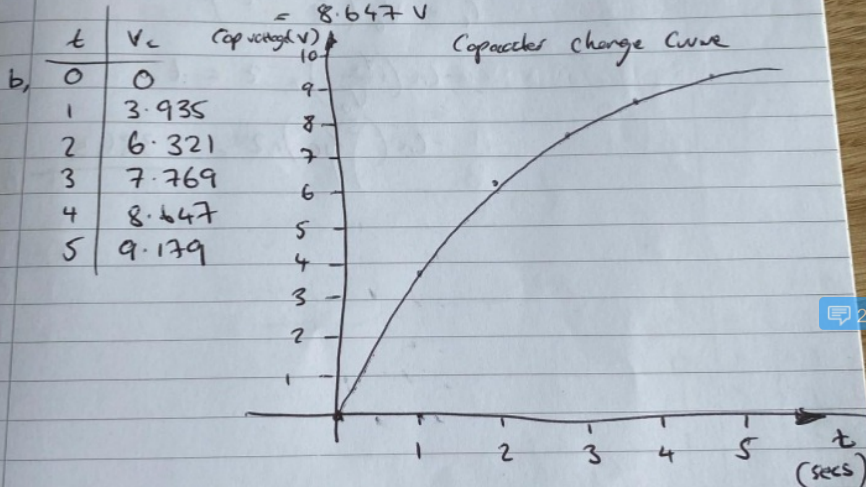
$$C = 20 \text{ pF}$$

$$V_s = 10 \text{ V}$$

$$\tau = RC = 2$$

$$V_c = 10(1 - e^{-t/2})$$

$$= 8.647 \text{ V}$$



c)

$$\begin{aligned}
 E &= \frac{1}{2} CV^2 \\
 &= \frac{1}{2} \times 20 \times 10^{-6} \times 10^2 \\
 &= \underline{1 \times 10^{-3} \text{ J}}
 \end{aligned}$$

d)

$$E = \frac{1}{2} CV^2$$

$$\begin{aligned}
 V &= \sqrt{\frac{E}{\frac{1}{2}C}} = \sqrt{\frac{0.25 \times 10^{-3}}{0.5 \times 20 \times 10^{-6}}} \\
 &= \underline{5 \text{ V}}
 \end{aligned}$$

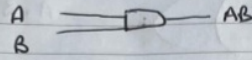
$$V_c = V_0 (e^{-t/\tau})$$

$$-\ln\left(\frac{V_c}{V_0}\right) \times 2 = t$$

$$-\ln\left(\frac{5}{10}\right) \times 2 = \underline{1.386 \text{ s}}$$

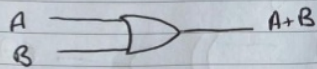
3

AND gate



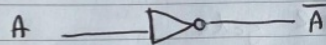
A	B	A · B
0	0	0
0	1	0
1	0	0
1	1	1

OR gate



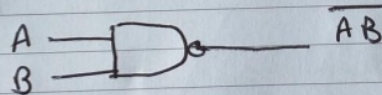
A	B	A + B
0	0	0
0	1	1
1	0	1
1	1	1

NOT gate



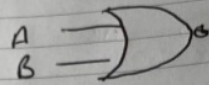
A	$\bar{A}$
0	1
1	0

NAND gate



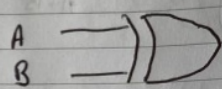
A	B	$\overline{A \cdot B}$
0	0	1
0	1	1
1	0	1
1	1	0

NOR gate



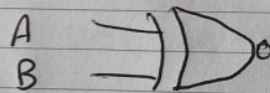
A	B	$A+B$
0	0	1
0	1	0
1	0	0
1	1	0

XOR gate



A	B	$A \oplus B$
0	0	0
0	1	1
1	0	1
1	1	0

XNOR gate



A	B	$A \oplus B$
0	0	1
0	1	0
1	0	0
1	1	1

Q4a

15V

$R_1 = 100$
 $R_2 = 310$
 $R_3 = 270$
 $R_4 = 330$
 $R_5 = 150$
 $R_6 = 750$
 $R_7 = 470$

$R_2 = 410$
 $R_3 = 270$
 $R_4 = 330$
 $R_5 = 150$
 $R_6 = 750$

150×750
 $150 + 750$
 $= 125 \Omega$

410
 270
 455

410
 169.448

270×455
 $270 + 455$
 $= 169.448 \Omega$

$\therefore R_T = 579.448 \Omega$

b,

$I = \frac{V}{R} = \frac{15}{579.448}$
 $= 0.025 A$

c,

$$I = I_{in} \times \frac{R_a}{R_b + R_a}$$

$$= 0.026 \times \frac{455}{750 + 455}$$

$$= \underline{9.817 \times 10^{-3} \text{ A}}$$

e,

$$P = I^2 R$$

$$= (9.817 \times 10^{-3})^2 \times 470$$

$$= \underline{0.045 \text{ W}}$$

d,

~~$$P = I^2 R$$~~

$$P = I^2 R$$

$$= (9.817 \times 10^{-3})^2 \times 549.448$$

$$= \underline{5.394 \text{ W}}$$

f,

$$I_1 + I_2 = I_3$$

~~$$I_1 = \frac{10 - V_x}{10}$$~~

~~$$I_2 = \frac{20 - V_x}{20}$$~~

$$I_3 = \frac{V_x}{30}$$

$$\frac{V_x}{30} = \frac{10 - V_x}{10} + \frac{20 - V_x}{20}$$

$$V_x = \frac{30}{10} - \frac{30V_x}{10} + \frac{60}{20} - \frac{30V_x}{20}$$

$$V_x = 3 - 3V_x + 3 - 1.5V_x$$

$$V_x = -4.5V_x + 6$$

$$5.5V_x = 6$$

$$V_x = 1.091 \text{ V}$$

$$I_1 = \frac{10 - 1.091}{10} = 0.891 \text{ A}$$

$$I_2 = \frac{20 - 1.091}{20} = 0.945 \text{ A}$$

$$I_3 = \frac{1.091}{30} = 0.036 \text{ A}$$

Exam answers

GRADEMARK REPORT

FINAL GRADE

GENERAL COMMENTS

Instructor

62/100

PAGE 1



Comment 1

total marks 31

marks available 50

$31/50 \times 100 = 62\%$

PAGE 2



Comment 2

Question 1

a) 1 Mark

b) 1 Mark

c) 1 Mark

d) 2 Marks

Q1 total 5 Marks



Comment 3

Graph should extend to 5 time constants so $5 \times 2 = 10$ seconds

PAGE 3



Comment 4

Question 2

Question 2

- a) 3 Marks
- b) 4 Marks
- c) 3 Marks
- d) 4 Marks

Q2 total 14 Marks

PAGE 4

PAGE 5



Comment 5

Question 3 - 7 Marks

PAGE 6

PAGE 7



Comment 6

Question 4

- a) 0 Marks - incorrect resistor grouping
- b) 2 Marks - incorrect answer propagated
- c) 0 Marks - incorrect resistor grouping
- d) 0 Marks
- e) 0 Marks
- f) 0 Marks

Q4 total 2 Marks

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Comment 7

Question 5 - 3 Marks

Careful with the signs - current directions wrong near the start.

Your three currents do not add up as per your first equation.