



Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David

Examination Answer Books

12 Pages

Instructions to Candidates

1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right, fold over and seal down (using the label provided) to hide your name.
3. The answers must be legibly written. The Examiners can either ignore illegible script or have it typed and the expense of typing charged to the candidate.
4. Write your answers in ink.
5. Begin each answer on a fresh page. Do all rough work in the answer book and cross it through.
6. No part of this book is to be torn out; it must be handed in complete.
7. If more books than one are used, fasten them together using the tags available from the invigilator(s).
8. **Every book must be handed in. In no circumstances may answer books, used or unused, be taken out of the examination venue.**

Complete, fold and seal
(see note 2 below)

SURNAME: Thomas

FORENAME(S): Joshua

1	Student Number	
2	Title of Examination Paper	~~SGEE~~ Electrical + Electronic Principles
3	Module Code	SGEE4000
4	Date and Time of Examination	Mon 23/5/22 9:30 - 11:30
5	Examination Venue	CSG Great Syn
6	Seat Number	
7	Number of Answer Books handed in	

[illegible]
$$\begin{array}{r} 25 \\ 11 \\ 2 \\ 2 \end{array}$$

40%
AGREED.

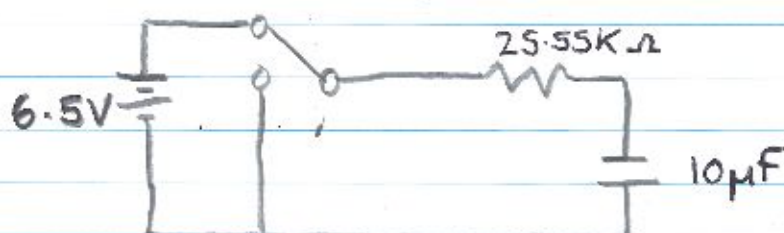
Q 1. Product Over Sum

$$a) \frac{47 \times 56}{47 + 56} = 25.55K\Omega$$

New Voltage:

$$\left(\frac{R_2}{R_1 + R_2} \right) \times V_s = \left(\frac{56}{47 + 56} \right) \times 12$$

$$= 6.5V$$



$$b) (i) \tau = RC = 25.55K \times 10 \times 10^{-6}$$

$$= 0.2555 \text{ seconds}$$

$$(ii) 5\tau = 5 \times 0.2555 = 1.2775 \text{ seconds}$$

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

$$(i) 3 = 6.5(1 - e^{-\frac{t}{0.2555}})$$

$$\frac{3}{6.5} = 1 - e^{-\frac{t}{0.2555}}$$

$$e^{-\frac{t}{0.2555}} = 1 - \frac{3}{6.5}$$

$$e^{-\frac{t}{0.2555}} = 1 - \frac{3}{6.5}$$

$$-\frac{t}{0.2555} = \ln\left(1 - \frac{3}{6.5}\right)$$

$$-\frac{t}{0.2555}$$

$$= -0.619$$

$$0.2555$$

$$t = 0.619 \times 0.2555$$

$$t = 0.158 \text{ seconds}$$

7

$$C. (ii) V_c = V_s (e^{-\frac{t}{\tau}})$$

$$3 = 6.5 (e^{-\frac{t}{0.2555}})$$

$$\frac{3}{6.5} = e^{-\frac{t}{0.2555}}$$

$$\ln\left(\frac{3}{6.5}\right) = \frac{-t}{0.2555}$$

$$-0.773 = \frac{-t}{0.2555}$$

$$t = 0.773 \times 0.2555$$

$$t = 0.198 \text{ Seconds}$$

$$d) (i) \tau = \frac{L}{R} = \frac{200 \times 10^{-3}}{1000}$$

$$= 0.2 \text{ ms} \text{ or } 0.0002 \text{ seconds}$$

$$(ii) \text{Steady State Current, } I = \frac{V}{R} = \frac{24}{1000}$$

$$= 0.024 \text{ A}$$

Time to fall to 20mA:

$$(iii) i = I (e^{-\frac{t}{\tau}})$$

$$0.02 = 0.024 (e^{-\frac{t}{0.0002}})$$

$$\frac{0.02}{0.024} = e^{-\frac{t}{0.0002}}$$

$$\ln\left(\frac{0.02}{0.024}\right) = \frac{-t}{0.0002}$$

$$-0.182 = \frac{-t}{0.0002}$$

$$t = 0.182 \times 0.0002$$

$$t = 36.4 \mu \text{ seconds}$$

12

Time to fall to 5mA

$$0.005 = 0.024(e^{-\frac{t}{0.0002}})$$

$$0.005 = e^{-\frac{t}{0.0002}}$$

$$\ln\left(\frac{0.005}{0.024}\right) = \frac{-t}{0.0002}$$

$$-1.569 = \frac{-t}{0.0002}$$

$$t = 1.569 \times 0.0002$$

$$t = 313.8 \mu \text{ seconds}$$

/

6

⑦

Q 2

$$a) Z_1 Z_2 = (3-j4)(6+j7)$$

$$Z_1 = 5 \angle -53.13^\circ$$

$$Z_2 = 9.22 \angle 49.4^\circ$$

$$5 \angle -53.13^\circ \times 9.22 \angle 49.4^\circ = 46.1 \angle -3.73^\circ$$

$$46.1 \angle -3.73^\circ \text{ in cartesian} = 46 - j3$$

$$Z_1 + Z_2 = 3-j4 + 6+j7$$

$$= 9+j3$$

$$9+j3 \text{ in polar} = 9.487 \angle 18.435^\circ$$

$$\frac{46.1 \angle -3.73^\circ}{9.487 \angle 18.435^\circ} = 4.859 \angle -22.165^\circ$$

↓

$$\text{in cartesian} = 4.5 - j1.8$$

$$4.5 - j1.8 + 2.5 - j6.5 = 7 - j8.3$$

$$Z_T = 7 - j8.3 \quad \checkmark$$

10

b)

$$(i) X_L = 2\pi fL = 2\pi \times 60 \times 0.4$$

$$= 150.8 \Omega \quad \checkmark$$

 $Z?$

$$(ii) I = \frac{V}{Z_R} = \frac{200 \angle 0^\circ}{40 + j150.8} = \frac{200 \angle 0^\circ}{156 \angle 75.14^\circ}$$

$$= \frac{200}{150.8} = 1.33 \text{ A} \quad \times$$

$$= 1.28 \angle -75.14^\circ$$

$$(iii) V_R = IR$$

$$= 1.33 \times 40$$

$$= 53.2 \text{ V}$$

S.2 1486

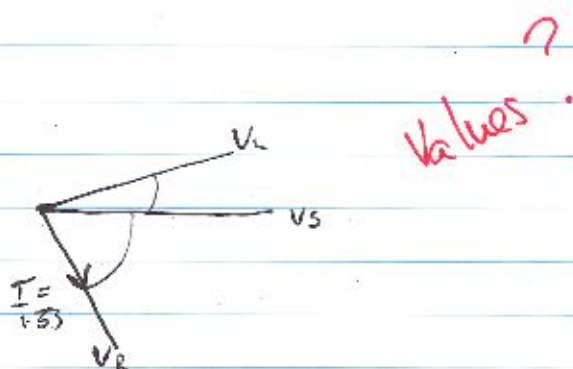
10

10

(iv) $V_L = LR = 0.4 \times 40$
 $= 16V$

c)

d)



1

①

Q 3

a)(i)

$$I = \frac{V}{Z} = \frac{60 \angle 30}{3 + j4} = \frac{60 \angle 30}{5 \angle 53.13}$$

$$= 12 \angle -23.13$$

↓

in cartesian = $11.4 - j4.7$

$$(ii) S = VI = 60 \angle 30 \times 12 \angle -23.13$$

$$= 720 \angle 6.87$$

$$714.83 + j 86.12$$

Active

Reactive

$$\text{Active} = 714.83$$

$$\text{Reactive} = 86.12$$

②

2

Q 4

$$\begin{aligned}
 \text{a) } C &= \frac{1}{4((2\pi f_r)^2 - \frac{1}{L^2})} \\
 &= \frac{1}{0.04(2\pi \times 2000)^2 - (\frac{100^2}{0.04^2})} \\
 &= \frac{1}{0.04 \times 151.66 \times 10^6} \\
 &= 164.84 \text{ nF}
 \end{aligned}$$

 $\frac{L}{CR}$

$$\text{b) } R = \frac{L}{CR} = \frac{0.04}{164.84 \times 10^{-9} \times 100} = 242.66$$

$$\text{c) } I = \frac{V}{R} = \frac{24}{242.66} = 98.9 \text{ mA}$$

$$\begin{aligned}
 \text{d) } Q &= \frac{2\pi fL}{R} \\
 &= \frac{2\pi \times 2000 \times 0.04}{100} \\
 &= 5.03
 \end{aligned}$$