

PRIFYSGOL CYMRU

Y Drindod Dewi Sant

UNIVERSITY OF WALES

Trinity Saint David

Examination Answer Book

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 and seal 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.**

1	Student Number	
2	Title of Examination Paper	Electrical + Electronic Principles
3	Module Code	SGEE 4000
4	Date and Time of Examination	Start 9:30 Finish 11:30
5	Examination Venue	Coleg Sir Gar
6	Seat Number	

7	Number of Answer Books handed in	1
---	----------------------------------	---

[illegible]

28%

Complete
section,
remove
strip, fold as
indicated
and SEAL

Please complete this section and SEAL before the examination starts.

Surname Bell (Block Capitals) Forename(s) Lewis

PATENT PENDING
INFOSAFE®

(Gweler yr ochr arall am y fersiwn Cymraeg)

Question 1

a) Equivalent Circuit

$$R_1 = 5k\Omega$$

$$C_1 = 1000\mu F$$

$$V_1 = 10V$$

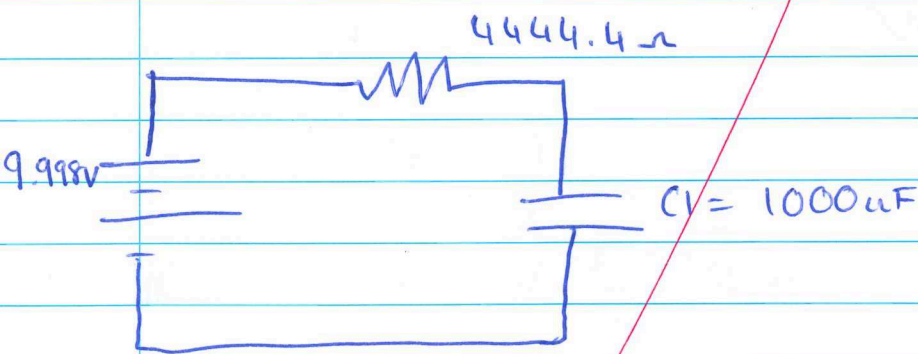
$$R_2 = 8k\Omega$$

~~$$R = \frac{(10 \times 8)}{(10 + 8)} = 225\Omega$$~~

$$R = \frac{(10 \times 8)}{(10 + 8)} \times 1000 = 4444.4\Omega \quad \times$$

~~$$V = \frac{8}{(10 + 8)} \times 10$$~~

$$V = \frac{8}{1000 \times 10^{-6} + 8} \times 10 = 9.998V \quad \times$$



method ok.
Knock an
error
 $\times$

b)i) $\tau = R_c$

$$\tau = 4444.4 \times 1000 \times 10^{-6}$$

$$\tau = 4.4444 \text{ seconds} \quad \times$$

b)ii) $\tau \times 5$

$$\tau \times 5 = 4.444 \times 5 = 22.22 \text{ seconds} \quad \times$$

c)i) @ 5V

$$\text{Charging} = V = V(1 - e^{-t/\tau})$$
$$5 = 9.998(1 - e^{-t/4.444})$$

Rearrange, Next page.

$$5 = 9.998(1 - e^{-t/4.4444})$$

Rearrange

$$-4.4444 \ln\left(1 - \frac{5}{9.998}\right)$$

mult
o/c

$$= 3.0815 \text{ seconds} \quad \times$$

c) ii) Discharging

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

$$5 = (9.998 e^{-t/4.4444})$$

Rearrange

$$-4.4444 \ln\left(\frac{5}{9.998}\right)$$

$$= 3.0797 \text{ seconds.} \quad \times$$

$$L = 250 \text{ mH}$$

$$R = 400 \Omega$$

$$V = 9 \text{ V}$$

D) i)

$$\tau = \frac{L}{R}$$

$$\tau = \frac{0.250}{400}$$

$$\tau = 6.25 \times 10^{-4} \text{ seconds} \quad \checkmark$$

ii) $\tau \times 5$

$$\tau \times 5 = 6.25 \times 10^{-4} \times 5 = 3.125 \times 10^{-3} \text{ seconds}$$

(4)

iii) 20mA (Discharge)

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

$$20 \text{ } 0.2 = (3.125 \times 10^{-3} e^{-t/6.25 \times 10^{-4}})$$

Rearrange

$$-6.25 \times 10^{-4} \ln \left(\frac{0.2}{3.125 \times 10^{-3}} \right)$$

method ok
values
are
wrong
check an
error.

$$= 2.599 \times 10^{-3} \text{ seconds}$$

x

iii) 10mA (Discharge)

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

$$0.1 = (3.125 \times 10^{-3} e^{-t/6.25 \times 10^{-4}})$$

Rearrange

$$-6.25 \times 10^{-4} \ln \left(\frac{0.1}{3.125 \times 10^{-3}} \right)$$

$$= 2.166 \times 10^{-3} \text{ seconds}$$

x

Question 2

$$a) Z_r = \left(\frac{Z_1 Z_2}{Z_1 + Z_2} \right) + Z_3$$

$$Z_1 \times Z_2 = (6 - j4) \times (3 + j5)$$

$$18 + j30 - j12 - j^2 20$$

$$18 + j18 + 20$$

$$38 + j18$$

$$Z_1 + Z_2 = (6 - j4) + (3 + j5)$$

$$9 + j1$$

$$\frac{38 + j18}{9 + j1} \times \frac{9 - j1}{9 - j1} = \frac{342 - j38 + j162 - j^2 18}{81 + j^2 1}$$

$$\frac{342 + j124 + 18}{82}$$

$$\frac{360 + j124}{82}$$

$$= 4.39 + j1.512$$

$$= 4.39 + j1.512 + Z_3$$

$$= 4.39 + j1.512 + 1.61 - j0.51$$

$$= \underline{\underline{6 + j1.002}}$$

12.

Question 3

a) i) $Z = (8 + j12)$ Conv to Pol $14.422 \angle 56.3$

$$I = \frac{V}{Z} \quad I = \frac{50 \angle 30^\circ}{14.422 \angle 56.3^\circ} = 3.466 \angle -26.3^\circ$$

ii)

Apparent

Active

Reactive

VAR
VA
W

$$S = VI = 50 \angle 30^\circ \times 3.466 \angle -26.3^\circ = 173 \angle 56.3^\circ \text{ VA}$$

$$Q = VI \sin \phi = 173 \sin(56.3) = 143.928 \text{ VAR}$$

3

$$P = VI \cos \phi = 173 \cos(56.3) = 95.98 \text{ W}$$

iii)

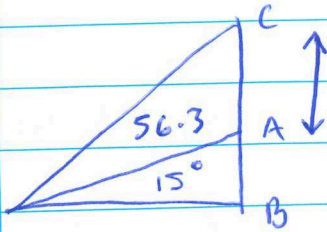
Current pf = $\cos(0.966)$
Rearrang

$$\phi = \cos^{-1}(0.966) = 14.98 = 15^\circ$$

Turn over

3

$$\theta = \cos^{-1}(0.966) = 15^\circ$$



$$\tan(15) = \frac{AB}{56.3}$$

Rearrange for AB

~~$$AB = \tan(15) \times 15.0855$$~~

$$AB = \tan(15) \times 56.3$$

$$AB = 15.085$$

$$\text{VAR} - AB$$

$$= 143.928 - 15.085 = 128.843 \text{ VAR leading}$$

~~$$B) 21 \text{ kW}$$~~
~~$$P_f = 0.7 \text{ lagging}$$~~

ii)