

Complete, fold and seal
(see note 2 below)

FORENAME(S): Bryn

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.

1	Student Number	
2	Title of Examination Paper	SGEE 40000 Electrical + Electronic Principles
3	Module Code	SGEE 4000
4	Date and Time of Examination	23/5/22
5	Examination Venue	GLM
6	Seat Number	
7	Number of Answer Books handed in	

List the numbers of the questions you have attempted	Office Use
1	12
2	~~8~~ 2
3	2
4	5
Total	21

(Gweler yr ochr arall am y fersiwn Cymraeg)

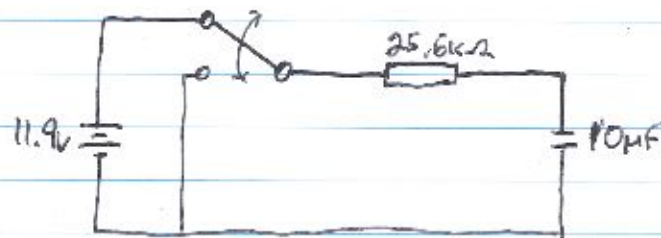
$$\frac{12}{25}$$

21%
AS REQD.

Q1.

$$a) R = \frac{R_1 \times R_2}{R_1 + R_2} = \frac{47 \times 56}{47 + 56} = 25.6k\Omega \quad \checkmark$$

$$New V_s = \frac{R_2}{R_1 + R_2} = \frac{56}{47 + 56} \times 22 = 11.9V \quad \times$$



$$b) i) \tau = RC = 25.6k \times 10\mu F = 0.256sec \quad \checkmark$$

2

$$ii) 5\tau = 5 \times 0.256 = 1.28sec \quad \checkmark$$

1

$$c) i) \text{charge } V_C = V_s(1 - e^{-t/RC}) \quad RC = \tau$$

$$3 = 11.9(1 - e^{-t/0.256})$$

$$\frac{3}{11.9} = 1 - e^{-t/0.256} \quad \text{method ok}$$

1

$$\ln \text{ of both sides } \ln \frac{3}{11.9} = 1 - e^{-t/0.256}$$

$$-1.381 + 1 = 0.38sec$$

$$ii) \text{discharge } V_C = V_s(e^{-t/RC})$$

$$3 = 11.9(e^{-t/0.256})$$

$$\frac{3}{11.9} = e^{-t/0.256} \quad \text{method ok}$$

1

$$\ln \text{ of both sides } \ln \frac{3}{11.9} = -1.38sec$$

6

6

2

$$d) i) \tau = \frac{L}{R} = \frac{2000 \text{ mH}}{1000 \Omega} = 2 \text{ msec} \quad \checkmark$$

$$ii) \text{ Wt } I = \frac{V}{R} = 24000 \text{ A} \quad \times$$

$$iii) i = I(e^{-Rt/L}) \quad \checkmark$$

$$20 \text{ mA} = 24 \text{ kA} (e^{-Rt/2000 \text{ H}})$$

$$\frac{20 \text{ mA}}{24 \text{ kA}} = e^{-Rt/2000 \text{ H}}$$

$$\ln \text{ of both sides } \ln \frac{20 \text{ mA}}{24 \text{ kA}} = e^{-Rt/2000 \text{ H}}$$

2

$$5 \text{ mA} = 24 \text{ kA} (e^{-Rt/2000 \text{ H}}) \quad \checkmark \quad = 13.99 \text{ sec} \quad \times$$

$$\frac{5 \text{ mA}}{24 \text{ kA}} = e^{-Rt/2000 \text{ H}}$$

$$\ln \text{ of both sides } \ln \frac{5 \text{ mA}}{24 \text{ kA}} = 15.38 \text{ sec} \quad \times$$

2

Q2.

$$a) Z_T = \left[\frac{(3-j4)(6+j7)}{(3-j4)+(6+j7)} \right] + 2.5 - j6.5$$

$$Z_1 Z_2 = (3-j4)(6+j7) = 18 - j24 + j21 - j^2 28 \quad \checkmark$$

$$= -10 + j3 \quad \times$$

$$Z_1 + Z_2 = (3-j4) + (6+j7) = 9 + j10 + j2 + j3 \quad \times$$

$$= 9 + j15 \quad \times$$

$$\frac{Z_1 Z_2}{Z_1 + Z_2} = \frac{-10 + j3}{9 + j15} = -1.1 + j0.2 \quad \times$$

$$-1.1 + j0.2 + 2.5 =$$

8

8

$$Z_T = -1.1 + j0.2 + 2.5 - j6.5$$
$$Z_T = 1.4 - j6.3$$

b) $V = 200V$ $f = 60Hz$ $L = 0.4H$ $R = 40\Omega$

i)

ii) $I = 200 \div 40 = 5A$ X

iii) $V = 5 \times 40 = 200V$
 $P_d = 200V$ X

d)



Q3.

a) $|Z| = \sqrt{3^2 + 4^2} = 5\Omega$ $I = \frac{60}{5} = 12A$ $\phi?$ 2

$\phi = 30^\circ$

i) $P = VI \cos \phi = 60 \times 12 \times \cos 30^\circ = 623.5$

$Q = VI \sin \phi = 60 \times 12 \times \sin 30^\circ = 360$

$S = P / \cos \phi = 623.5 \div \cos 30^\circ = 719.95$ X

$S = \text{Active}$ $P = \text{apparent}$ $Q = \text{reactive}$

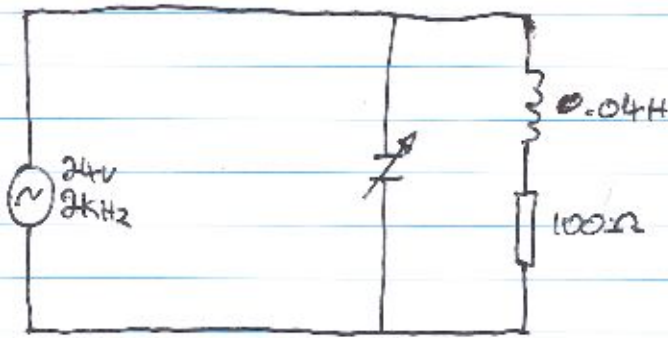
iii)

b)

2

Q4. $L = 0.04 \text{ H}$ $R = 100 \Omega$ $V = 24 \text{ V}$ $f = 2 \text{ kHz}$

a)



Capacitance $= 0.04 \times 100 = 4 \text{ F}$ ~~1000~~ $\times$

b) $R_D = \frac{L}{CR} \checkmark$, $\frac{0.04}{4 \times 100} = 100 \mu\Omega$

c) $24 \times 100 \mu\Omega = 2.4 \text{ mA}$ $\times$

d) $Q = 2\pi f_c L / R \checkmark$ $f_1 = 2000 \times 0.04 = 80 \text{ Hz}$?
 $f_2 = 2000 \times 100 = 200 \text{ kHz}$
 $f_c = \sqrt{f_2 \times f_1} = 4000 \text{ Hz}$

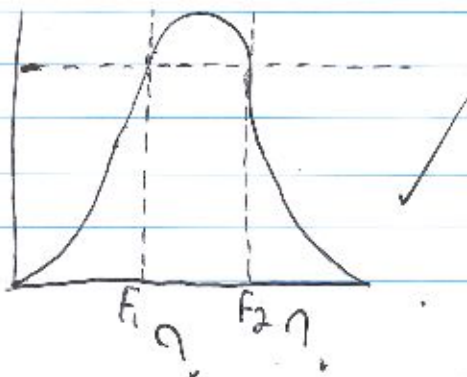
$Q = \frac{2\pi \times 4000 \text{ Hz} \times 0.04}{100} \checkmark = 10.05 \times$

e) $BW = f_2 - f_1 = 199920 \text{ Hz}$ $\times$

f)

g) impedance at $-3 \text{ dB} = 0.707 \times 2r = 0.707 \times 100 \times 10^{-6} = 70.7 \mu\text{H}$ $\times$

h)



5