



Complete, fold and seal
(see note 2 below)

SURNAME: Williams

FORENAME(S): Kieran

Examination Answer Books

12 Pages

Instructions to Candidates

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2. Enter your name in the space provided to the right, fold over and seal down (using the label provided) to hide your name.
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1	Student Number	1809801
2	Title of Examination Paper	ELEC + ELEC PRINCIPLES
3	Module Code	SGEE 4000
4	Date and Time of Examination	13/5/19 13:30
5	Examination Venue	G24
6	Seat Number	
7	Number of Answer Books handed in	

List the numbers of the questions you have attempted	Office Use
1	25
2	25
5	24 1/2
Total	74 1/2

(Gweler yr ochr arall am y fersiwn Cymraeg)



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

Llyfr Atebion Arholiadau

12 Tüdalen

Cyfarwyddiadau i Ymgeiswyr

1. Rhwch yr holl wybodaeth y gofynnir amdani yn y blychau isod.
2. Rhwch eich enw yn y lle a ddarparwyd ar y dde, pwygch et al i seil i lawr (gan dddefnyddio'r label a ddarparwyd) i guddio'ch enw.

guddio'ch enw.

6. Rhaid i'r atebion fod mewn llawysgriften ddarllenadwy. Gall yr Arholwyr naill ai anwybyddu sgrïpt annarllenadwy, neu drefnu iddi gael ei theipio a chael yr ymgeisydd i dalu.
4. Ysgrifennwch eich atebion mewn inc.
5. Dechreuwch bob ateb ar dudalen newydd. Gwnewch unrhyw fras nodiadau yn y llyfr atebion a thynnu llinell drwyddynt.
6. Ni ddylid rhwgo unrhyw ran o'r llyfr hwn; rhaid ei gyflwyno yn gyfan.
7. Os defnyddir mwy nag un llyfr, rhwymwch hwy gyda'i gilydd gan ddefnyddio'r tagiau sydd ar gael oddi wrth y gwylltw/gwylwyr.
8. Rhaid dychwelyd pob llyfr. Ni chaniateir mynd â llyfrau atebion, wedi eu defnyddio neu heb eu defnyddio, allan o'r lleoliad arholi o dan unrhyw amgylchiadau.

(See the other side for English version)

7	Nifer y Llyfrau Atebion a gyllwynwyd	
6	Rhif Sedd	
5	Lleoliad yr Arholiad	
4	Dyddiad ac Amser yr Archoliad	
3	Cod y Modwl	
2	Teitl y Papur Arholiad	
1	Rhif Myfyrwr	

[illegible]

Llenwch, plygwch a seliwch
(gweler nodyn 2 isod)

CYFEMM:

ENW(AU) CYNTAF:

1A

(a) time constant = $\frac{L}{R} = \frac{3125 \text{ mH}}{16} = 31.25 \text{ ms}$ ✓

b) steady state current = $\frac{V}{R} = \frac{12}{16} = 750 \text{ mA}$ ✓

c)

(i) 200 mA:

$$I = I_{\max} (e^{-\frac{R}{L} t})$$

$$200 = 750 (e^{-\frac{16}{3125} t})$$

$$\frac{200}{750} = e^{-32t}$$

$$\ln\left(\frac{200}{750}\right) = -32t$$

$$-1.322 = -32t$$

$$t = \frac{-1.322}{-32} = 41.3 \text{ ms}$$

(ii) 400 mA:

$$I = I_{\max} (e^{-\frac{R}{L} t})$$

$$400 = 750 (e^{-\frac{16}{3125} t})$$

$$\frac{400}{750} = e^{-32t}$$

$$\ln\left(\frac{400}{750}\right) = -32t$$

$$-0.629 = -32t$$

$$t = \frac{-0.629}{-32} = 19.66 \text{ ms}$$

1B

(a) time constant = $R \times C$
 $= 120 \times 10^3 \times 0.47 \times 10^{-6}$
 $= 56.4 \text{ ms}$

capacitor is fully charged at $5 \times T$

$$= 5 \times 56.4$$

$$= 282 \text{ ms}$$

(b)

(i)

$$V = V_{\max}(1 - e^{-\frac{t}{\tau}})$$

$$6 = 12(1 - e^{-\frac{t}{\tau}})$$

$$\frac{6}{12} = 1 - e^{-\frac{t}{\tau}}$$

$$0.5 - 1 = e^{-\frac{t}{\tau}}$$

$$\ln(0.5 - 1) = \frac{-t}{56.4}$$

$$-0.693 = \frac{-t}{56.4}$$

$$t = 39.1 \text{ ms}$$

(ii)

$$V = V_{\max}(e^{-\frac{t}{\tau}})$$

$$6 = 12(e^{-\frac{t}{\tau}})$$

$$\frac{6}{12} = e^{-\frac{t}{\tau}}$$

$$\ln(0.5) = \frac{-t}{56.4}$$

$$-0.693 = \frac{-t}{56.4}$$

$$t = 39.1 \text{ ms}$$

2A

$$Z_1 = 6 - j4 \quad Z_2 = 6 + j6 \quad Z_3 = 2.5 - j5.6$$

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

$$\begin{aligned} Z_1 Z_2 &= (6 - j4)(6 + j6) \\ &= 36 + j36 - j24 - j^2 24 \\ &= 36 + j12 + 24 \\ &= 60 + j12 \end{aligned}$$

$$\begin{aligned} Z_1 + Z_2 &= (6 - j4) + (6 + j6) \\ &= 12 + j2 \end{aligned}$$

$$\frac{Z_1 Z_2}{Z_1 + Z_2} = \frac{(60 + j12) \times (12 - j2)}{(12 + j2) \times (12 - j2)} = \frac{720 - j120 + j144 - j^2 24}{12^2 + 2^2} = \frac{744 + j24}{148}$$

$$= \frac{744 + j24}{148}$$

$$= 5.027 + j0.162$$

$$\left(\frac{Z_1 Z_2}{Z_1 + Z_2} \right) + Z_3 = (5.027 + j0.162) + (2.5 - j5.6) = 7.527 - j5.438$$

2B

(a)

(i)

$$\text{Impedance} = (R + jX_L)$$

$$X_L = 2\pi fL$$

$$= 2 \times \pi \times 60 \times 0.2$$

$$= 75.4 \, \Omega$$

$$\text{Impedance} = 20 + j75.4$$

$$= 78 \angle 75.14^\circ \, \Omega$$

(ii)

$$\text{current} = \frac{V}{X_L} = \frac{200 \angle 0}{78 \angle 75.14} = 2.56 \angle -75.14 \text{ A}$$

(iii)

the PD across 20 Ω resistor

$$= I \times R$$

$$= (2.56 \angle -75.14)(20 \angle 0)$$

$$= 51.2 \angle -75.14$$

$$= 13.13 - j49.5 \text{ V}$$

(iv)

the PD across the coil

$$= I \times R$$

$$= (2.56 \angle -75.14)(75.4 \angle 90)$$

$$= 193 \angle 14.86$$

$$= 186.55 + j49.5 \text{ V}$$

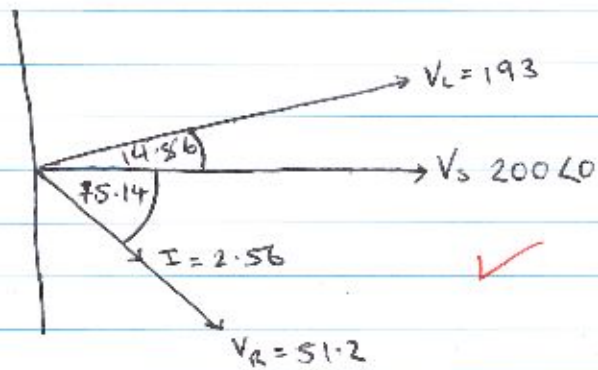
(b)

$$\text{Supply Voltage} = 200 \angle 0 \text{ or } 200 + j0$$

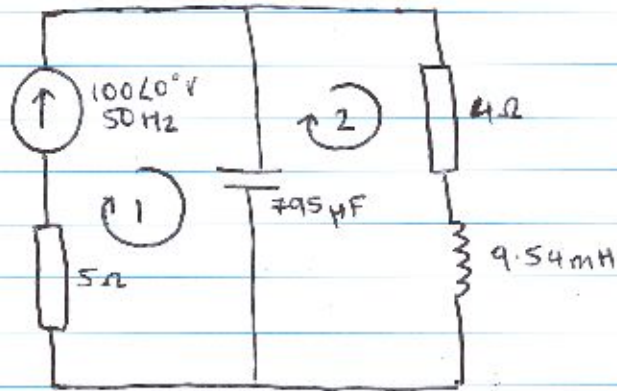
$$V_s = V_R + V_L$$

$$= (13.13 - j49.5) + (186.55 + j49.5) = 199.68 + j0 \text{ V}$$

c) Phasor diagram:



5)

(a) mesh currents I_1 and I_2

$$X_L = 2\pi fL = 2 \times \pi \times 50 \times 9.54 \times 10^{-3} = j3 \Omega$$

$$X_C = \frac{1}{2\pi fC} = \frac{1}{2\pi \times 50 \times 795 \times 10^{-6}} = -j4 \Omega$$

$$\text{Loop 1: } (5 - j4)I_1 - (-j4)I_2 = 100$$

$$\text{Loop 2: } (4 + j3 - j4)I_2 - (-j4)I_1 = 0$$

$$5 - j4 I_1 + j4 I_2 - 100 = 0$$

$$j4 I_1 + (4 - j) I_2 = 0$$

$$\frac{I_1}{\begin{vmatrix} j4 & -100 \\ (4-j) & 0 \end{vmatrix}} = \frac{-I_2}{\begin{vmatrix} (5-j4) & -100 \\ j4 & 0 \end{vmatrix}} = \frac{1}{\begin{vmatrix} (5-j4) & j4 \\ j4 & (4-j) \end{vmatrix}}$$

$$I_1 = (j4 \times 0) - (-100(4-j)) = 400 - j100$$

$$I_2 = (5-j4) \times 0 - (-100(j4)) = j400$$

$$1 = ((5-j4)(4-j)) - (j4 \times j4)$$

$$= 20 - j5 - j16 + j^2 4 - j^2 16$$

$$= 20 - j21 - 4 + 16$$

$$= 32 - j21$$

$$\frac{I_1}{400 - j100} = \frac{-I_2}{j400} = \frac{1}{32 - j21}$$

$$I_1 = \frac{400 - j100}{32 - j21} = \frac{412.31 \angle 14.04}{38.28 \angle -33.27} = 10.77 \angle 19.23^\circ \text{ A}$$

$$I_2 = \frac{-j400}{32 - j21} = \frac{400 \angle -90}{38.28 \angle -33.27} = 10.45 \angle -56.73^\circ \text{ A}$$

$$\begin{aligned} \text{(b) current flowing in capacitor} &= I_1 - I_2 \\ &= (10.77 \angle 19.23) - (10.45 \angle -56.73) \\ &= (10.17 + j3.54) - (5.73 - j8.73) \\ &= 4.44 + j12.27 \\ &= 13.04 \angle 70.11^\circ \end{aligned}$$

$$\text{current} = 13.04 \text{ A}$$

$$\begin{aligned} \text{(c) Power from } 100 \angle 0^\circ &= V \times I \times \cos \theta \\ &= 100 \times 10.77 \times \cos 19.23 \\ &= 1017 \text{ W} \end{aligned}$$

$$\begin{aligned} \text{Power from } 5 \Omega &= I^2 R \\ &= 10.77^2 (5) \\ &= 579.96 \text{ W} \end{aligned}$$

$$\begin{aligned}\text{Power from } 4\Omega &= I^2 R \\ &= 10.45^2 \times (4) \\ &= 436.81 \text{ W}\end{aligned}$$

$$\begin{aligned}\text{total power} &= 579.96 + 436.81 \\ &= 1016.77 \text{ W}\end{aligned}$$

4

4

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2	Title of Examination Paper	ELEC + ELEC PRINCIPLES HMC 1
3	Module Code	SGEE4000
4	Date and Time of Examination	13 May 2019 13:30
5	Examination Venue	Cowg Sir Gae G24
6	Seat Number	
7	Number of Answer Books handed in	

(Gweler yr ochr arall am y fersiwn Cymraeg)

Complete, fold and seal
(see note 2 below)

SURNAME: THOMAS

FORENAME(S): DAVID MATHEWS.

[illegible]

636

Llyfr Atebion Arholiadau

12 Tudalen

Cyfarwyddiadau i Ymgeiswyr

1. Rhwch yr holl wybodaeth y gofynnir amdani yn y blychau isod.
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Pwestynau a ymgeiswyr gennych	Cyfanswm
Af Ddibenion y Swyddfa	

1	Rhif Myfyriwr	
2	Tell y Papur Arholiad	
3	Cod y Modwl	
4	Dyddiad ac Amser yr Archoliad	
5	Lleoliad yr Arholiad	
6	Rhif Sedd	
7	Nifer y Llyfrau Atebion a gyflwynwyd	

(See the other side for English version)

Llenwch, plygwrch a seliwrch
(gweler nodyn 2 isod)

CYFENN:

ENW(AU) CYNTAF:

$$1A) \quad T = \frac{L}{R} = \frac{0.5}{16} = 0.03125 = 31.25 \text{ ms} \quad \checkmark$$

$$B) \quad I = \frac{V}{R} = \frac{12}{16} = 0.75 = 750 \text{ mA} \quad \checkmark$$

$$C) \quad I_L = I_{\max} \left(e^{-\frac{R}{L} t} \right)$$

$$= \frac{200}{750} \left(e^{-\frac{16}{0.5} t} \right) \quad \checkmark$$

$$= 0.26 \left(e^{-32 t} \right) \quad \checkmark$$

$$= \ln 0.26 \left(-32 t \right) \quad \checkmark$$

$$t = \frac{\ln 0.26}{-32} \quad t = \frac{\ln 0.26}{-32} \quad t = 0.042 = 42.1 \text{ ms} \quad \checkmark$$

$$I_L = I_{\max} \left(e^{-\frac{R}{L} t} \right)$$

$$= \frac{400}{750} \left(e^{-\frac{16}{0.5} t} \right)$$

$$0.53 \left(e^{-32 t} \right)$$

$$= \ln 0.53 = t = \frac{\ln 0.53}{-32} = 0.0198 = 19.8 \text{ ms} \quad \checkmark$$

$$1B) \tau = R \times C = (120 \times 10^3) \times (0.47 \times 10^{-6}) = 0.0564 = 56.4 \text{ ms} \checkmark$$

1 1/2

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

$$= \frac{6}{12} (1 - e^{-\frac{t}{\tau}}) \checkmark$$

$$= 0.5 (1) = 0.5 \text{ V} \checkmark$$

$$B) ii) V_c = V_s e^{-\frac{t}{\tau}} \checkmark$$

$$V_c = 6 (e^{-\frac{t}{\tau}}) \checkmark$$

$$0.5 = 6 e^{-\frac{t}{\tau}} \checkmark \Rightarrow 0.0833 = e^{-\frac{t}{\tau}} \checkmark \Rightarrow 0.0833 = e^{-\frac{t}{\tau}} \checkmark$$

3 1/2

$$2A) Z_T = \left(\frac{Z_1 \times Z_2}{Z_1 + Z_2} \right) + Z_3$$

$$Z_1 = 6 - j4$$

$$Z_2 = 6 + j6$$

$$Z_3 = 2.5 - j5.6$$

$$Z_1 \times Z_2 = (6 - j4) \times (6 + j6) = 36 + j36 - j24 - j^2 24 = 60 + j12 \checkmark$$

$$Z_1 + Z_2 = (6 - j4) + (6 + j6) = 12 + j2 \checkmark$$

$$= \left(\frac{60 + j12}{12 + j2} \right) \times \left(\frac{12 - j2}{12 - j2} \right) = \frac{720 - j120 + j144 - j^2 24}{144 - j24 + j24 - j^2 4} \checkmark$$

$$= \frac{744 + j24}{148} = 5.027 + j0.162 \checkmark$$

$$Z_T = (5.027 + j0.162) + (2.5 - j5.6) = 7.527 - j5.438 \checkmark$$

10

8

10

$$28) a) Z = R + jX_L \quad X_L = 2\pi FL = 2 \times \pi \times 60 \times 0.2 = 75.4 \Omega$$

$$Z = \sqrt{R^2 + X_L^2} = 78$$

$$\sqrt{20^2 + 75.4^2} = 78 \Omega$$

$$\tan^{-1}\left(\frac{75.4}{20}\right) = 75.14^\circ$$

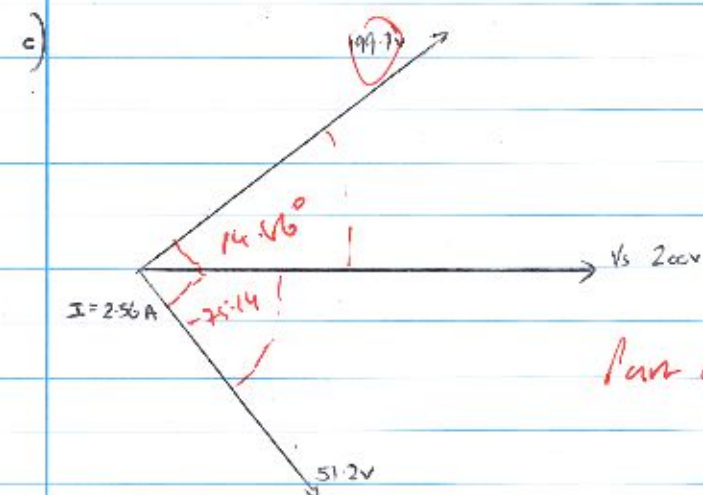
$$b) I = \frac{V}{Z} = \frac{200 \angle 0^\circ}{78 \angle 75.14^\circ} = 2.56 \angle -75.14^\circ \text{ A}$$

~~$$a) V_R = I \times R = 2.56 \times 20 = 51.2 \text{ V}$$~~
~~$$b) V_L = I \times X_L = 2.56 \times 75.4 = 193.02 \text{ V}$$~~

$$V_R = I \times R = 2.56 \angle -75.14^\circ \times 20 \angle 90^\circ = 51.2 \angle 14.86^\circ \text{ V}$$

$$V_L = I \times X_L = 2.56 \angle -75.14^\circ \times 75.4 \angle 90^\circ = 193.02 \angle 14.86^\circ \text{ V}$$

$$b) \begin{aligned} 51.2 \cos 14.86^\circ &= 49.9 \\ 51.2 \sin 14.86^\circ &= 13.13 \\ 193.02 \cos 0^\circ &= 193.02 \\ 193.02 \sin 0^\circ &= 0 \end{aligned}$$



Part correct.

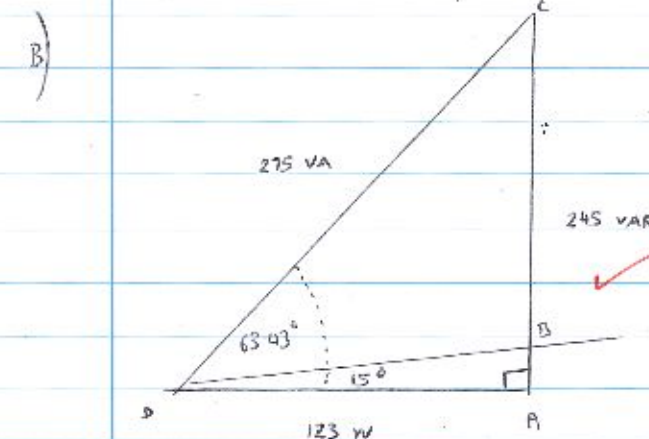
$$3) Z = 4 + j8$$

$$\sqrt{4^2 + 8^2} = 9$$

$$\tan^{-1}\left(\frac{8}{4}\right) = 63.43^\circ$$

$$a) i) I = \frac{V}{Z} = \frac{50 \angle 20^\circ}{9 \angle 63.43^\circ} = 5.5 \angle -43.43^\circ \text{ A}$$

$$ii) \begin{aligned} S &= V \times I = 50 \times 5.5 = 275 \text{ VA} \\ P &= VI \cos \phi = 275 \cos 63.43^\circ = 123 \text{ W} \\ Q &= VI \sin \phi = 275 \sin 63.43^\circ = 245 \text{ VAR} \end{aligned}$$



$$\cos^{-1}(0.986) = 14.98^\circ = 15^\circ$$

$$P = P_{\text{gen}} - P_{\text{loss}} = 123 \text{ W} - 15 \text{ W} = 108 \text{ W}$$

$$Q_C = 245 - 33 = 212 \text{ VAR}$$

$$I_C = \frac{Q_C}{V} = \frac{212}{50} = 4.24 \text{ A}$$

$$X_C = \frac{V}{I} = \frac{50}{4.24} = 11.79 \Omega$$

$$X_C = \frac{1}{2\pi fC} = \frac{1}{2\pi \times 60 \times 11.79} = 226.7 \text{ nF}$$

$$(4) A: I_{ph} = \frac{V_{ph}}{Z_{ph}} = \frac{200}{70} = 2.85 A \quad \times$$

$$Z = \sqrt{R^2 + L^2} = \sqrt{70^2 + 200 \times 10^{-3}^2}$$

$$B: I_{line} = \sqrt{3} \times 2.85 = 4.93 A \quad \times$$

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3	Module Code	SGEE4000
4	Date and Time of Examination	13/05/19
5	Examination Venue	
6	Seat Number	
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(Gweler yr ochr arall am y fersiwn Cymraeg)

Complete, fold and seal
(see note 2 below)

SURNAME: Morgan

FORENAME(S): Mason Richard

List the numbers of the questions you have attempted	Office Use
Q1	15 1/2
Q2	25
Q4	18 1/2
Total	59 1/2

59%



Llyfr Atebion Arholiadau

12 Tudalen

Cyfarwyddiadau i Ymgeiswyr

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8. Rhaid dychwelyd pob llyfr. Ni chaniateir mynd â llyfrau atebion, wedi eu defnyddio neu heb eu defnyddio, allan o'r lleoliad arholi o dan unrhyw amgylchiad.

Rhestrwch ffau'r cwestiynau a ymgyswyd ganlyn	
Af Ddihenion y Swyddfa	

7	Nifer y Llyfrau Atebion a gyflwynwyd	
6	Rhif Sedd	
5	Lleoliad yr Arholiad	
4	Dyddiad ac Amser yr Arholiad	
3	Cod y Modwl	
2	Teitl y Papur Arholiad	
1	Rhif Myfyrwr	

(See the other side for English version)

Llenwch, plygwrch a seliwrch
(gweler nodyn 2 isod)

CYFEMV:

ENW(AU) CYNTAF:

Q1a. $\frac{L}{R} = \frac{0.5}{16} = 0.03125 \text{ s or } 31.25 \text{ ms}$ ✓ ✓

2

b. $I = \frac{V}{R} = \frac{12}{16} = 0.75 \text{ A or } 750 \text{ mA}$ ✓ ✓

2

c. $I = I_{\max} e^{-\frac{R}{L}t}$
 $200 = 750 e^{-\frac{R}{L}t}$ ✓
 $\frac{200}{750} = e^{-\frac{R}{L}t}$ ✓
 $\ln(0.26) = -\frac{16}{0.5} t$ ✓
 $-1.347 = -32 t$ ✓
 $\frac{-1.347}{-32} = t$ ✓

4

$t = 0.04209375 \text{ s or } 42.09 \text{ ms}$ ✓ ✓

Q18.

a. $C \cdot R$ seconds

$0.47 \times 120 = 56.4 = T$

$56.4 \times 5 = 282 \text{ seconds}$ ✓ ✓

3

b. $V_c = V_s(1 - e^{-\frac{t}{T}})$

$6 = 12(1 - e^{-\frac{t}{T}})$

$0.5 = (1 - e^{-\frac{t}{T}})$

$-0.5 = -e^{-\frac{t}{T}}$ ✓

$\ln(-0.5) = -\frac{t}{T}$ ✓

$0.6931471806 = \frac{t}{T}$ ✓

$0.6931471806 \times 56.4 = t$

$t = 39.09$ ✓ ✓

4 1/2

$$Q2A. Z_T = \left(\frac{(6-j4)(6+j6)}{(6-j4) + (6+j6)} \right) + 2.5 - j5.6$$

$$\begin{aligned} i) (6-j4)(6+j6) \\ = 36 + j36 - j24 - j^2 24 \\ = 60 + j12 \end{aligned}$$

$$\begin{aligned} ii) (6-j4) + (6+j6) \\ = 12 + j2 \end{aligned}$$

$$\begin{aligned} iii) \frac{(60+j12)(12-j2)}{(12+j2)(12-j2)} \\ = \frac{720 - j120 + j144 - j^2 24}{144 - j24 + j24 - j^2 4} = \frac{744 + j24}{148} \\ = \frac{744}{148} + j\frac{24}{148} \\ = 5.027 + j0.162 \end{aligned}$$

$$\begin{aligned} iv) (5.027 + j0.162) + (2.5 - j5.6) \\ = 7.527 - j5.438 \end{aligned}$$

$$\text{Answer to 2.d.p} = 7.53 - j5.44$$

Q2B

$$a. Z = (R + jX_L)$$

$$X_L = 2\pi fL = 75.39822369$$

$$Z = 20 + j75.39822369 \text{ (Cartesian form)}$$

converting to polar form

$$\begin{aligned} \sqrt{20^2 + 75.39^2} \quad \tan^{-1}\left(\frac{75.39}{20}\right) \\ = 78.00571861 = 75.14394872 \end{aligned}$$

Answer for impedance (Z) in polar form is:

$$78.00571861 \angle 75.14394872$$

$$\text{or } 78 \angle 75.14 \text{ (2.d.p)}$$

$$ii. I = \frac{V}{Z} = \frac{200 \angle 0^\circ}{78 \angle 75.14} = 2.56 \angle -75.14 \text{ A}$$

$$\begin{aligned} iii) V_R = IR = (2.56 \angle -75.14)(20 \angle 0^\circ) \\ = 51.2 \angle -75.14 \end{aligned}$$

$$\begin{aligned} iv. V_L = I X_L = (2.56 \angle -75.14^\circ)(75.40 \angle 90^\circ) \\ = 193.02 \angle 14.86 \end{aligned}$$

$$\begin{aligned} b. V_s = V_R + V_L \\ = (51.2 \angle -75.14^\circ) + (193.02 \angle 14.86^\circ) \end{aligned}$$

convert $V_R + V_L$ back to cartesian form:

$$\begin{aligned} 51.2 \cos(-75.14) = 13.13 & \quad 193.02 \cos(14.86) = 186.56 \\ 51.2 \sin(-75.14) = -49.49 & \quad 193.02 \sin(14.86) = 49.50 \end{aligned}$$

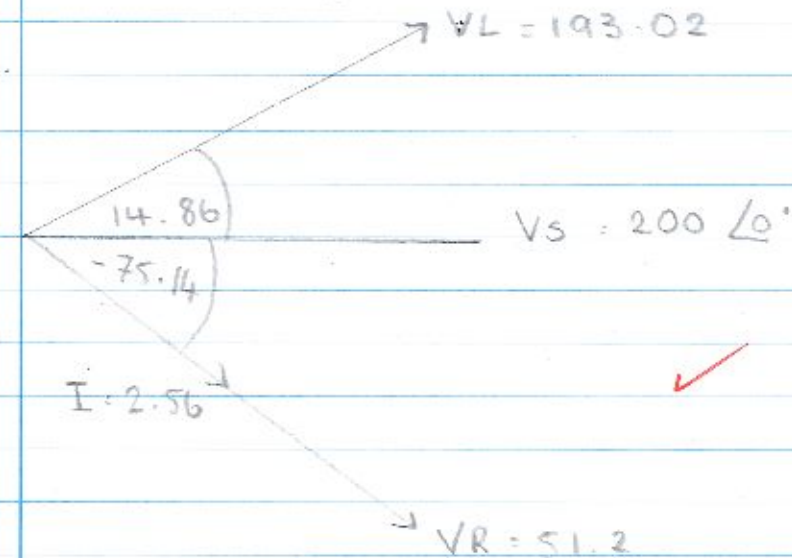
$$(13.13 - j49.49) + (186.56 + j49.50)$$

$$V_s = 199.69 + j0.01 \text{ (calculated)}$$

$$V_s = 200 \angle 0^\circ$$

$$V_s = 200 + j0 \text{ (actual)}$$

C.



V_L leads the V_s by 14.86°
 V_R and I lag V_s by 75.14°

Q4A

$$V_L = V_{ph} = 200V$$

$$a) I_{ph} = \frac{V_{ph}}{Z_{ph}} = \frac{200}{?}$$

$$Z_{ph} = \sqrt{R^2 + X_L^2}$$

$$X_L = 2\pi fL = 2\pi(50)(200) = 62831 \times 10^{-3} = 62.83 \checkmark$$

$$Z_{ph} = \sqrt{70^2 + 62.83^2} \quad \tan^{-1}\left(\frac{62.83}{70}\right) = 41.91$$

$$= 94.06$$

$$Z_{ph} = 94.06 \angle 41.91$$

$$I_{ph} = \frac{200 \angle 0}{94.06 \angle 41.91}$$

$$= 2.13 \angle -41.91^\circ A \checkmark$$

$$b. \sqrt{3} \times 2.13$$

$$= 3.7 A \checkmark$$

$$c. \sqrt{3} \times 200 \times 3.7 \times \cos \phi$$

$$\phi = \tan^{-1}\left(\frac{X_L}{R}\right)$$

$$= \tan^{-1}\left(\frac{62.83}{70}\right)$$

$$= 41.91^\circ$$

$$\sqrt{3} \times 200 \times 3.7 \times \cos(41.91)$$

$$\text{True power (P)} = 953.85 W \checkmark$$

$$\sqrt{3} \times 200 \times 3.7 \times \sin(41.91)$$

$$\text{Reactive power (Q)} = 856.14 VAR \checkmark$$

$$\sqrt{P^2 + Q^2}$$

$$\sqrt{953.85^2 + 856.14^2}$$

$$= 1281.72 KVA \checkmark \checkmark$$

1) True power / P / W

2) reactive power / Q / VAR

3) Apparent power / S / KVA

Q4B

Q4B

$$a) Z = \sqrt{R^2 + (X_L - X_C)^2} \quad \tan^{-1}\left(\frac{X_L - X_C}{R}\right)$$

$$X_L = 2\pi fL = 31415.92654 \times 10^{-3} = 31.42 \checkmark$$

$$X_C = \frac{1}{2\pi fC} = 0.01000974485 \times 10^3 = 10 \checkmark$$

$$Z = \sqrt{20^2 + (31.42 - 10)^2} \quad \tan^{-1}\left(\frac{31.42 - 10}{20}\right)$$

$$= 29.31 \checkmark \quad = 46.96 \checkmark$$

$$Z = 29.31 \angle 46.96 \checkmark \checkmark$$

$$ii. I = \frac{V}{Z} = \frac{10 \angle 0}{29.31 \angle 46.96} = 0.34 \angle -46.96 A \checkmark$$

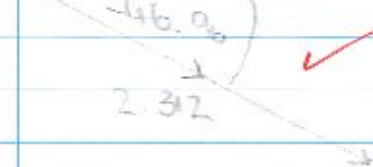
$$iii. P = I^2 R$$

$$= (0.34 \angle -46.96)^2 (20 \angle 0)$$

$$= 2.312 W \checkmark$$

iv.

$$V_L = 10 V, 50 Hz$$



$$b. f_r = \frac{1}{2\pi\sqrt{LC}} = 0.028 \text{ or } 28.22 MHz \checkmark$$

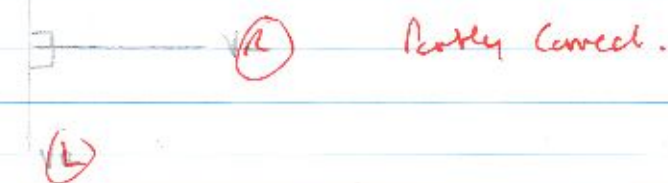
expression starts with:

$$X_L = X_C$$

$$2\pi fL = \frac{1}{2\pi fC}$$

Please transcribe!

v.



$$iii. \frac{1}{4\pi^2 f^2 (L)} = \frac{1}{4\pi^2 (50)^2 (0.1)} = 1.013211836 \times 10^{-4} \checkmark \text{ or } 0.1013211836 \checkmark$$

$$101 \times 10^{-6}$$

$$101 \mu F \checkmark$$

Q4B



Complete, fold and seal
(see note 2 below)

SURNAME: GEALY

FORENAME(S): ALUN DION

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.**

1	Student Number	1809813
2	Title of Examination Paper	Elec + Elec Principles.
3	Module Code	SGEE 4000
4	Date and Time of Examination	13/05/19 13:30
5	Examination Venue	G24.
6	Seat Number	
7	Number of Answer Books handed in	

List the numbers of the questions you have attempted	Office Use
1	15
2	23 1/2
5.	3
Total	41 1/2 9

(Gweler yr ochr arall am y fersiwn Cymraeg)

(See the other side for English version)

7	Nifer y Llyfrau Atebion a gyllwynwyd	
6	Rhif Sedd	
5	Lleoliad yr Arholiad	
4	Dyddiad ac Amser yr Archoliad	
3	Cod y Modwl	
2	Teitl y Papur Arholiad	
1	Rhif Myfyrwr	

[illegible]

guddio'ch enw.

3. Rhaid i'r atebion fod mewn llawysgrifen ddarlennadwy. Gall yr Arholwyr naill ai anwybyddu sgrïpt annarlenadwy, neu drefnu iddi gael ei theipio a chael yr ymgeisydd i dalu.
4. Ysgrifennwch eich atebion mewn inc.
5. Dechreuwch bob ateb ar dudalen newydd. Gwnewch unrhyw ffras nodiadau yn y lliffr atebion a thynnwch llinell drwyddynt.
6. Ni ddylid rhwgo unrhyw ran o'r lliffr. hwn; rhaid ei gyflwyno yn gyfan.
7. Os defnyddir mwy nag un lliffr, rhwymwch hwy gyda'i gilydd gan ddefnyddio'r tagiau sydd ar gael oddi wrth y gwyllwrr/gwyllwyr.
8. Rhaid dychwelyd pob lliffr. Ni chaniateir mynd â lliffrau atebion, wedi eu defnyddio neu heb eu defnyddio, allan o'r lleoliad arholi o dan unrhyw amgylchiadau.

1. Rhwch yr holl wybodaeth y gofynnir amdani yn y blychau isod.
2. Rhwch eich enw yn lle a ddarparwyd ar y dde, plygwch et at y seilio i lawr (gan ddefnyddio'r label a ddarparwyd)!

Cyfarwyddiadau i Ymgeiswyr

12 Tudalen

Llyfr Atebion Arholiadau



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

Llenwch, plygwh a seliwh
(gweler nodyn 2 isod)

CYFENN:

ENW(AU) CYNTAF:

$$2A. \quad Z_1 = 6 - j4 \quad Z_2 = 6 + j6$$

$$Z_3 = 2.5 - j5.6$$

$$Z_t = \frac{Z_1 Z_2}{Z_1 + Z_2} + Z_3$$

$$Z_1 Z_2 = (6 - j4)(6 + j6) \quad \checkmark$$

$$= 36 + j36 - j24 - j^2 24 \quad \checkmark$$

$$= 60 + j12 \quad \checkmark$$

$$Z_1 + Z_2 = (6 - j4) + (6 + j6)$$

$$= 12 + j2 \quad \checkmark$$

$$\frac{Z_1 Z_2}{Z_1 + Z_2} = \frac{60 + j12}{12 + j2} \times \frac{12 - j2}{12 - j2} \quad \checkmark$$

multiply by conjugate

$$= \frac{720 - j120 + j144 + j^2 24}{12^2 + 2^2}$$

$$= \frac{744 + j24}{148}$$

$$= 5.02 + j0.16 \quad \checkmark$$

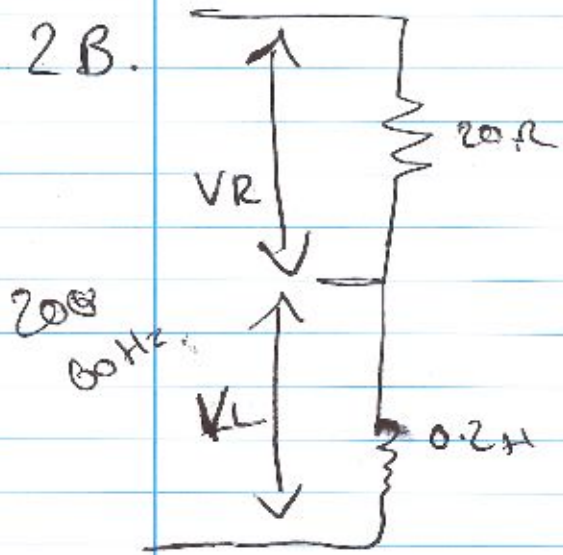
$$= 5.02 + j0.16 + Z_3 \quad \checkmark$$

$$= (5.02 + j0.16) + (2.5 - j5.6) \quad \checkmark$$

$$= 7.52 + j5.76 \quad \times$$

8 1/2.

2B.



a) i) Impedance = $R + jX_L$.

$$X_L = 2\pi fL$$

$$= 75.40 \Omega$$

$$Z = 20 + j75.40 = 78 \angle 75.14^\circ$$

$$\text{ii) } I = \frac{V}{Z} = \frac{200 \angle 0^\circ}{78 \angle 75.14^\circ} = 2.56 \angle -75.14^\circ \text{ A}$$

iii) Pd across 20 ohm Resistor

$$V_R = IR = (2.56 \angle -75.14^\circ)(20 \angle 0^\circ) = 51.2 \angle -75.14^\circ \text{ V}$$

iv) Pd across Coil.

$$V_L = IX_L = (2.56 \angle -75.14^\circ)(75.40 \angle 90^\circ) = 193 \angle 14.86^\circ \text{ V}$$

$$\text{b) } V_S = V_R + V_L$$

$$V_R = 51.2 \angle -75.14^\circ = 13.13 - j49.48$$

$$51.2 \cos(-75.14) = 13.13$$

$$51.2 \sin(-75.14) = -49.48$$

$$V_L = 193 \angle 14.86^\circ = 186.54 + j49.48$$

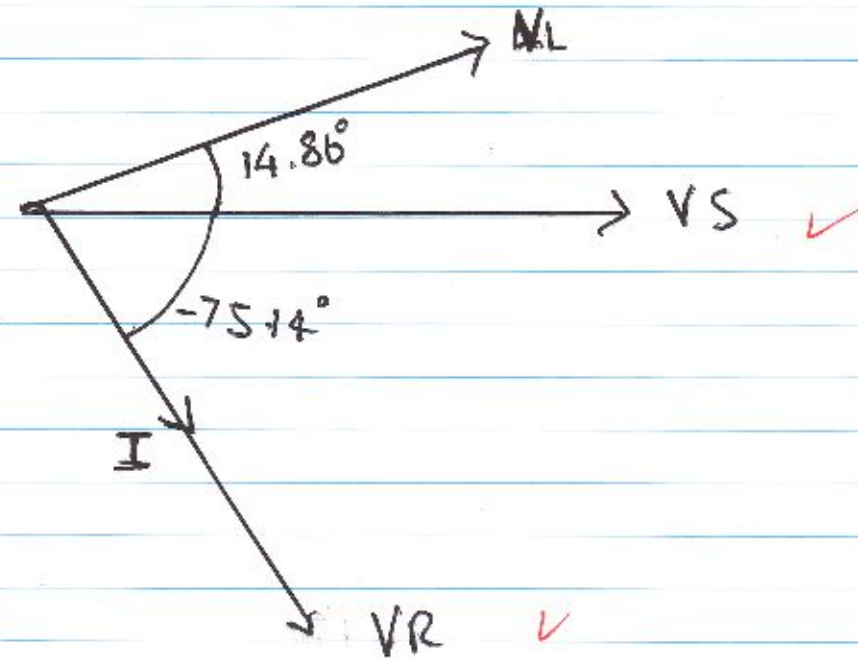
$$193 \cos(14.86) = 186.54$$

$$193 \sin(14.86) = 49.48$$

$$13.13 - j49.48 + 186.54 + j49.48$$

$$= 199.67 \approx 200 \text{ V} = V_S$$

c)



5. a) $X_L = 2\pi FL$
 $= j3$ ✓

$$X_C = \frac{1}{2\pi FC} = -j4$$

loop 1: $(5 + j4)I_1 + (j4)I_2 = 100$ ✓

loop 2: $(j4)I_1 + (4 + j3)I_2 = 0$ ✓

Kirchoff's Law.

loop 1: $(5 + j4)I_1 + (j4)I_2 - 100 = 0$ ✓

loop 2: $(j4)I_1 + (4 + j3)I_2 - 0 = 0$ ✓

$$\begin{bmatrix} I_1 \\ I_2 \end{bmatrix} \begin{bmatrix} j4 & -100 \\ 4 & 0 \end{bmatrix} = \begin{bmatrix} j4 \times 0 \\ (4 - j) \times 100 \end{bmatrix}$$

$$= 0 - 400 + j400$$

$$= 400 + j400$$

$$\begin{bmatrix} I_2 \\ I_1 \end{bmatrix} \begin{bmatrix} 5 + j4 & -100 \\ j4 & 0 \end{bmatrix} = \begin{bmatrix} (5 + j4) \times 0 \\ (100 \times j4) \end{bmatrix}$$

$$= 0 - j400$$

$$\frac{1}{\frac{5+j4}{j4} \cdot \frac{j4}{4-j}} = \frac{(5+j4) \times (4-j)}{j4 \times j4}$$

$$= \frac{(20 + j5 + j16 - j^2 16)}{j^2 16}$$

$$I_1 = \frac{400 + j100}{38 + j21} = \frac{412.3 \angle 14.03^\circ}{43.41 \angle 30.23^\circ} = 9.49 \angle -16.2^\circ$$

$$I_2 = \frac{400 + j400}{43.41 \angle 30.23^\circ} = \frac{400 \angle 45^\circ}{43.41 \angle 30.23^\circ} = 9.21 \angle 14.77^\circ$$

$$= \frac{24 + j21}{j^2 16}$$

$$= 40 + j21$$

P.T.O.

$$\begin{aligned}
 & \frac{1}{(5+j4)(4-j) - (j4)(j4)} \\
 & = \frac{1}{8 + j20 - j^2 16} \\
 & = \frac{1}{24 + j20} \\
 & = \frac{24 - j20}{24^2 + 20^2} \\
 & = \frac{24 - j20}{1160} \\
 & = 0.0207 - j0.0172 \text{ A}
 \end{aligned}$$

$$\begin{aligned}
 I_1 &= \frac{400 \angle 0^\circ}{32 - j21} = \frac{400 \angle 0^\circ}{38.27 \angle -33.27^\circ} \\
 &= 10.45 \angle 33.27^\circ \text{ A}
 \end{aligned}$$

$$\begin{aligned}
 I_2 &= \frac{0 - j400}{38.27 \angle -33.27^\circ} = \frac{400 \angle -90^\circ}{38.27 \angle -33.27^\circ} \\
 &= 10.45 \angle -56.73^\circ \text{ A}
 \end{aligned}$$

b. Current in Capacitor.

$$I_3 = I_1 - I_2$$

$$I_1 = 10.45 \angle 33.27^\circ$$

$$I_2 = 10.45 \angle -56.73^\circ$$

$$\begin{aligned}
 I_3 &= I_1 - I_2 = (10.45 \angle 33.27^\circ) - (10.45 \angle -56.73^\circ) \\
 &= 17.1 + j8.34 \text{ A} \\
 \text{or } &= 18.51 \angle 25.7^\circ \text{ A}
 \end{aligned}$$

$$\begin{aligned}
 c) P &= VI \cos \theta \\
 &= (100)(10.45) \cos (33.27^\circ) \\
 &= 866 \text{ W}
 \end{aligned}$$

$$ST = 0.282 \text{ seconds.}$$

$$\begin{aligned} & \begin{array}{cc} 5+j4 & -j4 \\ -j4 & 4-j \end{array} \\ & = (5+j4)(4-j) - (-j4)(-j4) \\ & = 20 + j5 + 16 - j^2 4 - (j^2 16) \\ & = 16 - j21 - (j^2 16) \\ & = 32 - j11. \end{aligned}$$

38.21



Complete, fold and seal
(see note 2 below)

SURNAME: Yeo

FORENAME(S): Rhys Andrew

Examination Answer Books

12 Pages

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1	Student Number	01809798
2	Title of Examination Paper	Electrical & Electronic Principles
3	Module Code	EGEE 4000
4	Date and Time of Examination	13/05/19 13:30
5	Examination Venue	Coley Sir Gar Greig Campus
6	Seat Number	1

7	Number of Answer Books handed in	1
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[illegible]

(Gweler yr ochr arall am y fersiwn Cymraeg)



Prysgol Cymru
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University of Wales
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Llyfr Atebion Arholiadau

12 Tudalen

Cyfarwyddiadau i Ymgeiswyr

1. Rhwch yr holl wybodaeth y gofynnir amdani yn y blychau isod.
2. Rhwch eich enw yn y lle a ddarparwyd ar y dde, pigwch et a'i selio i lawr (gan ddefnyddio'r label a ddarparwyd) i guddio'ch enw.

3. Rhaid i'r atebion fod mewn llawysgriften ddatllenadwy. Gall yr Arholwyr naill ai anwybyddu sgript annatllenadwy, neu drefnu iddi gael ei theipio a chael yr ymgeisydd i dalu.
4. Ysgrifennwch eich atebion mewn inc.
5. Dechreuwch bob ateb ar dudalen newydd. Gwnewch unrhyw fras nodiadau yn y lllyfr atebion a thynnwch llinell drwyddynt.
6. Ni ddylid rhwgo unrhyw ran o'r lllyfr hwn; rhaid ei gyflwyno yn gyfan.
7. Os defnyddir mwy nag un lllyfr, rhwyngwch hwy gyda'i gilydd gan ddefnyddio'r tagiau sydd ar gael oddi wrth y gwyllw/gwylwyr.
8. Rhaid dychwelyd pob lllyfr. Ni chaniateir mynd â lllyfrau atebion, wedi eu defnyddio neu heb eu defnyddio, allan o'r lleoliad arholi o dan unrhyw amgylchriad.

Rheswch effau'r cwestiynau a ymgaiswyd gennyh	
At Ddibenion y Swyddfa	
Cyfanswm	

1	Rhif Myfyrwr	
2	Teitl y Papur Arholiad	
3	Cod y Modwl	
4	Dyddiad ac Amser yr Arholiad	
5	Lleoliad yr Arholiad	
6	Rhif Sedd	
7	Nifer y Llyfrau Atbion a gyflwynwyd	

(See the other side for English version)

Llenwch, plygwh a seliwh
(gweler nodyn 2 isod)

CYFENN:

ENW(AU) CYNTAF:

$$a) T = \frac{L}{R} = \frac{0.5}{16} = 0.03125s = 31.25ms \quad \checkmark$$

$$b) \text{ i) } I = \frac{V}{R} = \frac{12}{16} = 0.75A = 750mA \quad \checkmark$$

$$c) \text{ i) } 200mA \quad I_c = I_{max} e^{-\frac{R}{L}t}$$

$$(200 \times 10^{-3}) = (750 \times 10^{-3}) \times e^{-\frac{16}{0.5}t}$$

$$e^{-32t} = (266.67 \times 10^{-3})$$

$$-32t = \ln(266.67 \times 10^{-3})$$

$$t = \frac{-1.322}{-32} = 0.0413s = 41.3ms \quad \checkmark$$

$$ii) 400mA \quad (400 \times 10^{-3}) = (750 \times 10^{-3}) \times e^{-\frac{16}{0.5}t}$$

$$e^{-32t} = (533.3 \times 10^{-3})$$

$$-32t = \ln(533.3 \times 10^{-3})$$

$$t = \frac{(-628.6 \times 10^{-3})}{-32} = 0.0196s = 19.6ms \quad \checkmark$$

$$a) T = R \times C$$

$$= 120,000 \times (0.47 \times 10^{-6})$$

$$= 56.4ms \quad \checkmark$$

$$\text{Full charge} = 5T$$

$$= 5 \times (56.4 \times 10^{-3})$$

$$= 282ms \quad \checkmark$$

b) i) Charging

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

$$6 = 12 (1 - e^{-\frac{t}{56.4 \times 10^{-3}}})$$

$$0.5 = 1 - e^{-\frac{t}{56.4 \times 10^{-3}}}$$

$$e^{-\frac{t}{56.4 \times 10^{-3}}} = 0.5 \quad \checkmark$$

$$-\frac{t}{56.4 \times 10^{-3}} = \ln 0.5 = -693.15 \times 10^{-3}$$

$$-t = (-693.15 \times 10^{-3}) \times (56.4 \times 10^{-3}) \quad \checkmark$$

$$-t = -39.1 \times 10^{-3} \quad (x-1)$$

$$t = 39.1ms \quad \checkmark$$

$$50\% \text{ Charge is also } 0.7T \quad \therefore 0.7 \times (56.4 \times 10^{-3}) = 39.5ms$$

ii) Discharging

$$V_c = V_s e^{-\frac{t}{T}}$$

$$6 = 12 e^{-\frac{t}{56.4 \times 10^{-3}}} \quad \checkmark$$

$$0.5 = e^{-\frac{t}{56.4 \times 10^{-3}}}$$

$$-\frac{t}{56.4 \times 10^{-3}} = \ln 0.5 = -693.15 \times 10^{-3} \quad \checkmark$$

$$-t = (-693.15 \times 10^{-3}) \times (56.4 \times 10^{-3}) = 39.1 \times 10^{-3} \quad (x-1)$$

$$t = 39.1ms \quad \checkmark$$

2A

$$Z_T = \frac{Z_1 Z_2}{Z_1 + Z_2} + Z_3$$

$$\begin{aligned} Z_1 &= 6 - j4 \\ Z_2 &= 6 + j6 \\ Z_3 &= 2.5 - j5.6 \end{aligned}$$

$$Z_1 = 6 - j4 \quad \text{Convert} \quad r = \sqrt{6^2 + 4^2} = 7.21 \quad \theta = \tan^{-1}\left(\frac{-4}{6}\right) = -33.69^\circ$$

$$Z_2 = 6 + j6 \quad \text{Convert} \quad r = \sqrt{6^2 + 6^2} = 8.49 \quad \theta = \tan^{-1}\left(\frac{6}{6}\right) = 45^\circ$$

$$Z_3 = 2.5 - j5.6 \quad \text{Convert} \quad r = \sqrt{2.5^2 + 5.6^2} = 6.13 \quad \theta = \tan^{-1}\left(\frac{-5.6}{2.5}\right) = -65.94^\circ$$

$$Z_1 Z_2 = 7.21 \angle -33.69^\circ \times 8.49 \angle 45^\circ$$

$$= (7.21 \times 8.49) \angle (-33.69 + 45)$$

$$= 61.21 \angle 11.31^\circ \quad \checkmark = 60 + j11$$

$$Z_1 + Z_2 = 7.21 \angle -33.69^\circ + 8.49 \angle 45^\circ$$

$$= (7.21 + 8.49) \angle (-33.69 + 45)$$

$$= 15.7 \angle 11.31^\circ \quad \times \quad \text{Use Cartesian method. Cannot add polar form.}$$

$$\frac{Z_1 Z_2}{Z_1 + Z_2} = \frac{61.21 \angle 11.31^\circ}{15.7 \angle 11.31^\circ} = \left(\frac{61.21}{15.7}\right) \angle (11.31 - 11.31) = 3.89 \angle 0^\circ$$

$$Z_T = 3.89 \angle 0^\circ + 6.13 \angle -65.9^\circ$$

$$= 10.02 \angle -65.94^\circ \quad \times$$

2B

$$a) i) Z = R + X_L$$

$$R = 20 \angle 0^\circ$$

$$X_L = 2\pi fL = 2 \times \pi \times 60 \times 0.2 = 75.4 \angle 90^\circ \quad \checkmark$$

$$\cancel{Z = 20 + 75.4 = 95.4}$$

$$Z = 20 \angle 0^\circ + 75.4 \angle 90^\circ = 95.4 \angle 90^\circ \quad \times$$

$$ii) I = \frac{V}{Z} = \frac{200 \angle 0^\circ}{95.4 \angle 90^\circ} = \left(\frac{200}{95.4}\right) \angle 0^\circ - 90^\circ = 2.096 \angle -90^\circ \quad \times \quad \text{Correct method.}$$

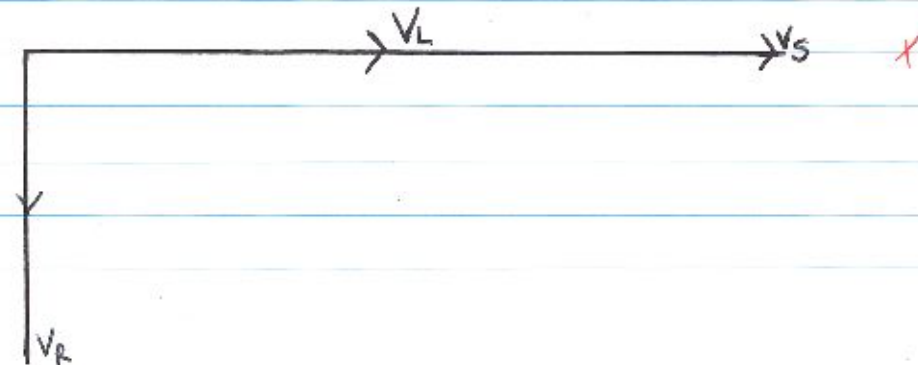
$$iii) V_R = I \cdot R = 2.096 \angle -90^\circ \times 20 \angle 0^\circ = (2.096 \times 20) \angle -90 + 0 = 41.92 \angle -90^\circ \quad \times \quad \text{method is correct}$$

$$iv) V_L = I \cdot X_L = 2.096 \angle -90^\circ \times 75.4 \angle 90^\circ = (2.096 \times 75.4) \angle -90 + 90 = 158.04 \angle 0^\circ \quad \times \quad \text{method is correct.}$$

$$b) V_S = V_R + V_L$$

$$\cancel{200 \angle 0^\circ} = 41.92 \angle -90^\circ + 158.04 \angle 0^\circ = 199.96 \angle -90^\circ \quad \times$$

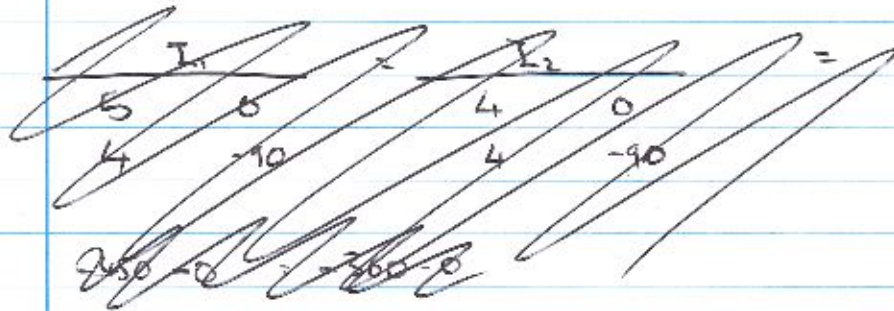
c)



5



$$X_C = \frac{1}{2\pi fC} = \frac{1}{2\pi \cdot 50 \cdot (795 \times 10^6)} = 4.0 \angle -90^\circ$$



4B

a)

$$i) Z_T = \frac{Z_1 Z_2}{Z_1 + Z_2} + Z_3$$

$$Z_3 = R = 20 \angle 0^\circ$$

$$Z_2 = X_L = 31.42 \angle 90^\circ$$

$$Z_1 = X_C = 10 \angle -90^\circ$$

$$X_L = 2\pi fL$$

$$= 2\pi \cdot 50 \times 0.1$$

$$= 31.42 \angle 90^\circ$$

$$X_C = \frac{1}{2\pi fC} = \frac{1}{2\pi \cdot 50 \cdot (318 \times 10^6)} = 10 \angle -90^\circ$$

~~Then~~

$$\begin{aligned} Z_1 Z_2 &= 31.42 \angle 90^\circ \times 10 \angle -90^\circ \\ &= (31.42 \times 10) \angle 90^\circ + -90^\circ \\ &= 314.2 \angle 0^\circ \end{aligned}$$

$$\begin{aligned} Z_1 + Z_2 &= 31.42 \angle 90^\circ + 10 \angle -90^\circ \\ &= 41.42 \angle 0^\circ \end{aligned}$$

$$\frac{Z_1 Z_2}{Z_1 + Z_2} = \frac{314.2 \angle 0^\circ}{41.42 \angle 0^\circ} = \left(\frac{314.2}{41.42} \right) \angle 0^\circ - 0^\circ = 7.56 \angle 0^\circ$$

$$\begin{aligned} Z_T &= 7.56 \angle 0^\circ + 20 \angle 0^\circ \\ &= 27.56 \angle 0^\circ \end{aligned}$$

$$\begin{aligned} ii) I &= \frac{V}{Z_T} = \frac{10 \angle 0^\circ}{27.56 \angle 0^\circ} = 0.36 \angle 0^\circ \text{ A} \\ &= 362.8 \angle 0^\circ \text{ mA} \end{aligned}$$

i)



4A

$$a) X_L = 2\pi fL = 2\pi \times 50 \times 0.2$$

$$= 62.83 \Omega \quad \checkmark$$

$$Z = R + X_L = 70 + 62.83$$

$$= 132.83 \Omega \quad \times$$

$$I = \frac{V}{Z} \checkmark = \frac{200}{(132.83 \Omega) \times} = \cancel{1.51 A} \quad 0.5 A$$

$$b) 0.5 \times 3 = 1.5 A$$

1 1/2



Complete, fold and seal
(see note 2 below)

SURNAME: John

FORENAME(S): Lloyd Griffiths

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.**

1	Student Number	1809805
2	Title of Examination Paper	QEC + Elec Principles
3	Module Code	SGEE4000
4	Date and Time of Examination	13/5/19 1:30 - 3:30
5	Examination Venue	
6	Seat Number	
7	Number of Answer Books handed in	

List the numbers of the questions you have attempted	Office Use
Q1	15
Q2	10 1/2
Total	25 1/2

(Gweler yr ochr arall am y fersiwn Cymraeg)



Prysgol Cymru
Y Prifdded Dewi Sant
University of Wales
Trinity Saint David

Llyfr Atebion Arholiadau

12 Tüdalen

Cyfarwyddiadau i Ymgeiswyr

1. Rhwch yr holl wybodaeth y gofynnir amdani yn y blychau isod.
2. Rhwch eich enw yn lle a ddarparwyd ar y dde, plygwch ef a'i seio i lawr (gan ddefnyddio'r label a ddarparwyd) i guddio'ch enw.
3. Rhaid i'r atebion fod mewn llawysgrifen ddarllenadwy. Gall yr Arhogaet ei theipio a chael yr ymgeisydd i dalu.

4. Ysgrifennwch eich atebion mewn inc.
5. Dechreuwch bob ateb ar dudalen newydd. Gwnewch unrhyw fras nodiadau yn y llyfr atebion a thynnu llinell drwyddynt.
6. Ni ddylid rhwygo unrhyw ran o'r llyfr hwn; rhaid ei gyflwyno yn gyfan.
7. Os defnyddir mwy nag un llyfr, rhwymwch hwy gyda'i gilydd gan ddefnyddio'r tagiau sydd ar gael oddi wrth y gwyllyllwrr/gwyllywyr.
8. Rhaid dychwelyd pob llyfr. Ni chaniateir mynd â llyfrau atebion, wedi eu defnyddio neu heb eu defnyddio, allan o'r lleoliad arholi o dan unrhyw amgylchiadau.

[illegible]

7	Nifer y Llyfrau Atebion a gyflwynwyd	
6	Rhif Sedd	
5	Lleoliad yr Arholiad	
4	Dyddiad ac Amser yr Arholiad	
3	Cod y Modwl	
2	Teitl y Papur Arholiad	
1	Rhif Myfyrwr	

(See the other side for English version)

Llenwch, plygwh a seliwh
(gweler nodyn 2 isod)

CYFENW:

ENW(AU) CYN TAF:

$$1A) a) T = \frac{L}{R} = \frac{0.5}{16} = 0.03125s \text{ or } 31.25ms$$

$$b) I = \frac{V}{R} = 0.75A \quad 750mA$$

$$c) I = I_{max} e^{-\frac{R}{L}t}$$

$$750 = 200 e^{-\frac{R}{L}t}$$

$$\frac{750}{200} = e^{-\frac{R}{L}t}$$

$$\ln \frac{750}{200} = \ln e^{-\frac{R}{L}t}$$

$$1.32 = -\frac{R}{L}t$$

$$t = \frac{1.32}{31.25} = 0.042ms$$

$$I = I_{max} e^{-\frac{R}{L}t}$$

$$750 = 400 e^{-\frac{R}{L}t}$$

$$\frac{750}{400} = e^{-\frac{R}{L}t}$$

$$\ln \frac{750}{400} = \ln e^{-\frac{R}{L}t}$$

$$0.63 = -\frac{R}{L}t$$

$$t = \frac{0.63}{31.25} = 0.020ms$$

Wrong formulae used.

$$1B) T = \frac{C}{R} = (0.47 \times 10^{-9}) \times (120 \times 10^6) = 56400 \text{ or } 56.4s$$

$$5T = 56.4 \times 5 = 282s$$

$$i) \text{ charge } V_C = VS(1 - e^{-\frac{t}{\tau}})$$

$$6 = 12(1 - e^{-\frac{t}{\tau}})$$

$$\frac{6}{12} = 1 - e^{-\frac{t}{\tau}}$$

$$\ln 0.5 = \ln e^{-\frac{t}{\tau}}$$

$$-0.693 = -\frac{t}{\tau}$$

$$t = \frac{0.693}{56.4} = 0.0123s$$

$$ii) \text{ discharge } V_C = VSe^{-\frac{t}{\tau}}$$

$$6 = 12e^{-\frac{t}{\tau}}$$

$$\frac{6}{12} = e^{-\frac{t}{\tau}}$$

$$\ln 0.5 = \ln e^{-\frac{t}{\tau}}$$

$$-0.693 = -\frac{t}{\tau}$$

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Wrong formulae used.

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$$5T = 56.4 \times 5 = 282s$$

i) charge

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

$$6 = 12 (1 - e^{-\frac{t}{T}})$$

$$\frac{6}{12} = 1 - e^{-\frac{t}{T}}$$

$$0.5 = 1 - e^{-\frac{t}{T}}$$

$$e^{-\frac{t}{T}} = 0.5$$

$$\ln 0.5 = \ln e^{-\frac{t}{T}}$$

$$-0.693 = -\frac{t}{T}$$

$$t = \frac{0.693}{56.4} = 0.0123s$$

ii) discharge

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

$$6 = 12 e^{-\frac{t}{T}}$$

$$\frac{6}{12} = e^{-\frac{t}{T}}$$

$$0.5 = e^{-\frac{t}{T}}$$

$$\ln 0.5 = \ln e^{-\frac{t}{T}}$$

$$-0.693 = -\frac{t}{T}$$

$$t = \frac{0.693}{56.4} = 0.0123s$$

2A)

$$Z_1 = 6 - j4$$

$$Z_2 = 6 + j6$$

$$Z_1 + Z_2 = [6 - j4][6 + j6] = 36 + j36 - j24 - j^2 24 \quad \checkmark$$

$$= 36 + j12 + 24$$

$$= 60 + j12 \quad \checkmark$$

$$= 60 + j12 \quad \checkmark$$

$$Z_1 + Z_2$$

$$[6 - j4][6 + j6] = 12 + j2$$

$$\frac{60 + j12}{12 + j2} \times \frac{12 + j2}{12 + j2} = \frac{720 + j120 + j144 + j^2 24}{144 + j4} \quad \checkmark$$

$$\frac{720 + j264 - 24}{144 + j4} \quad \checkmark$$

$$\frac{764 + j264}{144 + j4} = 5.16 + j60 \quad \times$$

$$[5.16 + j60] + [2.5 - j5.6] \quad \times$$

$$\underline{7.66 + j65.6} \quad \times$$

2B) 1)

$$Z = R + jX_L$$

$$X_L = 2\pi fL$$

$$2\pi \times 60 \times 0.2 = 75.39 \quad \checkmark$$

$$Z = 20 + j75.39 \quad \checkmark$$

$$\sqrt{20^2 + 75.39^2} = 77.99 \quad \checkmark$$

$$i) I = \frac{V}{Z} = \frac{200 \angle 0^\circ}{77.99 \angle 75.14^\circ} = 2.56 \angle -75.14^\circ \quad \checkmark$$

$$\tan^{-1} \frac{75.39}{20} = 75.14^\circ \quad \checkmark$$

$$ii) PD = I \times R$$

$$= 2.56 \angle -75.14^\circ \times 20$$

$$= 51.2 \angle -75.14^\circ \quad \checkmark$$

$$iii) PD = I \times L$$

$$= 2.56 \angle -75.14^\circ \times 0.2$$

$$= 0.512 \angle -75.14^\circ \quad \times$$

4A) A)

b)