

SURNAME: DYER

FORENAME(S): EMYR WYN

12 Pages

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	1503008
2	Title of Examination Paper	POWER ELECTRONIC + DRIVES
3	Module Code	SGEE6001
4	Date and Time of Examination	17.05.19 09:30
5	Examination Venue	C27
6	Seat Number	
7	Number of Answer Books handed in	

List the numbers of the questions you have attempted	Office Use
1	11½
3	7
Total	18½

(Gweler yr ochr arall am y fersiwn Cymraeg)



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

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, plynwch ei a'i seilio i lawr (gan ddefnyddio'r label a ddarparwyd) i guddio'ch enw.

3. Rhaid i'r atebion fod mewn llawysgriften ddarllenadwy. Gall yr Arholwyr naill ai anwybyddu sgrïp 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 gwyllwyr/gwyliwyr.
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.

Rhestrwch rifau'r cwestiynau a ymgelisiwyd gennyh	
At Dibenion y Swyddfa	Cyfanswm

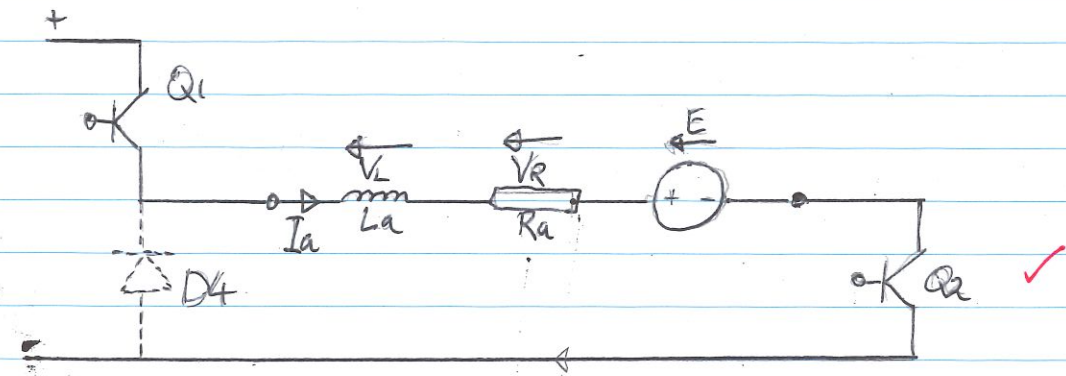
(See the other side for English version)

Llenwch, plygwrch a seliwrch
(gweler nodyn 2 isod)

CYFENW:

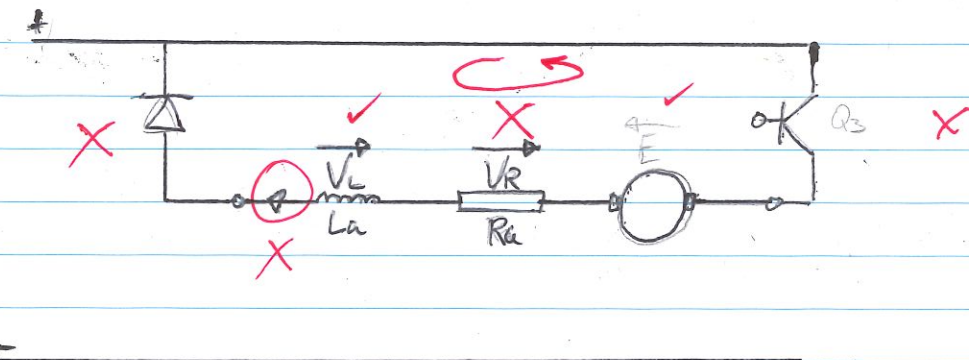
ENW(AU) CYNTAF:

1 (a)



In Quadrant 1, Q_1 and Q_2 switch on allowing ~~forward~~ forward flow of current to the connected load. D_4 is used as a flywheel diode in this configuration. ✓

3



1(b) $L_a = 80 \text{ mH}$
 $\omega = 150 \text{ rad/s}$
 $f_c = 2 \text{ kHz}$
 $T_L = 6 \text{ Nm}$
 $K_b = 0.4 \text{ V/rad/s (Nm/A)}$
 $V_s = 84 \text{ V}$

(i) $t_1 + t_2 = \frac{1}{f_c} = \frac{1}{2000} = 0.5 \times 10^{-3} = 0.5 \text{ ms} \checkmark$

$$D \times V_s = E$$

$$D = \frac{E}{V_s}$$

$$V_s \text{ to motor} = 84 - 2 - 2 = 80 \text{ V}$$

$$E = K_b \times \omega = 0.4 \times 150 = 60 \text{ V} \checkmark$$

$$D = \frac{60}{80} = 0.75 \checkmark$$

$$D = \frac{t_1}{t_1 + t_2}$$

$$0.75 = \frac{t_1}{0.5 \times 10^{-3}}$$

$$t_1 = 0.75 \times (0.5 \times 10^{-3}) = 0.375 \text{ ms} \checkmark$$

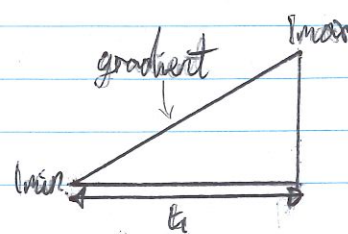
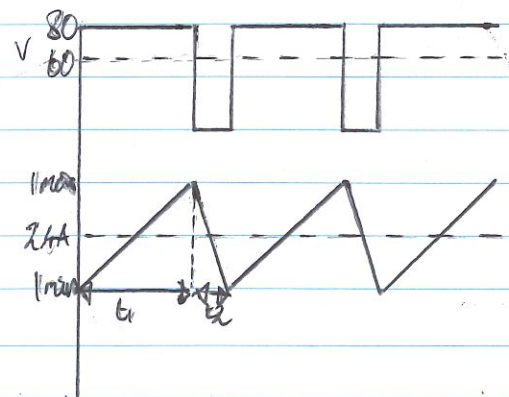
$$t_2 = (0.5 \times 10^{-3}) - (0.375 \times 10^{-3}) = 0.125 \text{ ms} \checkmark$$

(ii) $T = \frac{I_a}{K_b} \times T = K_b I_a(\text{mean})$

$$I_a(\text{av}) = T \times K_b$$

$$= 6 \times 0.4 = 2.4 \text{ A} \checkmark$$

$$I_a(\text{mean}) = \frac{6}{0.4} = 15 \text{ A}$$



$$\text{gradient} = \frac{I_{\max} - I_{\min}}{0.375 \times 10^{-3}}$$

$$\frac{di}{dt} = \frac{V_s - E}{L} = \frac{80 - 60}{80 \times 10^{-3}} = 250 \text{ A/s} = \text{gradient} \checkmark$$

$$250 = \frac{I_{\max} - I_{\min}}{0.375 \times 10^{-3}}$$

$$I_{\max} - I_{\min} = 250 \times (0.375 \times 10^{-3}) = 0.0938 \text{ A} \checkmark$$

$$\text{range} = \frac{I_{\max} + I_{\min}}{2} = 2.4 \text{ A} \times$$

$$I_{\max} + I_{\min} = 2.4 \times 2 = 4.8 \text{ A}$$

$$I_{\max} + I_{\min} = 2.4 \times$$

$$I_{\max} - I_{\min} = 0.0938 \checkmark$$

$$2 I_{\max} = 2.4938$$

$$I_{\max} = \frac{2.4938}{2} = 1.2469$$

$$I_{\min} = 4.8 - 1.2469 = 3.5531$$

$$I_{\min} = 2.4 - 1.2469 = 1.1531$$

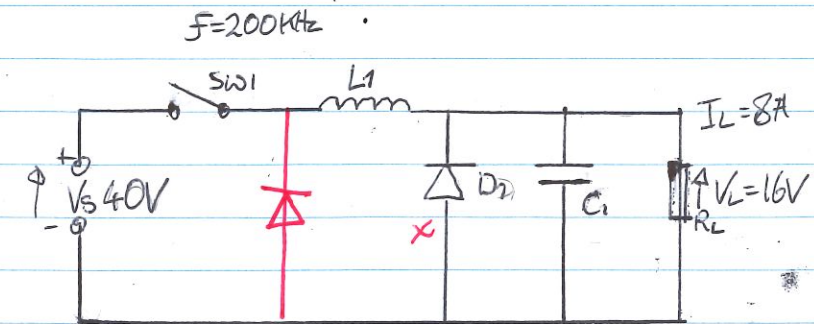
Correct method

3 1/2

5

5

300



When $sw1$ is closed, a field begins to form in $L1$. At the same time voltage is stored in $C1$. When $sw1$ opens, the field in $L1$ starts to collapse, releasing current flow to the load (R_L) while at the same time $C1$ discharges delivering a positive voltage to the load. $D1$ permits a continuous current flow until $sw1$ closes again, building the field at $L1$ and charging $C1$.

$$(b) \quad t_1 + t_2 = \frac{1}{200 \times 10^3} = 5 \mu s \quad \checkmark$$

$$D \times V_s = V_L$$

$$D = \frac{V_L}{V_s} = \frac{16}{40} = 0.4 \quad \checkmark$$

$$D = \frac{t_1}{t_1 + t_2}$$

$$0.4 = \frac{t_1}{5 \times 10^{-6}}$$

$$t_1 = 0.4 \times (5 \times 10^{-6}) = 2 \mu s \quad \checkmark$$

$$t_2 = (5 \times 10^{-6}) - (2 \times 10^{-6}) = 3 \mu s \quad \checkmark$$

2

2

3