



SURNAME: De-Vlugt

FORENAME(S): Calum Rhys

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	1708184
2	Title of Examination Paper	Further Engineering Mathematics
3	Module Code	SGEE5001
4	Date and Time of Examination	Tuesday 21/05/10 Start - 09:30 Finish - 12:00
5	Examination Venue	G43
6	Seat Number	

7	Number of Answer Books handed in	<u>1</u>
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[illegible]

(Gweler yr ochr arall am y fersiwn Cymraeg)



Prifysgol Cymru
Y Prifddod 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, pigwch e'r a'i seilio i lawr (gan ddefnyddio'r label a ddarparwyd) i guddio'ch enw.

3. Rhaid i'r atebion fod mewn llawysgriften ddarlennadwy. Gall yr Arholiwr 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 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 gwyllwr/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 amgylchriadau.

[illegible]

1	Rhif Myfyriwr	
2	Teitl 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, plygwch a seliwch
(gweler nodyn 2 isod)

CYFENN:

ENW(AU) CYNTAF:

a)

x	f	xf	$f(x-\bar{x})^2$
6	7	$6 \times 7 = 42$	$7 \times (6 - 8.59)^2 = 46.9567$
7	21	$7 \times 21 = 147$	$21 \times (7 - 8.59)^2 = 53.0901$
8	25	$8 \times 25 = 200$	$25 \times (8 - 8.59)^2 = 8.7025$
9	19	$9 \times 19 = 171$	$19 \times (9 - 8.59)^2 = 3.1939$
10	14	$10 \times 14 = 140$	$14 \times (10 - 8.59)^2 = 27.8334$
11	9	$11 \times 9 = 99$	$9 \times (11 - 8.59)^2 = 52.2729$
12	5	$12 \times 5 = 60$	$5 \times (12 - 8.59)^2 = 58.1405$
	$\Sigma = 100$	$\Sigma = 859$	$\Sigma = 250.19$

$$\bar{x} = \frac{\Sigma fx}{\Sigma f} = \frac{859}{100} = 8.59 \quad \checkmark$$

$$\sigma = \sqrt{\frac{\Sigma f(x-\bar{x})^2}{\Sigma f}} = \sqrt{\frac{250.19}{100}} = 1.58 \quad \checkmark$$

b) $P =$ Prob Probability of picking 1k resistor $= \frac{3}{5} = 0.6$
 $q = 1 - 0.6 = 0.4$

i) $n = 3$

$$P(1 \text{ resistor}) = \binom{3}{1} p^1 q^{3-1} = 3(0.6)(0.4) = 0.288 \quad \checkmark$$

ii) $n =$ either 3 or 4

$$P(3 \text{ resistors}) = \binom{4}{3} p^3 q^{4-3} = 4(0.6)^3(0.4) = 0.3456 \quad \checkmark$$

$$P(4 \text{ resistors}) = \binom{4}{4} p^4 q^{4-4} = (0.6)^4(0.4)^0 = 0.1296 \quad \checkmark$$

$$P(\text{at least 3 resistors}) = 0.3456 + 0.1296 = 0.4752 \quad \checkmark$$

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Section B

1) ~~$R = 20\Omega, C = 0.05, E = 20e^{-3t}$ and $I(0) = 0$~~

3. $R = 60\Omega, C = 0.02, L = 2, E(t) = 50V$, where
 $I(0) = 0$ and $I'(0) = 10$

$$E(t) = ER + EL + EC$$

$$E(t) = RI + L \frac{dI}{dt} + \frac{1}{C} \int I dt$$

$$\frac{dE}{dt} = R \frac{dI}{dt} + L \frac{d^2 I}{dt^2} + \frac{1}{C} I$$

$$\therefore \frac{dE}{dt} = 60 \frac{dI}{dt} + 2 \frac{d^2 I}{dt^2} + 50 I$$

where $\frac{dE}{dt} \neq E(t) = 50V = \text{constant supply}$,

$$\therefore \frac{dE}{dt} = 0$$

$$0 = 60 \frac{dI}{dt} + 2 \frac{d^2 I}{dt^2} + 50 I$$

rearrange and divide by 2:

$$\frac{d^2 I}{dt^2} + 30 \frac{dI}{dt} + 25 I = 0$$

C.F.

$$M^2 + 30M + 25 = 0$$

$$M = \frac{-b \pm \sqrt{b^2 - 4(ac)}}{2(a)}$$

$$M = \frac{-30 \pm \sqrt{30^2 - 4(1)(25)}}{2(1)}$$

$$= \frac{-30 \pm \sqrt{800}}{2}$$

$$= -0.858 \text{ or } -29.142$$

$\therefore I \Rightarrow$ real and different roots

$$\therefore I = Ae^{-0.858t} + Be^{-29.142t}$$

As $I(0) = 0$

$$0 = Ae^{-0.858t} + Be^{-29.142t}$$

$$0 = Ae^0 + Be^0$$

$$0 = A + B \quad \text{--- (1)}$$

$$\frac{dI}{dt} = -0.858Ae^{-0.858t} - 29.142Be^{-29.142t}$$

As $I'(0) = 10$

$$10 = -0.858Ae^0 - 29.142Be^0$$

$$10 = -0.858A - 29.142B \quad \text{--- (2)}$$

multiply (1) by 0.858

$$\therefore 0 = 0.858A + 0.858B$$

$$10 = -0.858A - 29.142B$$

$$0 = 0.858A + 0.858B$$

$$10 = -28.284B$$

$$B = \frac{10}{-28.284} = -0.353 - 0.354$$

$$\therefore A = 0.354$$

$$\text{So } I = 0.354Ae^{-0.858t} - 0.354Be^{-29.142t}$$

$$\text{So } I = 0.354e^{-0.858t} - 0.354e^{-29.142t}$$

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