

Llyfr Atebion Arholiadau

Cyfarwyddiadau i Ymgeiswyr

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

3. Rhaid i'r atebion fod mewn llawysgriflen dda gael ei theipio a chael yr ymgeisydd i dalu.

4. Ysgriennwch 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 defnyddi'r mwy nag un llyfr, rhwymwch hwy gyda'i gilydd gan ddefnyddio'r tagiau sydd ar gael oddi wrth y gwyliwr/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.

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 Myfyriwr	

(See the other side for English version)

Rhestrwch rffau'r cwestiynau a ymgelisiwyd gennyh	
At Ddibenion y Swyddfa	



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

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.**

Complete, fold and seal
(see note 2 below)

SURNAME: OWES

FORENAME(S): Nathan

1	Student Number	1602828
2	Title of Examination Paper	FURTHER ENGINEERING MATHEMATICS
3	Module Code	SGEE5001
4	Date and Time of Examination	Tuesday 21 st Mar 2019 9:30 AM
5	Examination Venue	Coleg Sir Gâr GRAIG G43
6	Seat Number	
7	Number of Answer Books handed in	ONE

(Gweler yr ochr arall am y fersiwn Cymraeg)

[illegible]

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Section A

a)

Life (hundreds of hours) x	FREQUENCY f	xf	$f(x-\bar{x})^2$
6	7	42	$7(6-8.59)^2 = 46.96$
7	21	147	$21(7-8.59)^2 = 53.09$
8	25	200	$25(8-8.59)^2 = 8.70$
9	19	171	$19(9-8.59)^2 = 3.19$
10	14	140	$14(10-8.59)^2 = 27.83$
11	9	99	$9(11-8.59)^2 = 52.27$
12	5	60	$5(12-8.59)^2 = 58.14$
Total = 100		Total = 859	Total = 250.18

$$\text{mean } (\bar{x}) = \frac{\sum fx}{\sum f} = \frac{859}{100} = 8.59 \quad \checkmark$$

$$\text{Standard deviation } (\sigma) = \sqrt{\frac{\sum f(x-\bar{x})^2}{\sum f}} = \sqrt{\frac{250.18}{100}} = 1.58 \quad \checkmark$$

b)

i) Probability of $\frac{3}{5}$ / 0.6 / 60% producing a resistor with 1k Ω

$$P = 0.6$$

$$Q = 0.4$$

$$\binom{n}{k} P^k Q^{n-k}$$

$$P(1 \text{ resistor}) = \binom{3}{1} P^1 Q^2$$

$$\binom{3}{1} = \frac{3!}{1!(3-1)!} = \frac{6}{2} = 3$$

$$= 3 \times 0.6 \times 0.4^2$$

$$= 0.288 \quad \checkmark$$

ii) At least 3 means 3 or 4.

$$P(3 \text{ resistors}) = \binom{4}{3} p^3 q^{4-3} = \frac{4!}{3!(4-3)!} = \frac{24}{6} = 4$$

$$= 4 \times 0.6^3 \times 0.4$$

$$= 0.3456 \quad \checkmark$$

$$P(4 \text{ resistors}) = \binom{4}{4} p^4 q^{4-4} = \frac{4!}{4!} = 1$$

$$= 1 \times 0.6^4 \times 0.4$$

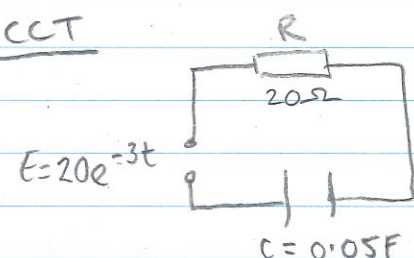
$$= 0.05184 \quad \times$$

$$P(\text{At least 3}) = 0.3456 + 0.05184$$

$$= 0.39744$$

Section B

1.) R.C. CCT



$$E = E_R + E_C$$

$$E = RI + \frac{1}{C} \int I dt$$

Differentiate w.r.t. t

$$\frac{dE}{dt} = R \frac{dI}{dt} + \frac{1}{C} I$$

$$R \frac{dI}{dt} + \frac{1}{C} I = \frac{dE}{dt}$$

Since $E = 20e^{-3t}$, $\frac{dE}{dt} = -60e^{-3t} \quad \checkmark$

Inserting values

$$20 \frac{dI}{dt} + \frac{1}{0.05} I = -60e^{-3t} \quad \checkmark$$

$$20 \frac{dI}{dt} + 20I = -60e^{-3t}$$

Divide by 20 throughout:

$$\frac{dI}{dt} + I = -3e^{-3t} \quad \checkmark$$

Write in Laplace

Since $I(0) = 0$

$$(sI - I_0) + I = \frac{-3}{s+3}$$

$$sI + I = \frac{-3}{s+3}$$

$$I(s+1) = \frac{-3}{s+3}$$

$$I = \frac{-3}{(s+3)(s+1)}$$

$$\frac{-3}{(s+3)(s+1)} = \frac{A}{s+3} + \frac{B}{s+1}$$

put $s = -1$

$$-3 = A(s+1) + B(s+3)$$

$$-3 = A(0) + B(2)$$

$$-3 = 2B$$

$$\frac{-3}{2} = B$$

$$B = -1.5$$

Put $s = -3$

$$-3 = A(-2) + B(0)$$

$$-3 = -2A$$

$$\frac{-3}{-2} = A$$

$$A = 1.5$$

$$\bar{I} = \frac{1.5}{s+3} + \frac{-1.5}{s+1}$$

$$\mathcal{L}^{-1} \left\{ \frac{1.5}{s+3} - \frac{1.5}{s+1} \right\} = 1.5e^{-3t} - 1.5e^{-t} \quad 0$$

2.) $y'' + 3y' + 2y = e^t$

$$(s^2\bar{y} - y_0 - y_1) + 3(s\bar{y} - y_0) + 2\bar{y} = 0$$

Since $y=0, y'=1$

$$s^2\bar{y} - 0 - 1 + 3s\bar{y} - 0 + 2\bar{y} = 0$$

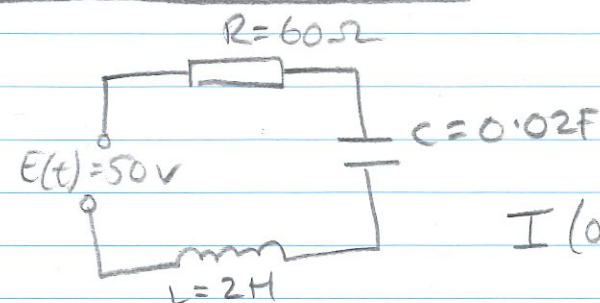
$$s^2\bar{y} + 3s\bar{y} + 2\bar{y} = 1 \quad \text{ecf.}$$

$$\bar{y}(s^2 + 3s + 2) = 1$$

$$\bar{y} = \frac{1}{(s^2 + 3s + 2)} = \frac{1}{(s+2)^2 + 1^2} \quad X$$

$\frac{6}{25}$

3.) RLC with constant voltage



$$I(0) = 0 \text{ and } I'(0) = 10$$

$$E(t) = E_R + E_L + E_C$$

$$E_t = RI + L \frac{dI}{dt} + \frac{1}{C} \int I dt$$

Differentiate w.r.t. t

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

rearrange:

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

Since E is constant, $\frac{dE}{dt} = 0$

insert values:

$$2 \frac{d^2I}{dt^2} + 60 \frac{dI}{dt} + \frac{1}{0.02} I = 0$$

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

Divide by 2 throughout

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

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

$$m = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-30 \pm \sqrt{30^2 - 4(1)(25)}}{2(1)}$$

$$= \frac{-30 \pm \sqrt{800}}{2} = m_1 = -0.858 \quad \checkmark$$

or

$$m_2 = -29.142 \quad \checkmark$$

General solution: (Real and different)

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

insert boundary

Condition $I(0) = 0$ $I(0) = 0 \rightarrow I = 0 \quad t = 0$

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

$$0 = A + B \quad \textcircled{1} \quad \checkmark$$

Differentiate

General Solution

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

insert boundary

Condition $I'(0) = 10$

$$I'(0) = 10 \rightarrow t = 0 \quad \frac{dI}{dt} = 10$$

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

$$10 = -0.858A + 29.142B \quad \textcircled{2}$$

Equation $\textcircled{1} : 0 = 0.858A - 0.858B$

$\times (0.858)$ $10 = -30B$

$$\frac{10}{-30} = B$$

$$B = -0.3 \quad \times$$

Substitute $B = -0.3$ into equation $\textcircled{1}$

$$0 = A - 0.3$$

$$A = 0.3 \quad \times$$

General solution = $I = 0.3e^{-0.858t} - 0.3e^{-29.142t} \quad \times$

Particular Solution =

$$I = 0.3e^{-0.858t} - 0.3e^{-29.142t} - 0.858e^{-0.858t} - 29.142e^{-29.142t} \quad \times$$

$\frac{20}{25}$ $\checkmark$

17 $\checkmark$

2 $\checkmark$
1 $\checkmark$