



Complete, fold and seal
(see note 2 below)

SURNAME: GEORGE

FORENAME(S): LIAM SEAN

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	1809812
2	Title of Examination Paper	ENGINEERING MATHS
3	Module Code	SGEE 4002
4	Date and Time of Examination	13/05/19 9.30
5	Examination Venue	C27
6	Seat Number	24
7	Number of Answer Books handed in	

[illegible]

(Gweler yr ochr arall am y fersiwn Cymraeg)



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

Llyfr Atebion Arholiadau

CYFENN:

Llenwch, plynwch a seliwch
(gweler nodyn 2 isod)

ENW(AU) CYNTAF:

Cyfarwyddiadau i Ymgeiswyr

12 Judalen

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

3. Rhaid i'r atebion fod mewn llawysgrifen ddarllenadwy. Gall yr Arholwyr naill ai anwybyddu sgript 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/gwyhwyr.
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 Archoliad	
3	Cod y Modwl	
2	Teitl y Papur Arholiad	
1	Rhif Myfyrwr	

(See the other side for English version)

[illegible]

$$\begin{aligned}
 1) \quad & 3(4y-3) - 5(2-3y) = 35 \\
 & 12y - 9 - 10 + 15y = 35 \\
 & 4y - 19 = 35 \\
 & 4y = 35 + 19 \\
 & 4y = 54 \\
 & y = \frac{54}{4} \\
 & y = 13.5 \quad \times
 \end{aligned}$$

ECF

2
 $\frac{3}{5}$

$$2) \quad A = \begin{pmatrix} 3 & 2 \\ 1 & 3 \end{pmatrix} \quad B = \begin{pmatrix} -1 & 3 \\ 2 & 5 \end{pmatrix}$$

$$(i) \quad 4B - 2A = \begin{pmatrix} -4 & 12 \\ 8 & 20 \end{pmatrix} - \begin{pmatrix} 6 & 4 \\ 2 & 6 \end{pmatrix} = \begin{pmatrix} -10 & 8 \\ 6 & 14 \end{pmatrix} \quad \checkmark$$

2.

$$(ii) \quad AB = \begin{pmatrix} 3 & 2 \\ 1 & 3 \end{pmatrix} \times \begin{pmatrix} -1 & 3 \\ 2 & 5 \end{pmatrix} = \begin{pmatrix} 3 & 24 \\ 7 & 18 \end{pmatrix} \quad \times$$

$$c_{11} = (3 \times -1) + (2 \times 2) = 3$$

$$c_{12} = (3 \times 3) + (2 \times 5) = 24$$

$$c_{21} = (1 \times -1) + (3 \times 2) = 7$$

$$c_{22} = (1 \times 3) + (3 \times 5) = 18$$

$$(iv) \quad \text{INVERSE OF } A = \begin{pmatrix} 3 & 2 \\ 1 & 3 \end{pmatrix} = 9 - 2 = 7 \quad ??$$

$$\frac{1}{7} = \frac{1}{7} \begin{pmatrix} 3 & -2 \\ -1 & 3 \end{pmatrix} = \begin{pmatrix} \frac{3}{7} & -\frac{2}{7} \\ -\frac{1}{7} & \frac{3}{7} \end{pmatrix} \quad \checkmark \quad 5$$

$$|A| = 9 - 2 = 7$$

$$A^{-1} = \frac{1}{7} \begin{bmatrix} 3 & -2 \\ -1 & 3 \end{bmatrix}$$

$$\begin{pmatrix} 0.428 & -0.285 \\ -0.142 & 0.428 \end{pmatrix}$$

7
12

$$3) \quad z_1 = 3 - j5 \quad z_2 = 2 + j3$$

$$(i) \quad [3 - j5] - [2 + j3] = [1 - j8] \quad \checkmark$$

2

$$(ii) \quad z_1 + z_2 = [3 - j5] + [2 + j3]$$

$$= [6 - j2]$$

$$j^2 = -1$$

$$(iii) \quad \frac{z_1}{z_2} = \frac{3 - j5}{2 + j3} \times \frac{2 - j3}{2 - j3} = \frac{6 - j9 - j10 + j^2 15}{2^2 + 3^2}$$

$$= \frac{6 - j9 - j10 + (-1)15}{2^2 + 3^2}$$

$$= \frac{6 - j9 - j10 - 15}{13} \quad \checkmark$$

$$= \frac{-9 + j20}{13}$$

$$= -0.69 + j1.61 \quad \checkmark$$

$$j^2 = -1$$

$$(iv) \quad z_1 \times z_2 = (3 - j5) \times (2 + j3) = 6 + j9 - j10 - j^2 15$$

$$= 6 + j9 - j10 - (-1)15 \quad \checkmark$$

$$= 6 + j9 - j10 + 15$$

$$= 21 - j1 \quad \checkmark$$

3

9/10

4) differentiate = $y = 3x^5 - \frac{4}{x^2} + \sqrt{x}$

$$y = 15x^4 - 4x^{-2} + x^{\frac{1}{2}}$$

$$\frac{dy}{dx} = 60x^3 + 8x^{-3} + \frac{1}{2}x^{-\frac{1}{2}}$$

5) Evaluate the integral $\int_2^3 (4 + 5t + 3t^2) dt$

$$[4t + 5t^2 + 6t^3]_2^3$$

$$[4(3) + 5(3)^2 + 6(3)^3] - [4(2) + 5(2)^2 + 6(2)^3]$$

$$= 219 - 76$$

$$= 143$$

3) a)

$$10I_1 + 6(I_1 + I_2) = 6$$

$$8I_2 + 6(I_1 + I_2) = 10$$

$$16I_1 + 6I_2 = 6$$

$$6I_1 + 14I_2 = 10$$

$$\begin{pmatrix} 16 & 6 \\ 6 & 14 \end{pmatrix} \begin{pmatrix} I_1 \\ I_2 \end{pmatrix} = \begin{pmatrix} 6 \\ 10 \end{pmatrix}$$

$$\begin{pmatrix} 16 & 6 \\ 6 & 14 \end{pmatrix}, |A| = 224 - 36 = 188$$

$$A^{-1} = \frac{1}{188} \begin{pmatrix} 14 & -6 \\ -6 & 16 \end{pmatrix} = \begin{pmatrix} \frac{7}{94} & -\frac{3}{94} \\ -\frac{3}{94} & \frac{4}{47} \end{pmatrix}$$

$$\begin{pmatrix} 0.074 & -0.031 \\ -0.031 & 0.085 \end{pmatrix}$$

$$\begin{pmatrix} 0.074 & -0.031 \\ -0.031 & 0.085 \end{pmatrix} \begin{pmatrix} 6 \\ 10 \end{pmatrix} =$$

$$C_{I1} = (0.074 \times 6) + (-0.031 \times 10) = 0.134$$

$$C_{I2} = (-0.031 \times 6) + (0.085 \times 10) = 0.664$$

$$I_1 = 0.134$$

$$I_2 = 0.664$$

10.

3

6) CONFIRM

$$16I_1 + 6I_2 = 6 \quad \times 6 \quad \textcircled{1}$$

$$6I_1 + 14I_2 = 10 \quad \times 16 \quad \textcircled{2}$$

$$96I_1 + 36I_2 = 36 \quad \textcircled{3}$$

$$96I_1 + 224I_2 = 160 \quad \textcircled{4}$$

$$188I_2 = 124$$

$$I_2 = \frac{124}{188}$$

$$I_2 = 0.660$$

SUBSTITUTE INTO ①

$$16I_1 + 6(0.660) = 6$$

$$16I_1 + 3.96 = 6$$

$$I_1 = \frac{6 - 3.96}{16}$$

$$I_1 = \frac{2.04}{16}$$

$$I_1 = 0.137$$

$$I_1 = 0.137$$

$$I_2 = 0.660$$

①

7

$$\frac{17}{20}$$

4)

$$\begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix} \quad \begin{pmatrix} 1 & 0 \\ \frac{1}{2} & 1 \end{pmatrix}$$

$$\begin{pmatrix} 1 & 40 \\ 0 & 1 \end{pmatrix} \quad \begin{pmatrix} 1 & 0 \\ \frac{1}{60} & 1 \end{pmatrix} = \begin{pmatrix} 1.6 & 40 \\ 0.016 & 1 \end{pmatrix}$$

$$C_{11} = (1 \times 1) + (40 \times \frac{1}{60}) = 1.6$$

$$C_{12} = (1 \times 0) + (40 \times 1) = 40$$

$$C_{21} = (0 \times 1) + (1 \times \frac{1}{60}) = 0.016$$

$$C_{22} = (0 \times 0) + (1 \times 1) = 1$$

$$\begin{pmatrix} 1.6 & 40 \\ 0.016 & 1 \end{pmatrix} = 1.6 - 0.64 = 0.96$$

$$\frac{1}{0.96} \begin{pmatrix} 1 & -40 \\ -0.016 & 1 \end{pmatrix} = \begin{pmatrix} 1.04 & -41.6 \\ -0.016 & 1.6 \end{pmatrix}$$

1) a) Express $\frac{6}{(x+1)(x-2)}$

$$\frac{6}{(x+1)(x-2)} = \frac{A}{(x+1)} + \frac{B}{(x-2)}$$

$$0 = \frac{A(x-2)}{x+1} + \frac{B(x+1)}{x-2}$$

To Equal 0

$$B = (2+1)$$

$$B = 3$$

$$A = \frac{-1-2}{-1} = -3$$

$$A = -3$$

$$B = 3$$

b) Estimate the integral $\int_3^5 \frac{6}{(x+1)(x-2)} dx$

4 strips

$$h = \frac{5-3}{4} = 0.5$$

$$h = 0.5$$

3	3.5	4	4.5	5
1.5	0.8	0.6	0.4	0.3
y_0	y_1	y_2	y_3	y_4

$$\frac{6}{(3+1)(3-2)} = 1.5$$

$$\frac{6}{(3.5+1)(3.5-2)} = 0.8$$

$$\frac{6}{(4+1)(4-2)} = 0.6$$

$$\frac{6}{(4.5+1)(4.5-2)} = 0.4$$

$$\frac{6}{(5+1)(5-2)} = 0.3$$

$$h \left\{ \frac{1}{2} (y_0 + y_4) + y_1 + y_2 + y_3 + \dots \right\}$$

$$\frac{1}{2} \left(\frac{1}{2} (1.5 + 0.3) + 0.8 + 0.6 + 0.4 \right)$$

$$\approx 1.35$$

-1

9/20

7

2a) $L_1: 4x + 2y - 6 = 0$ $L_2: 3y - 6x = 3$

i) $L_1: 4x + 2y - 6 = 0$
 $2y - 6 = -4x$
 $2y = -4x + 6$
 $y = -2x + 3$

~~$y = -2x + 3$~~
 $y = -2x + 3$

Gradient = -2 ✓ Intercept = 3 ✓

3.

ii) $L_1: 4x + 2y - 6 = 0$
 $y = \frac{-4x + 6}{2}$

$y = \frac{-4x + 6}{2}$

$y = mx + c$

$-2 = (6)(5) + c$
 $-2 = 30 + c$

$c = 30 + 2$

$c = 32$

OR $\frac{30+2}{2}$

$= 15 = 1$

15

1

b) $S = t^4 \sin 3t$ $t = 1.5$

~~$\frac{dS}{dt} = 4t^3 \sin 3t + t^4 \cdot 3 \cos 3t$~~
 $\frac{dS}{dt} = 4t^3 \sin 3t + t^4 \cdot 3 \cos 3t$ here.

$\frac{dy}{dx} = u \frac{dv}{dx} + v \frac{du}{dx}$

$= (t^4)(3 \cos 3t) + (\sin 3t)(4t^3)$

$= 3t^4 \cos 3t + 4t^3 \sin 3t$ ✓

$t = 1.5$ $= 3(1.5)^4 \cos 3(1.5) + 4(1.5)^3 \sin 3(1.5)$

~~$3(1.5)^4 \cos 3(1.5) + 4(1.5)^3 \sin 3(1.5)$~~
 $3(1.5)^4 \cos(4.5) + 4(1.5)^3 \sin(4.5)$

$= -3.20 + 13.19$ ✓

$= 16.39$ ✓

c) $i = 2(3 - e^{-10t})$
 $i = 6 - e^{-10t}$

$\frac{di}{dt} = -60e^{-10t}$

$60 = -e^{-10t}$

$\ln 60 = -10t$

$4.09 = -10t$

~~$t = -\frac{4.09}{10}$~~
 $t = -0.409$

$4.09 + 10 = t$

$t = 14.09$ ✓

1

10/20