



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: Rackley

FORENAME(S): Rhys
William

1	Student Number	
2	Title of Examination Paper	Phase test 1
3	Module Code	PCEE4000
4	Date and Time of Examination	23/1/2019 9:30
5	Examination Venue	Pembrokeshire college
6	Seat Number	
7	Number of Answer Books handed in	

List the numbers of the questions you have attempted	Office Use
1	5
2	16
3	13
4	12
5	17
6	15
7	10
8	5
9	7
Office Use	100

$$1) F_0 = \frac{1}{2\pi\sqrt{LC}} \rightarrow \sqrt{LC} = \frac{1}{2\pi(F_0)}$$

$$\Rightarrow \sqrt{LC} = \frac{1}{2\pi(F_0)} \rightarrow C = \frac{1}{2\pi(F_0)\sqrt{L}}$$

Question 1 re-done at end of paper.

$$\begin{aligned} 2) i) & 3(x-5) - 2(4-5x) - 3 = 0 \\ & (3x - 15) - (8 - 10x) - 3 = 0 \checkmark \\ & 3x - 15 - 8 + 10x - 3 = 0 \\ & 13x - 26 = 0 \checkmark \\ & 13x = 26 \\ & x = \frac{26}{13} = 2 \checkmark \quad \underline{x=2} \checkmark \end{aligned}$$

④

$$\begin{aligned} ii) & 3x^2 + 11x - 4 = 0 \\ & 3x^2 - x + 12x - 4 = 0 \quad \begin{matrix} 12 \\ 12 \end{matrix} \\ & x(3x-1) + 4(3x-1) \checkmark \quad \begin{matrix} 12 \\ 12 \end{matrix} \\ & (x+4) \text{ or } (3x-1) \end{aligned}$$

$$x = -4 \checkmark \text{ or } x = \frac{1}{3} \checkmark$$

⑥

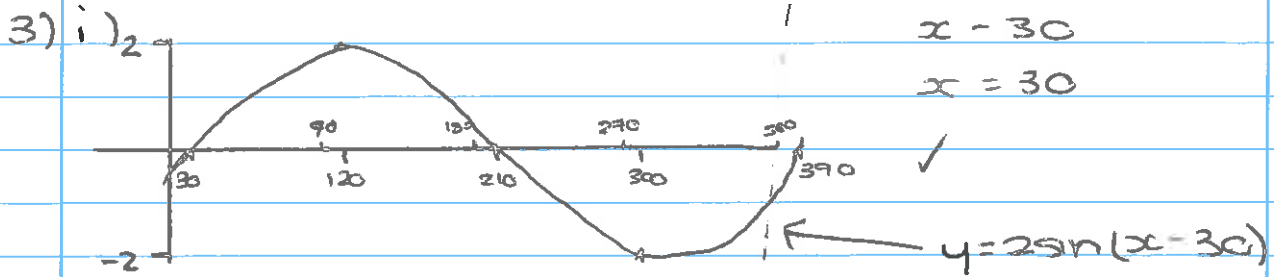
$$iii) 1.5 \times 10^{2x-1} = 153$$

$$\log_{10}(153/1.5) = 2x-1 \checkmark$$

$$\frac{\log_{10}(153/1.5) + 1}{2} = 1.504 \checkmark$$

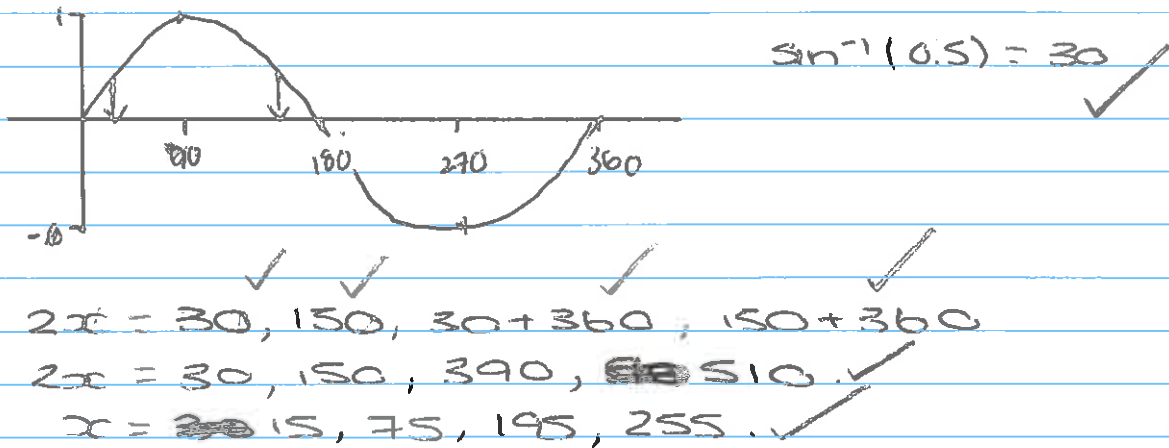
⑥

✓
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6

ii) Find $\sin 2x = 0.5$



7

4) $Z_1 = 3 + 2j$ $Z_2 = -1 - 5j$

i) $Z_1 - Z_2 = (3 + 2j) - (-1 - 5j)$
 $= 3 + 2j + 1 + 5j$
 $= \underline{4 + 7j}$ ✓

3

ii) $Z_1 Z_2 = (3 + 2j)(-1 - 5j)$
 $\Rightarrow -3 - 15j - 2j - 10j^2$ ✓ $j^2 = -1$
 $\Rightarrow -3 - 15j - 2j - 10(-1)$ ✓
 $= -3 - 17j + 10$ ✓
 $= \underline{7 - 17j}$ ✓

4

SDP

$$iii) \frac{Z_1}{Z_2} = \frac{(3+2j)(-1+5j)}{(-1-5j)(-1+5j)} = \frac{-3+15j-2j+10j^2}{1-5j+5j-25j^2} \checkmark$$

$$= \frac{-3+13j+10(-1)}{1-25(-1)} \checkmark$$

$$j^2 = -1$$

$$= \frac{-3+13j-10}{1+25} = \frac{-13+13j}{26} \checkmark$$

$$= \frac{-13}{26} + \frac{13j}{26} \Rightarrow = -\frac{1}{2} + \frac{1j}{2} \checkmark$$

$$= -0.5 + 0.5j \checkmark$$

(5)

$$5) A = \begin{pmatrix} 1 & 3 \\ -1 & -2 \end{pmatrix} \quad B = \begin{pmatrix} 0 & 1 \\ -3 & 2 \end{pmatrix}$$

$$i) 3B - A = 3 \begin{pmatrix} 0 & 1 \\ -3 & 2 \end{pmatrix} - \begin{pmatrix} 1 & 3 \\ -1 & -2 \end{pmatrix}$$

$$= \begin{pmatrix} 0 & 3 \\ -9 & 6 \end{pmatrix} - \begin{pmatrix} 1 & 3 \\ -1 & -2 \end{pmatrix} = \begin{pmatrix} -1 & 0 \\ -8 & 8 \end{pmatrix} \checkmark$$

(3)

$$ii) AB = \begin{pmatrix} 1 & 3 \\ -1 & -2 \end{pmatrix} \times \begin{pmatrix} 0 & 1 \\ -3 & 2 \end{pmatrix} \downarrow$$

$$= \left(\begin{array}{cc|cc} 1 & \times & 0 & \\ 3 & \times & -3 & \\ \hline -1 & \times & 0 & \\ -2 & \times & -3 & \end{array} \right) \quad \left(\begin{array}{cc|cc} 1 & \times & 1 & \\ 3 & \times & 2 & \\ \hline -1 & \times & 1 & \\ -2 & \times & 2 & \end{array} \right)$$

$$= \begin{pmatrix} -9 & 7 \\ 6 & -5 \end{pmatrix} \checkmark$$

(4)

iii) Show that $AB \neq BA$.

$$BA = \begin{pmatrix} 0 & 1 \\ -3 & 2 \end{pmatrix} \times \begin{pmatrix} 1 & 3 \\ -1 & -2 \end{pmatrix} \downarrow$$

$$\left(\begin{array}{ccc|ccc} 0 & \times & 1 & 0 & \times & 3 \\ 1 & \times & -1 & 1 & \times & -2 \\ -3 & \times & 1 & -3 & \times & 3 \\ 2 & \times & -1 & 2 & \times & -2 \end{array} \right)$$

$$= \begin{pmatrix} -1 & -2 \\ -5 & -13 \end{pmatrix} \checkmark \therefore AB \neq BA$$

④

iv) inverse matrix of A . $A = \begin{pmatrix} 1 & 3 \\ -1 & -2 \end{pmatrix}$

$$\det A = \begin{pmatrix} 1 & \times & -2 \\ -2 & - & -3 \end{pmatrix} = 1 \checkmark$$

$$\det A = 1$$

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

$$= \begin{pmatrix} -2 & -3 \\ 1 & 1 \end{pmatrix} \checkmark = \text{inverse matrix.}$$

⑥

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b)

	I_1	I_2
	3	5
4		
	6	6
	I_3	

$$4 = 3I_1 + 6(I_1 + I_2)$$

$$4 = 9I_1 + 6I_2 \quad \checkmark$$

$$6 = 5I_2 + 6(I_1 + I_2)$$

$$6 = 6I_1 + 11I_2 \quad \checkmark$$

$$4 = 9I_1 + 6I_2 \quad \checkmark$$

$$6 = 6I_1 + 11I_2 \quad \checkmark$$

$$I_1 = \frac{\begin{vmatrix} 4 & 6 \\ 6 & 11 \end{vmatrix}}{\begin{vmatrix} 9 & 6 \\ 6 & 11 \end{vmatrix}} = \frac{4 \times 11 - 6 \times 6}{9 \times 11 - 6 \times 6} = \frac{8}{63} \quad \checkmark$$

$$= 0.13 \text{ A}$$

$$I_2 = \frac{\begin{vmatrix} 9 & 4 \\ 6 & 6 \end{vmatrix}}{\begin{vmatrix} 9 & 6 \\ 6 & 11 \end{vmatrix}} = \frac{9 \times 6 - 6 \times 4}{9 \times 11 - 6 \times 6} = \frac{30}{63} \quad \checkmark$$

$$= 0.48 \text{ A}$$

$$I_3 = 0.13 + 0.48 = 0.61 \text{ A}$$

Current flowing through $3\Omega = 0.13 \text{ A } (I_1)$

" " $5\Omega = 0.48 \text{ A } (I_2)$

" " $6\Omega = 0.61 \text{ A } (I_3)$ (5)

SDP

7) i) $y = mx + c$

$(1, 8) (4, -4)$

$$\frac{y_2 - y_1}{x_2 - x_1} = m$$

$$\frac{-4 - 8}{4 - 1} = \frac{-12}{3} = -4 \checkmark$$

$$y = (-4)x + c$$

$$8 = (-4)1 + c$$

$$8 = -4 + c$$

$$12 = c \checkmark$$

$$y = -4(x) + 12 \checkmark$$

(5)

ii) $y = mx + c$

$(-1, 0)$

$$y = \frac{1}{4}(x) + c$$

perpendicular to -4
 $m = \frac{1}{4} \checkmark$

$$0 = \frac{1}{4}(-1) + c$$

$$0 = -\frac{1}{4} + c$$

$$\frac{1}{4} = c \checkmark$$

$$y = \frac{1}{4}(x) + \frac{1}{4} \checkmark$$

(5)

SDP

$$8) a + (n-1)d$$

$$150 + (12-1)79 = 1019 \checkmark$$

(5)

$$9) ar^{n-1} \quad 10r^{5-1} = 600$$

$$r^4 = 60 \rightarrow r = \sqrt[4]{60} \checkmark$$

$$1^{st} \text{ Speed} = 10 \text{ rev/min}$$

$$2^{nd} \text{ " " } = 10(\sqrt[4]{60})^{2-1} = 28 \text{ rev/min} \checkmark$$

$$3^{rd} \text{ " " } = 10(\sqrt[4]{60})^{3-1} = 77 \text{ rev/min} \checkmark$$

$$4^{th} \text{ " " } = 10(\sqrt[4]{60})^{4-1} = 216 \text{ rev/min} \checkmark$$

$$5^{th} \text{ " " } = 600 \text{ rev/min}$$

(7)

Question 1

$$1) F_0 = \frac{1}{2\pi\sqrt{LC}} \quad \text{Find } C$$

$$\sqrt{LC} = \frac{1}{2\pi(F_0)} \Rightarrow LC = \left(\frac{1}{2\pi(F_0)} \right)^2$$

$$C = \frac{\left(\frac{1}{2\pi(F_0)} \right)^2}{L} \checkmark$$

(5)

SDP

Question No.

Examiner Only