



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: HAMMOND

FORENAME(S): JAMES RHYS

1	Student Number	
2	Title of Examination Paper	<u>TCAI</u>
3	Module Code	<u>PCEE4000/ PCPO4000</u>
4	Date and Time of Examination	<u>25/1/2023 1600</u>
5	Examination Venue	<u>Pembrokeshire College</u>
6	Seat Number	
7	Number of Answer Books handed in	

List the numbers of the questions you have attempted	Office Use
1	4
2	16
3	10
4	4
5	14
6	14
7	10
8	4
9	8
Total	84 ✓

second marker
SD Hunt
08/02/23

$$1/ \quad f_{res} = \frac{1}{2} \sqrt{\frac{K}{m}} \quad \text{find } m$$

$$2 f_{res} = \sqrt{\frac{K}{m}} \quad (\times 2) \quad \checkmark$$

$$4 f_{res}^2 = \frac{K}{m} \quad (\times 2) \quad \checkmark$$

$$M 4 f_{res}^2 = K \quad (M) \quad \checkmark$$

$$M = \frac{K}{4 f_{res}^2} \quad (\div 4 f_{res}^2) \quad \checkmark$$

(4)

$$2/ \quad 5(x-1) - 4(3x-1) + 15 = 0$$

$$5x - 5 - 12x + 4 + 15 = 0$$

$$-7x + 14 = 0 \quad \checkmark$$

$$\frac{-7x}{-7} = \frac{-14}{-7}$$

$$x = 2 \quad \checkmark$$

(4)

$$ii) \quad 2x^2 - 5x - 3 = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$* (+) \rightarrow x = \frac{5 + \sqrt{5^2 - 4 \times 2 \times -3}}{2 \times 2} = \underline{\underline{3}} \quad \checkmark$$

$$(-) \rightarrow x = \frac{5 - \sqrt{5^2 - 4 \times 2 \times -3}}{2 \times 2} = \underline{\underline{-\frac{1}{2}}} \quad \underline{\underline{-0.5}} \quad \checkmark$$

(6)

$$iii) \quad 7.5 \times 10^{x-5} = 255$$

$$10^{x-5} = \frac{255}{7.5}$$

$$10^{x-5} = 34 \quad \checkmark$$

$$x-5 = \log_{10}(34) \quad \checkmark$$

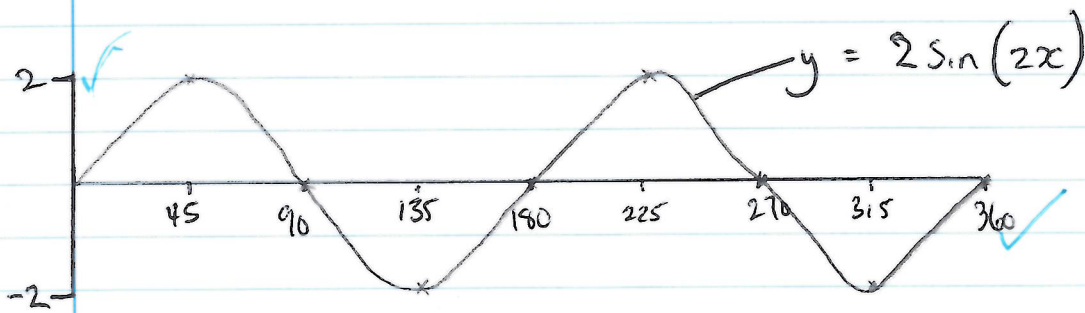
$$x = \log_{10}(34) + 5 \quad \checkmark$$

$$x = \underline{\underline{6.53}} \quad \checkmark$$

(6)

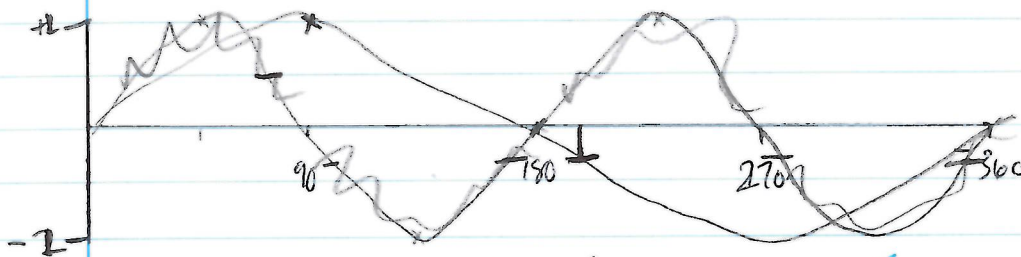
SDP

3i) $y = 2 \sin(2x)$



(6)

ii $\sin 2x = \pm 0.5$ $\sin^{-1}(-0.5) = -30$



$$\begin{aligned}
 180 + 30 &= 210 \\
 360 - 30 &= 330 \\
 210 + 360 &= 570 \\
 330 + 360 &= 690 \\
 570/2 &= 285 \\
 690/2 &= 345
 \end{aligned}$$

$2x = 210^\circ, 285^\circ, 330^\circ, 345^\circ$
 $x = ?$

(4)

4/ $z_1 = -1 + j2$ and $z_2 = 5 + j3$

i) $z_1 - z_2$
 $= (-1 + j2) - (5 + j3)$
 $= -1 - 5 + j2 - j3 = -6 - j$

(2)

SDP

$$4 \text{ ii) } = Z_1 Z_2$$

$$\begin{array}{c|c|c|c} (-1+J2) & \times & (5+J3) & \\ \hline -1 \times 5 & -1 \times J3 & J2 \times 5 & J2 \times J3 \\ \hline -5 & -J3 & J10 & J^2 6 \\ \hline -5 & & & -6 \\ \hline -11 & \text{?} & J7 & \end{array}$$

$$\text{iii) } \frac{Z_1}{Z_2}$$

$$\frac{-1+J2}{5+J3} \times \frac{-5-J3}{-5-J3} = \text{ans}$$

$$\begin{array}{c|c|c|c} -1 \times -5 & -1 \times -J3 & +J2 \times -5 & J2 \times -J3 \\ \hline 5 & J3 & -J10 & -J6 \\ \hline 5 & & & +6 \\ \hline \text{Top} & 11 & -J7 & \end{array}$$

$$\begin{array}{c|c|c|c} 5 \times -5 & 5 \times -J3 & J3 \times -5 & J3 \times J3 \\ \hline -25 & -J15 & -J15 & -9 \\ \hline 25 & & & -9 \\ \hline \text{Bottom} & = 16 & & \end{array}$$

$$\frac{11}{16} \quad \frac{-J7}{16} \quad \times$$

JDP

$$5/ \quad A = \begin{pmatrix} 1 & 0 \\ -2 & 5 \end{pmatrix} \quad B = \begin{pmatrix} 6 & -3 \\ 3 & -1 \end{pmatrix}$$

$$i) \quad 4B - 2A$$

$$4B = 4 \times \begin{pmatrix} 6 & -3 \\ 3 & -1 \end{pmatrix} = \begin{pmatrix} 24 & -12 \\ 12 & -4 \end{pmatrix} = 4B$$

$$2A = 2 \times \begin{pmatrix} 1 & 0 \\ -2 & 5 \end{pmatrix} = \begin{pmatrix} 2 & 0 \\ -4 & 10 \end{pmatrix} = 2A$$

$$\begin{pmatrix} 24 & -12 \\ 12 & -4 \end{pmatrix} - \begin{pmatrix} 2 & 0 \\ -4 & 10 \end{pmatrix} = \begin{pmatrix} 22 & 0 \\ 16 & -14 \end{pmatrix} = 4B - 2A$$

(2)

$$ii) \quad AB = \begin{pmatrix} 1 & 0 \\ -2 & 5 \end{pmatrix} \times \begin{pmatrix} 6 & -3 \\ 3 & -1 \end{pmatrix}$$

$1 \times 6 = 6$
 $0 \times 3 = 0$
 $-2 \times 6 = -12$
 $5 \times 3 = 15$

$1 \times -3 = -3$
 $0 \times -1 = 0$
 $-2 \times -3 = 6$
 $5 \times -1 = -5$

$$\begin{pmatrix} 6 & -3 \\ 3 & 1 \end{pmatrix} = AB$$

(3)

$$iii) \quad AB \neq BA$$

$$BA = \begin{pmatrix} 6 & -3 \\ 3 & -1 \end{pmatrix} \times \begin{pmatrix} 1 & 0 \\ -2 & 5 \end{pmatrix}$$

$6 \times 1 = 6$
 $-3 \times -2 = 6$
 $3 \times 1 = 3$
 $-1 \times 5 = -5$

$$\begin{pmatrix} 12 & -15 \\ 5 & -5 \end{pmatrix} \neq AB$$

$6 \times 0 = 0$
 $-3 \times 5 = -15$
 $3 \times 0 = 0$
 $-1 \times 5 = -5$

(3)

5010

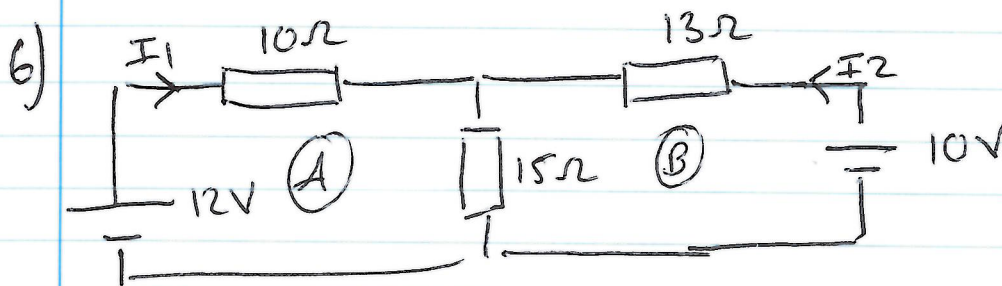
iv) inverse matrix of B

$$\begin{pmatrix} 6 & -3 \\ 3 & -1 \end{pmatrix} \quad \begin{matrix} 6 \times -1 & - & 3 \times -3 \\ -6 & - & -9 \end{matrix} = 3 \checkmark$$

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

$$\frac{1}{3} \times \begin{pmatrix} -1 & +3 \\ -3 & 6 \end{pmatrix} = \begin{pmatrix} -\frac{1}{3} & 1 \\ -1 & 2 \end{pmatrix} \checkmark$$

(6)



$$12 = 10I_1 + 15I_1 + 15I_2$$

$$12 = 25I_1 + 15I_2 \checkmark$$

$$10 = 15I_1 + 13I_2 + 15I_2$$

$$10 = 15I_1 + 28I_2 \checkmark$$

A) $25I_1 + 15I_2 = 12$

B) $15I_1 + 28I_2 = 10$

$$\begin{bmatrix} 25 & 15 \\ 15 & 28 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} 12 \\ 10 \end{bmatrix}$$

$$25 \times 28 - 15 \times 15 = 700 - 225 = 475 \checkmark$$

$$\frac{1}{475} = \begin{matrix} 28 & -15 \\ -15 & 25 \end{matrix} \quad \begin{matrix} 12 \\ 10 \end{matrix}$$

$$\begin{matrix} 28 \times 12 & 336 \\ -15 \times 10 & -150 \end{matrix} = (I_1) 186$$

$$\begin{matrix} -15 \times 12 & -180 \\ 25 \times 10 & 250 \end{matrix} = I_2 70$$

$$I_1 = \frac{186}{475} A \checkmark$$

$$I_1 + I_2 = \frac{186}{475} + \frac{14}{95} = \frac{256}{475} A \checkmark$$

$$I_2 = \frac{70}{475} = \frac{14}{95} A \checkmark$$

$$10\Omega \times \frac{186}{475} A = 0.39 A \quad 13\Omega \times \frac{14}{95} A = 0.14 A$$

$$15 A \times \frac{256}{475} = 0.54 A \checkmark$$

SDP

Rhif y Cwestiwn

(14)

$$10 \Omega \quad \frac{186}{475} A = 0.39 A$$

$$13 \Omega \quad \frac{14}{95} A = 0.14 A \text{ (rounding)}$$

$$15 \Omega \quad \frac{256}{475} A = 0.54 A$$

7/i) Find the equation straight line $(0, 3)$ $(2, -1)$

$$y = mx + c$$

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

$$m = \frac{-1 - 3}{2 - 0} = \frac{-4}{2} = \underline{\underline{-2}} \checkmark$$

$$y = -2x + c$$

$$3 = -2 \times 0 + c$$

$$3 = 0 + c$$

$$\underline{\underline{c = 3}} \checkmark$$

$$\underline{\underline{y = -2x + 3}} \checkmark$$

(6)

ii) perpendicular line passing point $(4, 3)$

$$-\frac{2}{1} = \frac{1}{2} \checkmark$$

$$y = \frac{1}{2}x + c$$

$$3 = \frac{1}{2} \times 4 + c$$

$$3 = 2 + c \checkmark \div 2$$

$$1.5 = c \times$$

$$\underline{\underline{y = \frac{1}{2}x + 1.5}} \times$$

(4)

SDP

8/ Oil Company 50m deep

First = £23 £2 per meter

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

$$23 + (50-1)2$$

$$23 + 49 \times 2 = 102 \times 2 = 204$$

$$\frac{(a+L)}{2} \times n$$

$$\frac{(23 + 121)}{2} \times 50$$

$$= 13600$$

9/ drilling machine

$$a = 50$$

$$ar^{n-1} = 500$$

$$50r^{n-1} = 500$$

$$r^{n-1} = 10$$

$$r^3 = 10$$

$$r = \sqrt[3]{10}$$

$$50 \times \sqrt[3]{10}^n$$

$$1/ 50 \times \sqrt[3]{10}^0 = 50 \text{ rev/min}$$

$$2/ 50 \times \sqrt[3]{10}^1 = 108 \text{ rev/min}$$

$$3/ 50 \times \sqrt[3]{10}^2 = 232 \text{ rev/min}$$

$$4/ 50 \times \sqrt[3]{10}^3 = 500 \text{ rev/min}$$

4

8

SDP