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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.

1	Student Number	
2	Title of Examination Paper	TCA 1
3	Module Code	PL EE 4000 PC PD 4000
4	Date and Time of Examination	25 th Jan 23 16:00
5	Examination Venue	Pembrokeshire College
6	Seat Number	
7	Number of Answer Books handed in	

Complete, fold and seal
(see note 2 below)

SURNAME: Gucic

FORENAME(S): Aleksandar

List the numbers of the questions you have attempted	Office Use
1	3
2	16
3	12
4	15
5	14
6	14
7	12
8	4
9	8
Total	98 ✓

Second Marker
SOLIC
08/02/23

$$\textcircled{1} \text{ Fres} = \frac{1}{2} \sqrt{\frac{k}{M}}$$

$$2\text{Fres} = \sqrt{\frac{k}{M}} \quad \checkmark$$

$$4\text{Fres}^2 = \frac{k}{M} \quad \checkmark$$

$$4\text{Fres}^2 M = k \quad \checkmark$$

$$\therefore M = \frac{k}{4\text{Fres}^2} \quad \textcircled{3} \quad \times$$

$$\textcircled{2} \text{ i) } 5(x-1) - 4(3x-1) + 15 = 0$$

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

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

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

$$x = \frac{-14}{-7} = 2 \quad \checkmark \quad \textcircled{4}$$

$$\text{ii) } 2x^2 - 5x - 3 = 0$$

$$\frac{+5 \pm \sqrt{5^2 - 4(2)(-3)}}{2(2)}$$

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

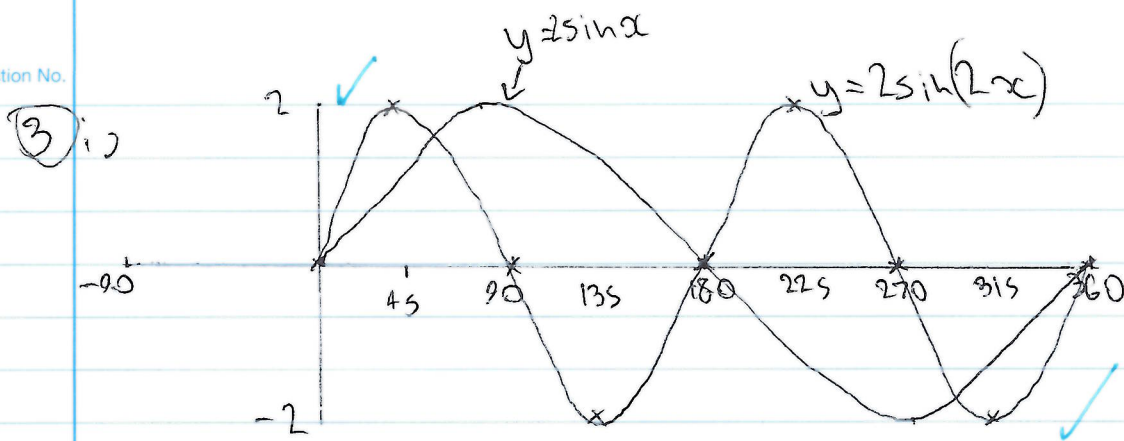
$$x = 3 \quad \checkmark \quad \textcircled{6}$$

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

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

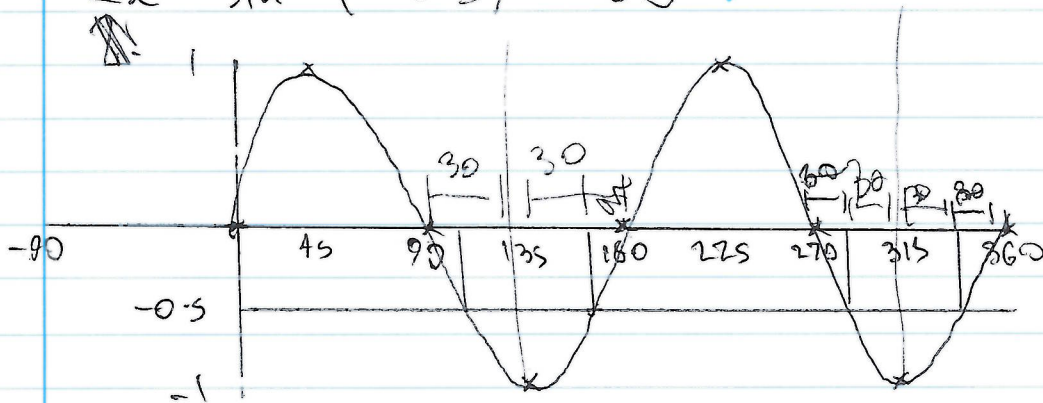
$$x-5 = \log 34 \quad \checkmark$$

$$x = \log 34 + 5 = 6.53 \quad \checkmark \quad \textcircled{6}$$



ii) $\sin 2x = -0.5$

$2x = \sin^{-1}(-0.5) = -30$ ✓



$\sin(2(135 - 30)) = -0.5 \therefore x = 135 - 30 = 105$ ✓

$\sin(2(135 + 30)) = -0.5 \therefore x = 135 + 30 = 165$ ✓

$\sin(2(315 - 30)) = -0.5 \therefore x = 315 - 30 = 285$ ✓

$\sin(2(315 + 30)) = -0.5 \therefore x = 315 + 30 = 345$ ✓

④ $z_1 = -1 + j2$ $z_2 = 5 + j3$

i) $-1 + j2 - (5 + j3)$

$-1 + j2 - 5 - j3 = -6 - j1$ ✓

ii) $z_1 z_2 = (-1 + j2)(5 + j3) = -5 - j3 + j10 + j^2 6$
 $= -5 + j7 - 6$
 $= -11 + j7$ ✓

$$\text{iii)} \quad \frac{z_1}{z_2} = \frac{-1+j2}{5+j3} \times \frac{5-j3}{5-j3} = \frac{-5+j3+j10-j^2 6}{25-j15+j15-j^2 9}$$

$$= \frac{-5+j13-(-1)6}{25-(-1)9}$$

$$= \frac{1+j13}{34}$$

$$= \frac{1}{34} + j\frac{13}{34}$$

(5)

$$\text{iv)} \quad r = \sqrt{5^2 + 3^2} = \sqrt{34}$$

$$\tan \theta = \frac{O}{A}$$

$$\theta = \tan^{-1} \left(\frac{3}{4} \right) = 36.87$$

$$(\sqrt{34})^4 \angle 36.87 \times 4$$

$$1156 \angle 147.48$$

$$180 - 147.48 = 32.52$$

$$\cos = \frac{A}{H}$$

$$\sin = \frac{O}{H}$$

$$\cos(32.52) = \frac{x}{1156}$$

$$1156 \cos(32.52) = 974.74$$

$$1156 \sin(32.52) = 626.3$$

$$= 974.74 + j626.3$$

500

3

③

(2)

(6)

50

rhif y Cwestiwr

rhif y Cwestiwr

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

$$\textcircled{6} \quad 12 = 10I_1 + 15I_1 + 15I_2 \\ = 25I_1 + 15I_2 \quad \checkmark$$

$$10 = 13I_2 + 15I_2 + 15I_1 \\ = 15I_1 + 28I_2 \quad \checkmark$$

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

$$|\det| = 25 \times 28 - 15 \times 15 = 475 \quad \checkmark$$

$$\frac{1}{475} \begin{bmatrix} 28 & -15 \\ -15 & 25 \end{bmatrix} \begin{bmatrix} 12 \\ 10 \end{bmatrix} = \frac{1}{475} \begin{bmatrix} 28 \times 12 - 15 \times 10 \\ -15 \times 12 + 10 \times 25 \end{bmatrix} \quad \checkmark$$

$$\frac{1}{475} \begin{bmatrix} 186 \\ 70 \end{bmatrix} = \begin{bmatrix} \frac{186}{475} \\ \frac{14}{95} \end{bmatrix} \quad \checkmark$$

current through 10Ω resistor is $\frac{186}{475} \text{ A} \quad \checkmark$

current through 13Ω resistor is $\frac{14}{95} \text{ A} \quad \checkmark$

current through 15Ω resistor is $\frac{186}{475} + \frac{14}{95} = \frac{256}{475} \text{ A} \quad \checkmark$

$$\textcircled{2} \text{ i) } (0, 3) \quad (2, -1)$$

$$m = \frac{3 - (-1)}{0 - 2} = -2 \quad \checkmark$$

$$y = mx + c$$

$$3 = -2(0) + c \quad \therefore c = 3 \quad \checkmark$$

$$y = -2x + 3 \quad \checkmark$$

$$\text{ii) } (4, 3) \quad m = \frac{1}{2} \quad \checkmark$$

$$y = mx + c$$

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

$$3 = 2 + c \quad \therefore c = 1 \quad \checkmark$$

$$y = \frac{1}{2}x + 1 \quad \checkmark$$

14

6

6

⑧

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

$$23 + (20-1) \times 2 = \pounds 61$$

$$\text{avg} = \frac{a+L}{2} \Rightarrow \frac{23+61}{2} = \pounds 42 \quad 42 \times 20 = \pounds 840$$

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

$$23 + (50-1) \times 2 = \pounds 121 \quad \checkmark$$

$$\text{avg} = \frac{a+L}{2} = \frac{23+121}{2} = \pounds 72$$

turns (avg) $\downarrow$

$$72 \times 50 = \pounds 3600 \quad \checkmark$$

⑨

$$ar^{n-1} = \text{max}$$

$$50r^3 = 500$$

$$r^3 = 10$$

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

$$50(\sqrt[3]{10})^1 = 108 \text{ rev/min} \quad \checkmark$$

$$50(\sqrt[3]{10})^2 = 232 \text{ rev/min} \quad \checkmark$$

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

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

④

⑧

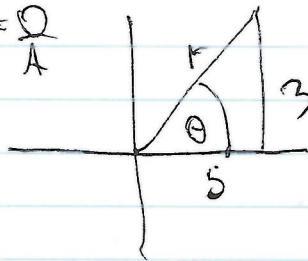
DSE

~~$$\begin{aligned}(5+j3)(5+j3) &= 25 + j15 + j15 + j^2 9 \\&= 25 + j30 - 9 \\&= 16 + j30\end{aligned}$$~~

~~$$\begin{aligned}(16+j30)(16+j30) &= 256 + j480 + j480 + j^2 900 \\&= 256 + j960 - 900 \\&= -644 + j960\end{aligned}$$~~

iv) $r = \sqrt{5^2 + 3^2} = \sqrt{34}$ $\tan \theta = \frac{Q}{A}$

$$\theta = \tan^{-1}\left(\frac{3}{5}\right) = 30.96^\circ$$



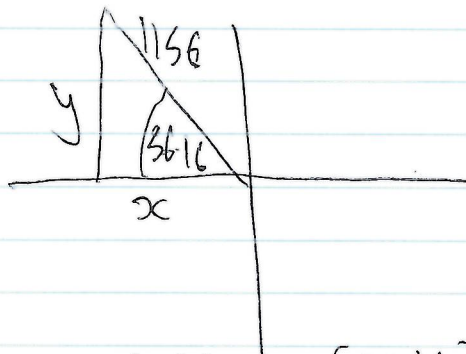
$$(\sqrt{34})^4 \angle 30.96 \times 4$$

$$1156 \angle 123.84^\circ$$

$$180 - 123.84 = 56.16$$

$$\sin = \frac{Q}{H}$$

$$\cos = \frac{A}{H}$$



$$\cos(56.16) = \frac{x}{1156} \quad \therefore x = 1156 \cos(56.16) = 643.75$$

$$\sin(56.16) = \frac{y}{1156} \quad \therefore y = 1156 \sin(56.16) = 960.17$$

$$-643.75 + j960.17$$

5

SDP

$$\frac{1}{2} \frac{k}{m} = f_{res}$$

$$\frac{k}{m} = 2 f_{res}$$

$$\frac{k}{m} = 4 f_{res}^2$$

$$\frac{k}{4 f_{res}^2} = 4 f_{res}^2 m$$

$$2) S(x-1) - (3x-1) + 15 = 0$$

$$5x - 3 - 12x + 4 + 15 = 0$$

$$-7x + 14 = 0$$

$$7x = -14$$

$$-1 + j2 - (5 + j3)$$

$$-1 + j2 - 5 - j3 = -6 - j1$$

$$(-1 + j2)(5 + j3) = -5 - j3 + j10 + j^2 6$$

$$= -5 + j7 - 6$$

$$= -11 + j7$$

$$\frac{-1 + j2}{5 + j3}$$

$$\frac{5 - j3}{5 - j3}$$

$$= \frac{-5 + j3 + j10 - j^2 6}{25 + j15 - j15 - j^2 9}$$

$$= \frac{-5 + j7 + 6}{25 + 9}$$

$$= \frac{-11 + j7}{34}$$

$$5) \quad 4 \begin{pmatrix} 6 & -3 \\ 3 & -1 \end{pmatrix} - 2 \begin{pmatrix} 1 & 0 \\ -2 & 5 \end{pmatrix}$$

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

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

$$= \begin{pmatrix} 6 & -3 \\ -12 & 6-5 \end{pmatrix} = \begin{pmatrix} 6 & -3 \\ 3 & 1 \end{pmatrix}$$

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

$$= \begin{pmatrix} 6+6 & -15 \\ 3+2 & -5 \end{pmatrix} = \begin{pmatrix} 12 & -15 \\ 5 & -5 \end{pmatrix}$$

$$|B| = (6 \times -1) - (3 \times 3) = -9 - 9 = -18$$

$$B^{-1} \begin{bmatrix} -1 & 3 \\ 3 & 6 \end{bmatrix} \frac{1}{-18} = \begin{bmatrix} -\frac{1}{18} & \frac{1}{6} \\ -\frac{1}{6} & \frac{1}{3} \end{bmatrix}$$