



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.**

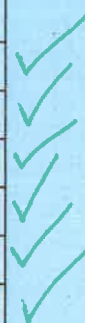
Complete, fold and seal
(see note 2 below)

SURNAME: HUNT

FORENAME(S): JOSHUA
LEE

1	Student Number	1604816/1
2	Title of Examination Paper	Dynamics, Control and Instrumentation
3	Module Code	GOAC4005-006
4	Date and Time of Examination	16/05/18
5	Examination Venue	Main Hall
6	Seat Number	9
7	Number of Answer Books handed in	1

List the numbers of the questions you have attempted	Office Use
Q1	10
Q2	7
Q3	0
Q4	13
Q5	10
Q6	1
Total	41

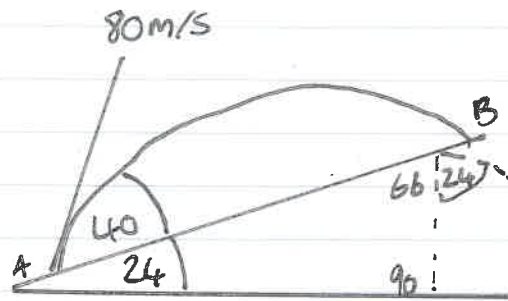


59% ✓

Question one

$g = 9.81 \text{ m/s}^2$

$$\begin{aligned}
 V &= u + at \\
 S &= \left(\frac{u+V}{2}\right)t \\
 S &= ut + \frac{1}{2}at^2 \\
 V^2 - u^2 &= 2aS
 \end{aligned}$$



	Horizontal	Plane	90° to Plane
initial velocity u	$80 \cos 64$	$80 \cos 40$	$80 \sin 40$
Final velocity V	$80 \cos 64$	?	?
acceleration A	0	$-9.81 \cos 66$	$-9.81 \cos 24$
Time T	11.489	11.489	11.489
Distance S		441.015	0

① $S = ut + \frac{1}{2}at^2$ ✓

$$\begin{aligned}
 0 &= (80 \sin 40)t + \frac{1}{2}(-9.81 \cos 24)t^2 \\
 &= -80 \sin 40 - 4.9 \cos 24 t \\
 &= -51.423 - 4.476 t \\
 t &= \frac{51.423}{4.476} = 11.489 \text{ Sec} \quad \checkmark
 \end{aligned}$$

6 ✓

② $S = ut + \frac{1}{2}at^2$ ✓

$$\begin{aligned}
 S &= (80 \cos 40)(11.489) + \frac{1}{2}(-9.81 \cos 66)(11.489^2) \\
 S &= 704.087 - (4.9 \cos 66)(11.489^2) \\
 &= 704.087 - 263.072 \\
 &= 441.015 \text{ m} \quad \checkmark
 \end{aligned}$$

4 ✓

Question Two

$$\textcircled{A} \quad S = 17t^2 + 10t$$

$$\textcircled{B} \quad S = 9t^2 + 30$$

A

$$\textcircled{A} \quad \frac{ds}{dt} = 34t + 10 \quad \textcircled{B} \quad \frac{ds}{dt} = 18t$$

$$\textcircled{A} = 2 \times \textcircled{B}$$

$$34t + 10 = 2 \times 18t$$

$$34t + 10 = 36t$$

$$34t = 26t$$

$$t = \frac{-34}{26} = \underline{-1.38 \text{ sec}}$$

2.
✓B

$$\textcircled{A} \quad \begin{array}{l} t @ 0 \\ S = (17 \times 0^2) + (10 \times 0) \\ = 0 \end{array}$$

$$\begin{array}{l} t @ 4 \text{ seconds} \\ S = (17 \times 4^2) + (10 \times 4) \\ 272 + 40 \end{array}$$

$$\text{Answer } \textcircled{A} = 312$$

$$\textcircled{B} \quad \begin{array}{l} t @ 0 \text{ seconds} \\ S = (9 \times 0^2) + 30 \\ = 30 \end{array}$$

$$\begin{array}{l} t @ 4 \text{ seconds} \\ S = (9 \times 4^2) + 30 \\ 144 + 30 \\ = 174 \end{array}$$

$$174 - 30 = \underline{144}$$

4.
✓C

$$\textcircled{A} \quad \frac{dv}{dt} = 34 \text{ m/s}^2$$

$$\text{After } 8 \text{ seconds} = 34 \text{ m/s}^2$$

1.
✓

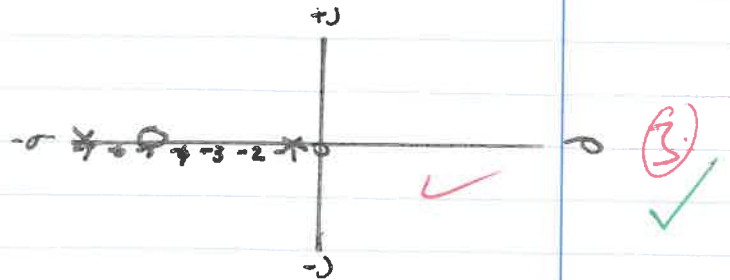
Question Four

$$G_s = \frac{(s+5)}{s^2 + 8s + 7} \quad \begin{array}{l} \text{Zeros } \circ \\ \text{Poles } \times \end{array}$$

$$a) \quad = \frac{(s+5)}{(s+7)(s+1)}$$

$$\text{Zeros} = -5$$

$$\text{Poles} = -7, -1$$



b) DC Response - $s=0$

$$\frac{(0+5)}{(0+7)(0+1)} = \frac{5}{7}$$

Using Partial fractions

c)

$$G_s = \frac{(s+5)3}{(s+7)(s+1)} = \frac{A}{s} + \frac{B}{s+7} + \frac{C}{s+1}$$

$$= \frac{(s+5)3}{(s+7)(s+1)} = \frac{A(s+7)(s+1) + Bs(s+1) + Cs(s+7)}{(s+7)(s+1)}$$

Find A $s=0$

$$(0+5)3 = A(0+7)(0+1) + 0 + 0$$

$$15 = A7$$

$$A = \frac{15}{7}$$

Question Four Continued

$$(s+5)^3 = A(s+7)(s+1) + Bs(s+1) + Cs(s+7)$$

find B $s = -7$

$$\begin{aligned} (-7+5)^3 &= 0 + B(-7)(-7+1) + 0 \\ -6 &= B(42) \\ B &= \frac{-6}{42} \end{aligned}$$

find C $s = -1$

$$\begin{aligned} (-1+5)^3 &= 0 + 0 + C(-1)(-1+7) \\ 12 &= C(-6) \\ C &= \frac{-12}{6} \end{aligned}$$

$$= -\frac{15}{7(s)} - \frac{6}{42(s+1)} - \frac{12}{6(s+1)}$$

$$\mathcal{L} = -\frac{15}{7} - \frac{6e^{-7t}}{42} - \frac{12e^{-t}}{6}$$

after 2 seconds

$$\frac{15}{7} - \frac{6e^{-7(2)}}{42} - \frac{12e^{-2}}{6}$$

$$= \frac{15}{7} - \frac{6e^{-14}}{42} - \frac{12e^{-2}}{6}$$

7.

Question Five

$$2s^5 + 3s^4 + 2s^3 + s^2 - s + 4$$

s^5	2	2	-1	✓	
s^4	3	1	4	✓	$-\left(\frac{ad-cb}{c}\right)$
s^3	1.33	-3.66	0	✓	
s^2	9.25	4	0	✓	
s^1	-4.24	0	0	✓	$s^3 = \left(\frac{(2 \times 1) - (2 \times 3)}{3}\right) = 1.33$
s^0	4	0	0		

Answer

$$s^3 = \left(\frac{(2 \times 4) - (3 \times 1)}{3}\right) = -3.66$$

* Unstable, goes from positive to negative $s^2 = \left(\frac{(3 \times -3.66) - (1.33 \times 1)}{1.33}\right) = 9.25$

* 2 Poles are in the RH plane ✓

$$s^2 = \left(\frac{(3 \times 0) - (1.33 \times 4)}{1.33}\right) = +4$$

$$s^1 = \left(\frac{(1.33 \times 4) - (9.25 \times -3.66)}{9.25}\right) = -4.24$$

$$s^0 = \left(\frac{(9.25 \times 0) - (-4.24 \times 4)}{-4.24}\right) = 4$$

10
✓

Question Six

