



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)

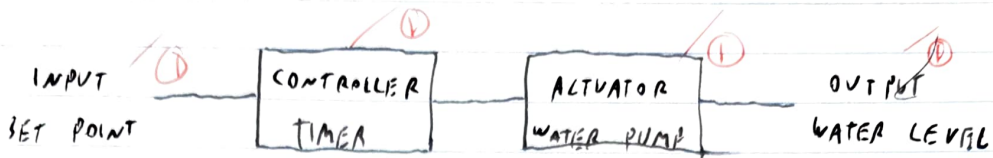
SURNAME: JONES

FORENAME(S): MICHAEL HYNEL

1	Student Number	JON 11801980
2	Title of Examination Paper	DYNAMICS, CONTROL AND INSTRUMENTATION
3	Module Code	GDEE4002
4	Date and Time of Examination	12/5/26 10.00
5	Examination Venue	68860
6	Seat Number	C2
7	Number of Answer Books handed in	

List the numbers of the questions you have attempted	Office Use
Q1 (a)	4
(b)	2
(c)	5
(d)	7
Q2 (a)	0
(b)	0
Q3 (a)	4
(b)	3
(c)	1
(d)	5
Q4 (a)	5
Q5 (a)	5
(b)	6
Total	47% E.N.

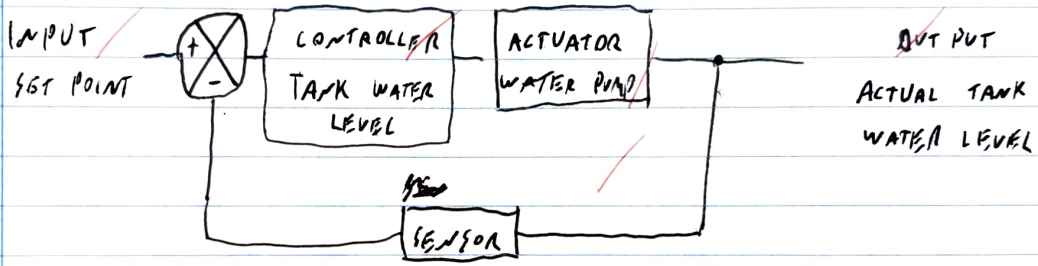
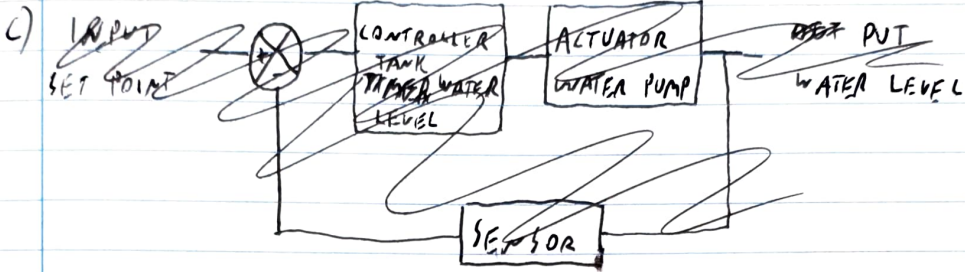
Q. a)



Q1 (a)
4

b) THERE IS NO FEED BACK SYSTEM SO THE OPEN LOOP SYSTEM WILL NOT CHANGE STATE. (2)

Q1 (b)
2



Q1 (c)
5

~~DEL~~

Q. d)
i)

$$T_{cl} = \frac{K_p \left(\frac{5}{s+3} \right)}{1 + \left(\frac{5}{s+3} \right) K_p (1)}$$

Q1 (d)
(i) 4

$$= \frac{\cancel{5K_p} s+3}{1 + \frac{5K_p}{s+3}} = \frac{\cancel{5K_p} s+3}{\frac{5K_p + s+3}{s+3}}$$

$$T_{cl} = \frac{5K_p}{s+3} \times \frac{s+3}{5K_p + s+3}$$

$$= \frac{5K_p}{5K_p + s+3}$$

ii)

$$L_{SET} = 100 \quad L = \frac{100}{s}$$

Q1 (d)
(ii) 3

~~100~~
~~s+3~~

$$L_{ss} = \lim_{s \rightarrow 0} s \left(\frac{5K_p}{s+5K_p+3} \times \frac{100}{s} \right)$$

$$= \lim_{s \rightarrow 0} s \left(\frac{500K_p}{s(s+5K_p+3)} \right)$$

$$= \lim_{s \rightarrow 0} \left(\frac{500K_p}{s+5K_p+3} \right)$$

$$L_{ss} = \frac{500K_p}{5K_p+3}$$

Q 2(a)

0

Q2 a)

~~Handwritten~~

$$40 - (5 \times 9.81 \times \sin(30^\circ))$$

$$F = m \cdot a$$

$$= 5 \times 0.25 \times 9.81$$

$$= 12.26 \text{ N}$$

$$ma = 40 - (5 \times 9.81 \times \sin(30^\circ)) - (5 \times 9.81 \times 0.25)$$

$$ma = 10.98$$

$$a = \frac{10.98}{5}$$

$$F = 40 - 12.26 = 27.74 \text{ N}$$

$$F = ma$$

$$a = 2.19 \text{ m/s}^2$$

$$a = \frac{F}{m}$$

$$a = \frac{27.74}{5}$$

$$a = 5.548 \text{ m/s}^2$$

b)

$$F = ma$$

$$F = 5 \left(\frac{1}{m_s + 0.4} \right)$$

$$F = 5 \left(\frac{1}{m_s + 0.4} \right)$$

$$F = \frac{m}{1.5 + 0.4}$$

$$F = 2.67 \text{ mN}$$

$$F = 5 \left(\frac{1}{0.4 + 1.5} \right)$$

$$F =$$

Q 2(b)

0

Q3 a) ZEROS - $s+3$
 $s=-3$ ✓ ①

POLES - $s+4$
 $s=-4$ ✓ ①

$$(s^2 + 3s + 6) = \frac{-3 \pm \sqrt{3^2 - 4 \times 1 \times 6}}{2 \times 1}$$

$$= \frac{-3 \pm \sqrt{-15}}{2}$$

$$* = \frac{-3 \pm j\sqrt{15}}{2}$$

$$\frac{-3 + 3.87j}{2}$$

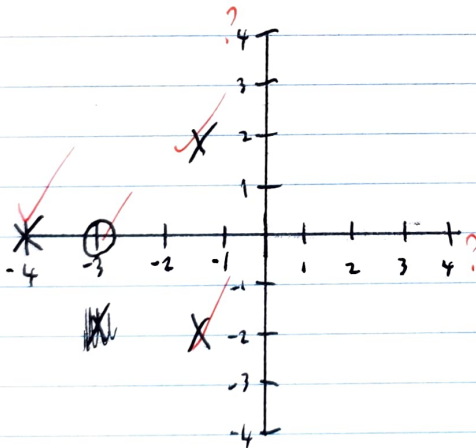
$$\frac{-3 - 3.87j}{2}$$

$$\downarrow$$

$$-1.5 + 1.94j$$

$$-1.5 - 1.94j$$

b)



c) OPEN LOOP SYSTEM WILL RAPIDLY OSCILLATE UNTIL REACHING A STEADY STATE ✓

Q3(a)
4

Q3(b)
3

Q3(c)
1

d)

$$s = \frac{-1 + 2j}{(-1 + 2j + 4)(-1 + 2j)^2 + 3(-1 + 2j) + 6}$$

~~$$= \frac{2 + 2j}{(3 + 2j)(-2 - 4j - 3 + 6j + 6)}$$~~

Error in expanding brackets

$$(-1 + 2j)^2 = -2 - 4j$$

$$3(-1 + 2j) = -3 + 6j$$

$$= \frac{2 + 2j}{(3 + 2j)(-2 - 4j - 3 + 6j + 6)}$$

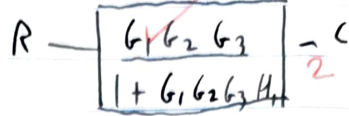
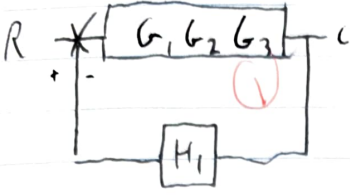
$$= \frac{2 + 2j}{(3 + 2j)(-1 + 2j)}$$

$$= \frac{2 + 2j}{-3 + 6j - 2j + 3}$$

$$= \frac{2 + 2j}{4j}$$

Q 3(d)
5

Q4 a)

Q4 a)
5

$$\frac{Y_s}{R_s} = \left(\frac{4}{s+4} \right) * \left(\frac{2}{s+3} \right) \left(\frac{5}{s+1} \right) \quad \checkmark \textcircled{2}$$

$$1 + \left(\frac{4}{s+4} \right) \left(\frac{2}{s+3} \right) \left(\frac{5}{s+1} \right) \left(\frac{s}{s+2} \right)$$

Q5 a) i)

$$\frac{V_{O(s)}}{V_{I(s)}} = \frac{\frac{1}{sC}}{R + \frac{1}{sC}}$$

$$= \frac{\frac{1}{sC}}{R + \frac{1}{sC}} \quad \checkmark \times sC$$

$$= \frac{1}{1 + CRs} \quad \checkmark$$

$$\text{ii) } \frac{V_o}{V_i} = \frac{1}{1 + CRs}$$

Q5 (a)

iii) Low PASS FILTER DUE TO HIGH CAPACITY IMPEDANCE THAT
 ALLOWS LOW FREQUENCY TO FLOW BUT BLOCK HIGH FREQUENCY

(ii) 2

Q5 b)i

$$\omega_n = \sqrt{\frac{1}{LC}}$$

✓ ①

Q5(b)
(1) 6

$$\omega_n = \sqrt{\frac{1}{2 \times 25 \times 10^{-6}}} = 141.42 \text{ RAD/S}$$

✓ ①

$$2\zeta\omega_n = \frac{R}{L}$$

✓ ①

$$2\zeta 141.42 = \frac{150}{2}$$

✓ ①

$$\zeta = \frac{75}{282.84}$$

$$\zeta = 0.27$$

✓ ①

 $\zeta < 1 = \text{UNDER DAMPED}$

✓ ①



CYFENW:

12 Tudalen

ENW(AU) CYNTAF:

- | | | |
|---|---|--|
| 1 | Rhif Myfyriwr | |
| 2 | Teitl y Papur
Arholiad | |
| 3 | Cod y Modwl | |
| 4 | Dyddiad ac Amser yr
Archoliad | |
| 5 | Lleoliad yr Arholiad | |
| 6 | Rhif Sedd | |
| 7 | Nifer y Llyfrau Atebion
a gyflwynwyd | |

[illegible]

(See the other side for English version)