



Complete, fold and seal
(see note 2 below)

SURNAME:

Prescott

FORENAME(S):

Kieran

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.**

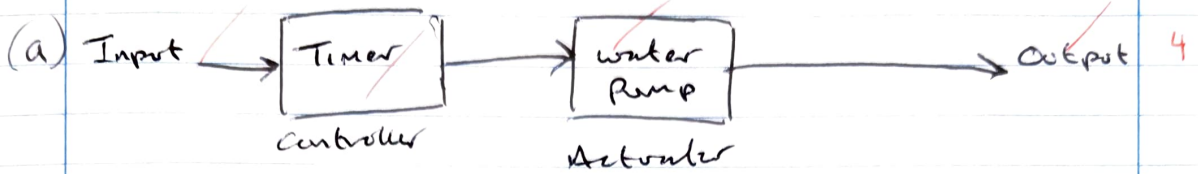
1	Student Number	PRE08094825
2	Title of Examination Paper	Dynamics Control Instrumentation
3	Module Code	GOEE 4002
4	Date and Time of Examination	12/05/2026 10:00 AM
5	Examination Venue	Main Hall/ Main Site
6	Seat Number	C4
7	Number of Answer Books handed in	1

List the numbers of the questions you have attempted	Office Use
Q1 (a)	4
(b)	1
(c)	5
(d)	6
Q2 (a)	1
(b)	2
(c)	1
(d)	0
Q3 (a)	4
(b)	4
(c)	4
Q4 (a)	6
Q5 (a)	2
(b)	5
Total	45 %

45 % RK
EN.

Q1 (Water pump Activator) (Water sensor) (Controller)

Q1(a)

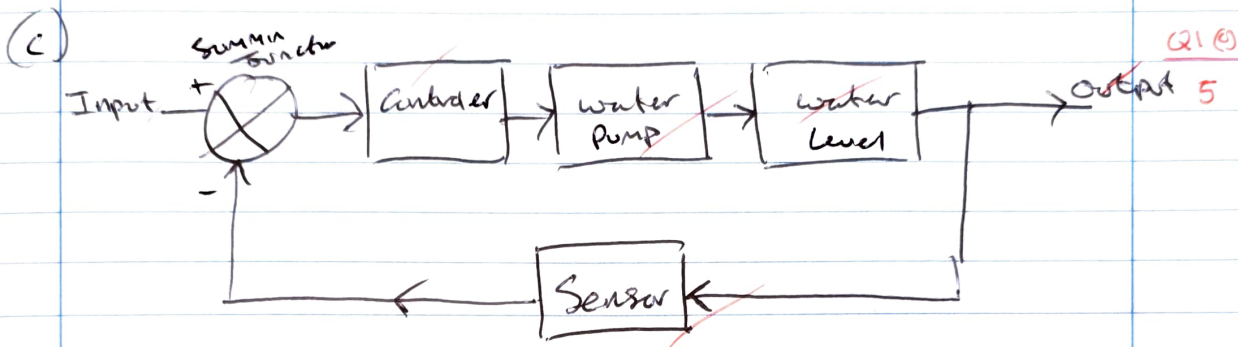


4

(b) System would not respond as there is no feedback loop, pre-set filling times would continue to operate as pre defined.

Q1(b)

1



Q1(c)

5

(d) KP gain
only feedback $H(s) = 1$
 $L_{set} = 100cm$

Q1(d)

4

(i) $G(s) = \frac{5}{s+3}$

$$T(s) = \frac{Y(s)}{R(s)} = \frac{KP G(s)}{1 + KP G(s) H(s)}$$

$$T(s) = \frac{KP \frac{5}{s+3}}{1 + KP \left(\frac{5}{s+3} \right)}$$

$$T(s) = \frac{\frac{5KP}{s+3}}{\frac{5}{s+3} + KP}$$

$$T(s) = \frac{5KP}{s + (3 + 5KP)}$$

Q1 (ii) $\frac{5KP}{s + (3 + 5KP)}$ $\frac{100}{s}$ $LSS = 100cm$ A unit step $\frac{1}{s}$

$\frac{500KP}{3 + 5KP}$

Q1 (d)

(i) 2

Q2 $M = 6kg$ $\theta = 20^\circ$ $\mu = 0.25$ $F = 40N$

Q2 (a)

1

(a) $F_{net} = Ma = m \frac{dz}{dt^2}$ $F_f = \mu \cdot M \cdot g$

$F_f = 0.25 \times 6 \times 9.81 = 14.715$

$40 - 14.715 = 25.28N$

(b) $G(s) = \frac{1}{ms + b}$

Q2 (b)

(i) 2

(ii) 0

at steady state $G(s) = 0$

$G(s) = \frac{1}{ms + b}$

$\frac{1}{+0.4} = 2.5 m/s$

(ii) At steady state $G(0)$ is equal to zero

Question No.

C
(i)

$$\sum F_{\text{net}} = ma$$

$$F - mg \sin \theta - f_f = ma \quad (1)$$

(ii)

$$F_{\text{net}} = ma = m \frac{dv}{dt} \quad \times$$

(d)

$$0.02 \text{ V/m} \quad 1.5 \text{ m/s}$$

$$6 \times 0.02 = 0.12 \text{ V} \quad \times$$

Q 2(c)

(i) 1

(ii) 0

Q 2(d)

0

Q3

$$G(s) = \frac{(s+3)}{(s+4)(s^2+3s+6)}$$

Zeros

Poles

Q3(a)

4

(a) Zeros = $s+3$

$s = -3$ ✓ ①

Poles = $s+4$ ✓

$s = -4$ ✓ ①

$$\frac{-(B) \pm \sqrt{(B)^2 - 4(A)(C)}}{2(A)}$$

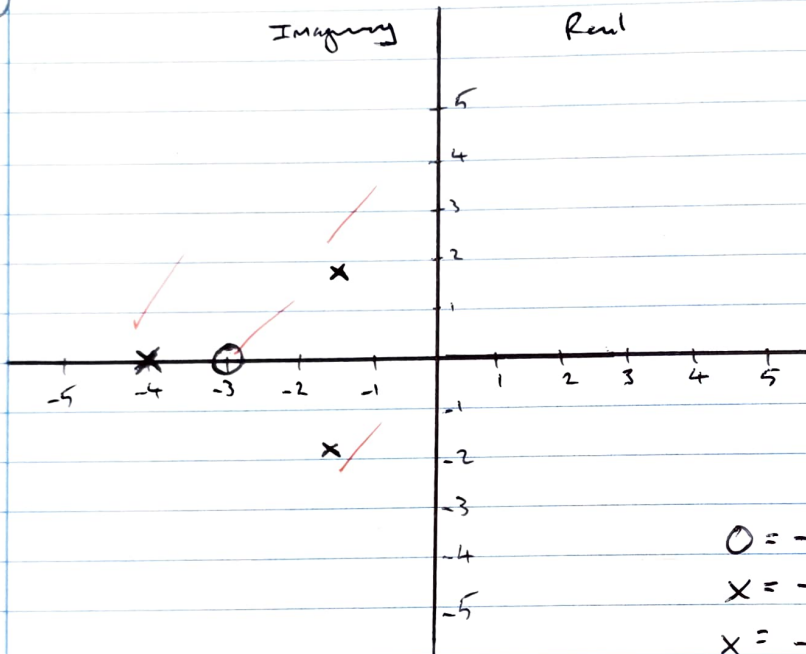
$$\frac{-3 + \sqrt{15}i}{2}$$

$$\frac{-3 - \sqrt{15}i}{2}$$

$$-1.5 + 1.94i$$

$$-1.5 - 1.94i$$

(b)



Zero = 0

Poles = x

0 = -3

x = -4

x = -1.5 + 1.94i

x = -1.5 - 1.94i

(c) System operates in the imaginary showing no system feedback

Q3(b)

4

Q3(c)

0

Q3
(d)

$$s = -1 + 2j$$

$$\frac{(s+3)}{(s+4)(s^2+3s+6)}$$

Q3(d)
4

$$-1 + 2j + 3 = 2 + 2j \quad \checkmark \textcircled{1}$$

$$-1 + 2j + 4 = 3 + 2j \quad \checkmark \textcircled{1}$$

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

$$(-1+2j)(-1+2j) + 3(-1+2j) \quad \checkmark \textcircled{1}$$

$$1 - 2j - 2j - 4j - 3 + 6j + 6 \quad \checkmark \textcircled{1}$$

$$4 - 2j \quad \times$$

$$\frac{2+2j}{(3+2j)(4-2j)} \quad \times$$

$$12 - 6j + 8j + 4j$$

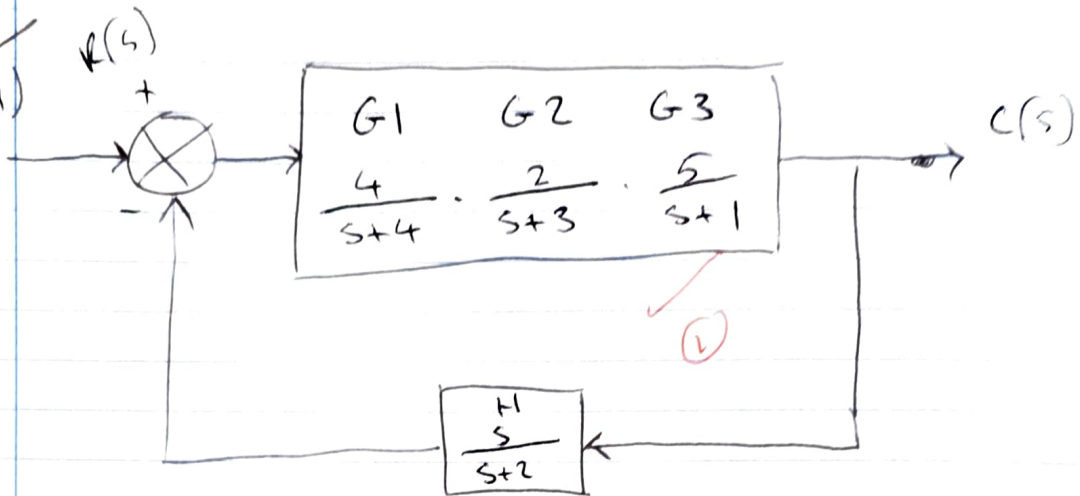
$$12 + 6j$$

$$\frac{2+2j}{12+6j} \quad \frac{12-6j}{12-6j} \quad \times$$

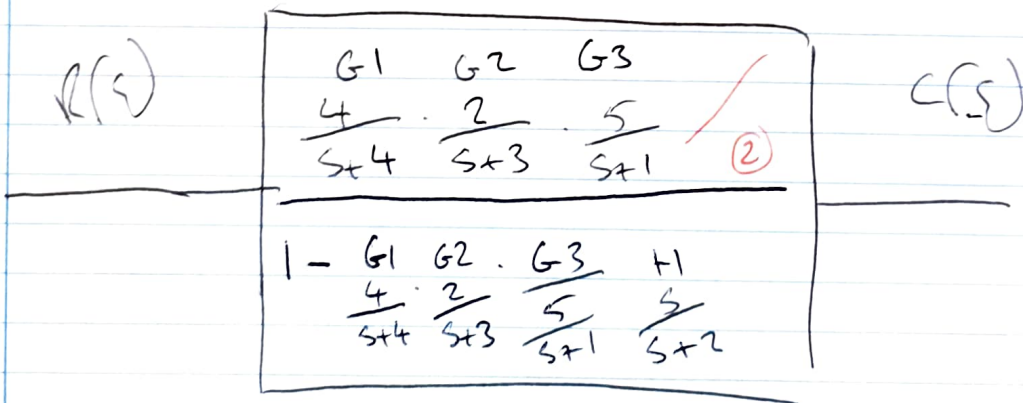
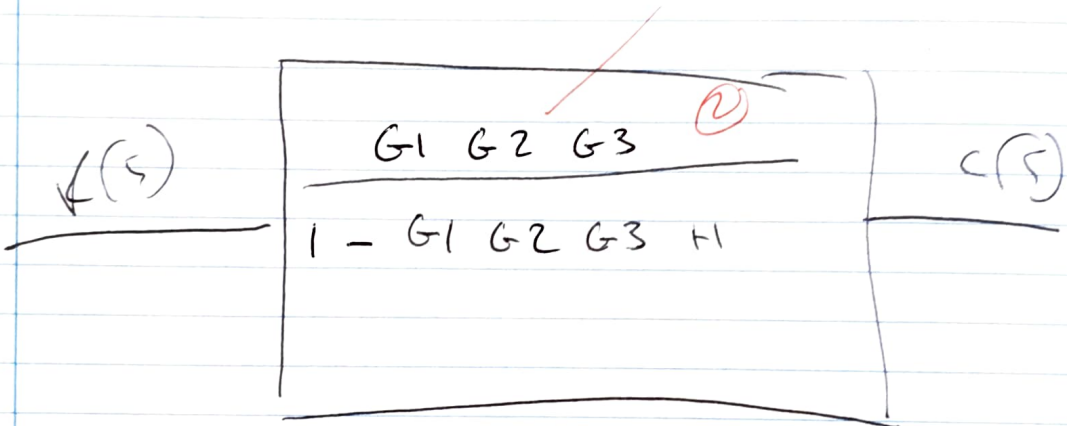
$$\frac{2}{12} + \frac{2j}{6j}$$

$$\frac{1}{6} + \frac{1}{3}j$$

$$0.16 > 0.333j \quad \times$$

Q4
(a)

$$\frac{Y(s)}{R(s)} = \frac{G(s)}{1 \pm G(s)H(s)} \quad \checkmark$$

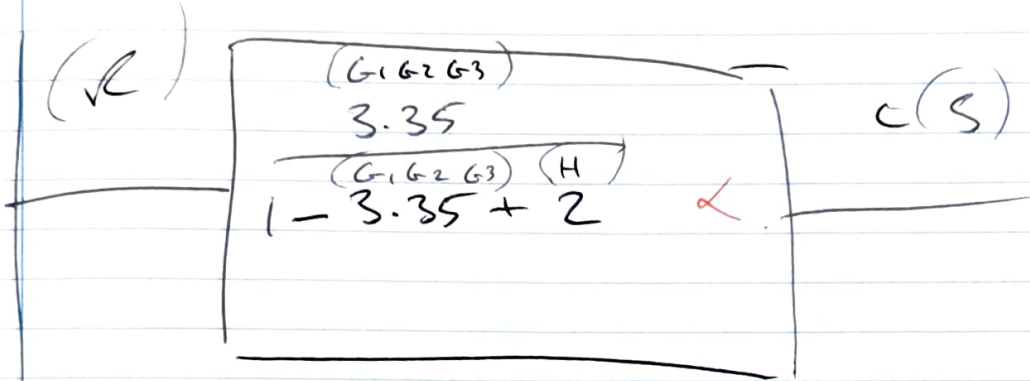


All $S = 0$

$$\begin{array}{cccc} G_1 & G_2 & G_3 & H \\ \frac{4}{4} = 1 & \frac{2}{3} = 0.67 & \frac{5}{1} = 5 & 2 \end{array}$$

3.35

2



Second order

C —

~~Q5~~
(a) $R = 2k\Omega$ $C = 10\mu f$ $V_{in}(t)$

(i) $H(s) = \frac{V_o(s)}{V_{in}(s)}$ ✓ ①

(ii)

(iii) low pass ✓ ①

(b) $R = 150\Omega$ $L = 2H$ $C = 25\mu F$

(i) $\frac{d^2 \phi_o}{dt^2} + 2\zeta \omega_n \frac{d\phi_o}{dt} + \omega_n^2 \phi_o = 51 \omega_n^2 \phi_i$ ✓ ①

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

$$\frac{1}{\sqrt{2 \times 25 \times 10^{-6}}} = 141.42 \text{ Rad/s} \quad \checkmark \quad ①$$

$$\omega_d = \omega_n \sqrt{1 - \zeta^2}$$

$$141.42 \times 2 = 282.84$$

$$\frac{150}{282.84} = 0.53 \quad \checkmark$$

Under damped ✓ ①

Q5 (a)
① 1
② 1

Q5 (b)
① 3

(iii) Steady state current is equal to 0 ✓ ①

(iv) $V(t) = V_0$ ✓ ①

Q 5(b)

(ii) 1

(iv) 1



Llyfr Atebion Arholiadau

CYFENW: _____

ENW(AU) CYNTAF: _____

12 Tudalen

Cyfarwyddiadau i Ymgeiswyr

1. Rhowch yr holl wybodaeth y gofynnir amdani yn y blychau isod.
2. Rhowch eich enw yn y lle a ddarparwyd ar y dde, plygwch ef a'i selio i lawr (gan ddefnyddio'r label a ddarparwyd) i guddio'ch enw.
3. Rhaid i'r atebion fod mewn llawysgrifen ddarllenadwy. Gall yr Arholwyr naill ai anwybyddu sgrïpt annarllenadwy, neu drefnu iddi gael ei theipio a chael yr ymgeisydd i dalu.
4. Ysgrifennwch eich atebion mewn inc.
5. Dechreuwch bob ateb ar dudalen newydd. Gwnewch unrhyw fras nodiadau yn y llyfr atebion a thynnu llinell drwyddynt.
6. Ni ddylid rhwygo unrhyw ran o'r llyfr hwn; rhaid ei gyflwyno yn gyfan.
7. Os defnyddir mwy nag un llyfr, rhwymwch hwy gyda'i gilydd gan ddefnyddio'r tagiau sydd ar gael oddi wrth y gwylwr/gwylwyr.
8. Rhaid dychwelyd pob llyfr. Ni chaniateir mynd â llyfrau atebion, wedi eu defnyddio neu heb eu defnyddio, allan o'r lleoliad arholi o dan unrhyw amgylchiadau.

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	

Rhestrwch rifau'r cwestiynau a ymgeisiwyd gennych	At Ddibenion y Swyddfa
Cyfanswm	