

SULIT



**BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI
KEMENTERIAN PENDIDIKAN MALAYSIA**

JABATAN KEJURUTERAAN ELEKTRIK

PEPERIKSAAN AKHIR

SESI JUN 2019

DEJ30013: BASIC CONTROL SYSTEM

TARIKH : 06 NOVEMBER 2019

MASA : 8.30 PAGI - 10.30 PAGI (2 JAM)

Kertas ini mengandungi **ENAM (6)** halaman bercetak.

Bahagian A: Struktur (4 soalan)

Bahagian B: Esei (1 soalan)

Dokumen sokongan yang disertakan : Table of Laplace Transforms, Block
Diagram Reduction Rules / ~~Tiada~~

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SULIT

SECTION A : 80 MARKS
BAHAGIAN A : 80 MARKAH

INSTRUCTION:

This section consists of **FOUR (4)** structured questions. Answer **ALL** questions.

ARAHAN:

*Bahagian ini mengandungi **EMPAT (4)** soalan berstruktur. Jawab **SEMUA** soalan.*

CLO1
C1

QUESTION 1
SOALAN 1

- a) Identify **TWO (2)** types of control system with **TWO (2)** examples for each type.
*Tentukan **DUA (2)** jenis sistem kawalan berserta **DUA(2)** contoh bagi setiap jenis.*

[4 marks]

[4 markah]

CLO1
C2

- b) Compare open loop and closed loop control systems in general with an example of real time application.

Bandingkan sistem kawalan gelung terbuka dan gelung tertutup secara umum beserta dengan contoh aplikasi sebenar.

[6 marks]

[6 markah]

CLO1
C3

- c) The boy is kicking a ball as shown in Figure A1(c). Write the operations in the closed-loop control system with the aid of a block diagram.

Seorang budak lelaki sedang menendang bola seperti yang ditunjukkan di dalam rajah A1(c). Tuliskan operasi sistem kawalan gelung tertutup dengan bantuan gambarajah blok.



Figure A1(c)/Rajah A1(c)

[10 marks]

[10 markah]

QUESTION 2

SOALAN 2

CLO1
C1

- a) List **FOUR (4)** advantages of block diagram.

Senaraikan EMPAT(4) kelebihan gambarajah blok.

[4 marks]

[4 markah]

CLO1
C2

- b) Referring to the block diagram in Figure A2(b), express the transfer function of the system.

Merujuk kepada Rajah A2(b), ungkapkan rangkap pindah bagi sistem ini.

[6 marks]

[6 markah]

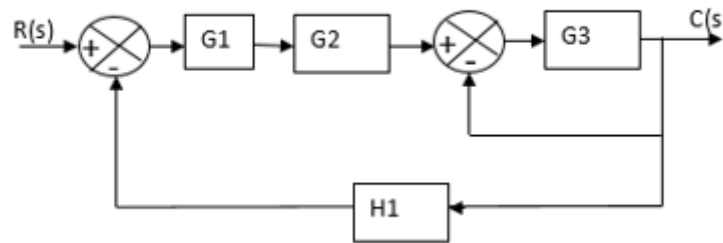


Figure A2(b)/ Rajah A2(b)

CLO1
C3

- c) Referring to diagram in Figure A2(c), calculate the transfer function by using Mason's Gain Rule.

Merujuk kepada Rajah A2(c), kirakan rangkap pindah dengan menggunakan Hukum Gandaan Mason.

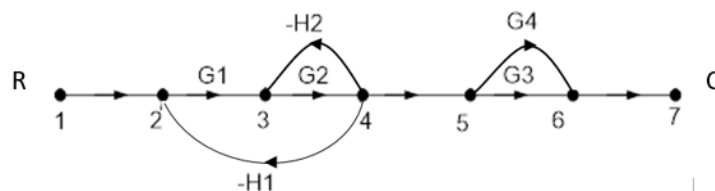


Figure A2(c) / Rajah A2(c)

[10 marks]

[10 markah]

CLO1
C1**QUESTION 3****SOALAN 3**

- a) State the system classification of damping ratio, ζ below with the aid of respond curve diagram.

Nyatakan klasifikasi system bagi nisbah redaman, ζ di bawah dengan bantuan gambarajah lengkuk sambutan.

i. $0 < \zeta < 1$

ii. $\zeta > 1$

[4 marks]

[4 markah]

CLO1
C3

- b) The close loop transfer function of the unity feedback control system is given as below;

$$\frac{C(s)}{R(s)} = \frac{5s + 10}{s^2 + 6s + 10}$$

Calculate the steady state error for:

- i. unit step input
ii. unit ramp input

Fungsi rangkap pindah bagi sebuah sistem suap balik uniti diberi sebagai;

$$\frac{C(s)}{R(s)} = \frac{5s + 10}{s^2 + 6s + 10}$$

Kirakan ralat keadaan mantap bagi:

- i. masukan unit langkah
ii. masukan unit tanjakan

[8 marks]

[8 markah]

CLO1
C3

- c) With the value of $\omega_n = 4$, $\zeta = 0.4$ and the system is fed with step input, calculate the following parameter of the system.
- Rise Time, T_r
 - Peak Time, T_p
 - % Maximum Overshoot, %Mp
 - Type of damping

Dengan nilai $\omega_n = 4$, $\zeta = 0.4$ dan sistem disuap dengan masukan unit langkah, kirakan sambutan parameter sistem berikut:

- i. Masa menaik, T_r
- ii. Masa puncak, T_p
- iii. % Lampau lajak maksima, $\%M_p$
- iv. Jenis redaman

[8 marks]

[8 markah]

QUESTION 4**SOALAN 4**CLO1
C1

- a) Give **TWO (2)** types of continuous controller mode with the mathematical equation for both controller modes.

Berikan DUA (2) jenis mod pengawal berterusan bersama persamaan matematik bagi kedua-dua mod pengawal.

[4 marks]

[4 markah]

CLO1
C2

- b) Explain **TWO(2)** advantages and **TWO(2)** disadvantages of Proportional Controller.
- Terangkan DUA(2) kelebihan dan DUA (2) kelemahan Pengawal Perkadaran.*

[6 marks]

[6 markah]

CLO1
C3

- c) A proportional + Integral, (PI) controller is used to control certain process. The setting of the controller are $K_p=3\%$ and $K_i=6\%$ per min. While $p(0)=4\%$, the error signal is found to be $9t+3$ where t is the time. Calculate the controller output in percentage after 2 minutes.

Satu pengawal perkadaran + kamilan, (PI) digunakan untuk mengawal proses tertentu. Tetapan pengawal $K_p=3\%$ dan $K_i=6\%$ setiap min. Sementara $p(0) =4\%$, isyarat ralat ialah $9t+3$ di mana t ialah masa. Kirakan keluaran pengawal dalam peratus selepas 2 minit.

[10 marks]

[10 markah]

SECTION B : 20 MARKS
BAHAGIAN B : 20 MARKAH

INSTRUCTION:

This section consists of **ONE (1)** essay question. Answer the question.

ARAHAN:

Bahagian ini mengandungi SATU (1) soalan esei. Jawab soalan tersebut.

QUESTION 1

SOALAN 1

CLO1
C3

Transfer the block diagram in Figure B1 into the signal flow graph and calculate the overall transfer function using Mason's Gain Formula.

Pindahkan gambarajah blok di Rajah B1 kepada graf aliran isyarat dan kirakan rangkap pindah keseluruhan dengan menggunakan Formula Gandaan Mason's.

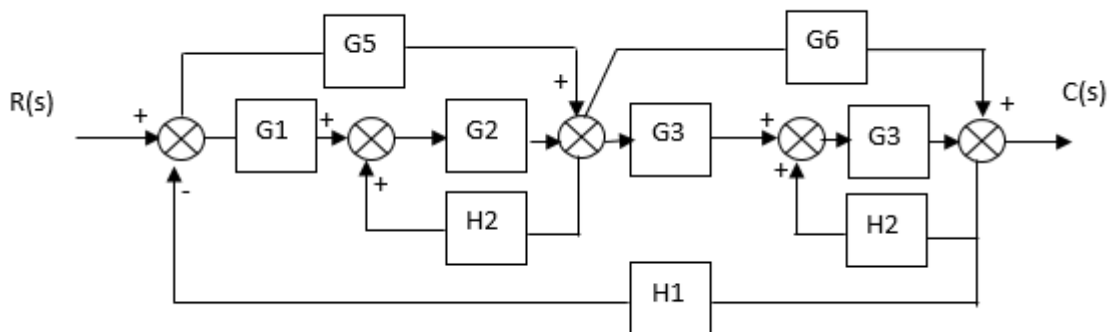


Figure B1/Rajah B1

[20 marks]

[20 markah]

SOALAN TAMAT


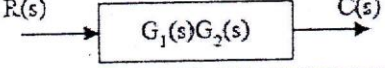
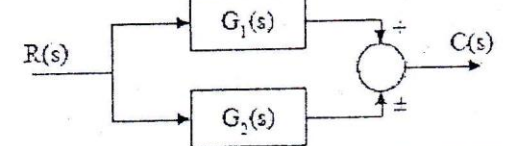
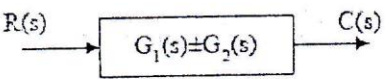
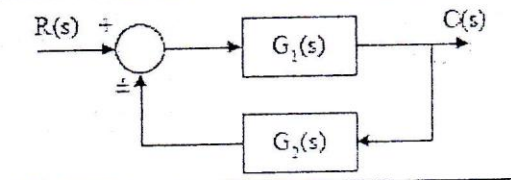
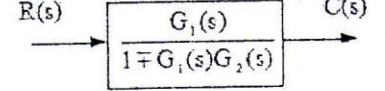
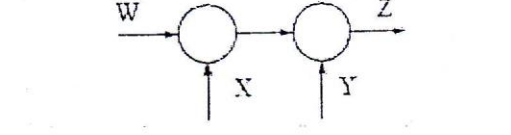
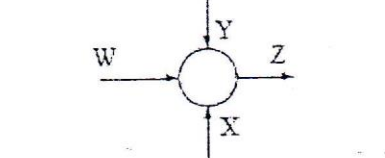
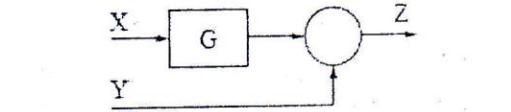
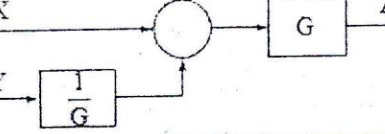
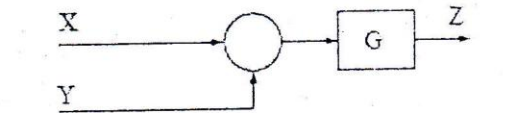
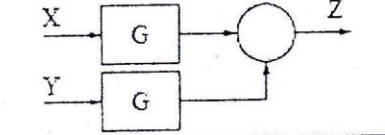
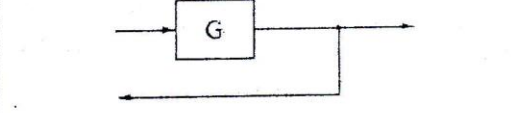
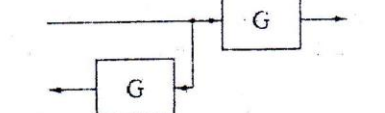
KEMENTERIAN PENDIDIKAN MALAYSIA
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TABLE OF LAPLACE TRANSFORMS

$f(t)$	$F(s)$
$\delta(t)$	1
$H(t-a)$	$\frac{e^{-as}}{s}$
1	$\frac{1}{s}$
t^n	$\frac{n!}{s^{n+1}}$
e^{kt}	$\frac{1}{s-k}$
$t^n e^{kt}$	$\frac{n!}{(s-k)^{n+1}}$
$\sin(\omega t)$	$\frac{\omega}{s^2 + \omega^2}$
$\cos(\omega t)$	$\frac{s}{s^2 + \omega^2}$
$e^{kt} \sin(\omega t)$	$\frac{\omega}{(s-k)^2 + \omega^2}$
$e^{kt} \cos(\omega t)$	$\frac{(s-k)}{(s-k)^2 + \omega^2}$
$\sinh(\omega t)$	$\frac{\omega}{s^2 - \omega^2}$
$\cosh(\omega t)$	$\frac{s}{s^2 - \omega^2}$
$t \sin(\omega t)$	$\frac{2\omega s}{(s^2 + \omega^2)^2}$
$t \cos(\omega t)$	$\frac{s^2 - \omega^2}{(s^2 + \omega^2)^2}$

KEMENTERIAN PENDIDIKAN MALAYSIA
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BLOCK DIAGRAM REDUCTION RULES

Case	Original Structure	Equivalent Structure
1		
2		
3		
4		
5		
6		
7		
8	