

SULIT



**KEMENTERIAN PENDIDIKAN TINGGI
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI**

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

JABATAN KEJURUTERAAN ELEKTRIK

PEPERIKSAAN AKHIR

SESI II : 2022/2023

DEJ30013: BASIC CONTROL SYSTEM

TARIKH : 07 JUN 2023

MASA : 2.30 PTG – 4.30 PTG (2 JAM)

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

Bahagian A: Subjektif (4 soalan)

Bahagian B: Esei (1 soalan)

Dokumen sokongan yang disertakan : Formula

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)** subjective questions. Answer **ALL** questions.

ARAHAN:

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

QUESTION 1**SOALAN 1**

- CLO1 (a) Give **TWO (2)** advantages and disadvantages of closed loop control system against open loop control.
- Berikan **DUA (2)** kebaikan dan keburukan sistem kawalan gelung tertutup terhadap gelung buka.*
- [4 marks]
[4 markah]
- CLO1 (b) Express a suitable block diagram of the closed loop control system if a person wants to reach a book on a table.
- Nyatakan gambarajah blok yang sesuai bagi sistem kawalan gelung tertutup jika seseorang ingin mencapai buku di atas meja.*
- [6 marks]
[6 markah]
- CLO1 (c) An electrical tumble dryer shown in figure A1(c) is an open loop system. Draw the general block diagram of the system with complete labeling and operation.

Mesin pengering elektrik yang ditunjukkan dalam rajah A1(c) ialah sistem gelung terbuka. Lukis gambarajah blok umum sistem dengan label dan operasi yang lengkap.

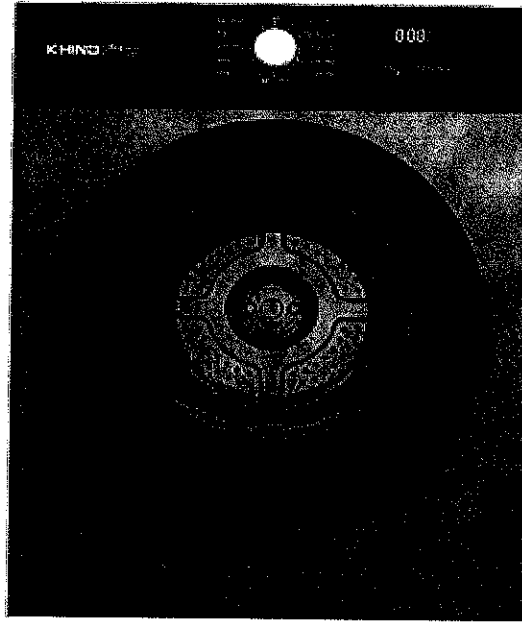


Figure A1 (c)/Rajah A1(c)

[10 marks]

[10 markah]

QUESTION 2 SOALAN 2

- CLO1 (a) List **FOUR (4)** advantages of Block Diagram Reduction.
*Senaraikan **EMPAT (4)** kebaikan Pengecilan Gambarajah Blok.*

[4 marks]

[4 markah]

- CLO1 (b) By referring to figure A2(b), express all values of poles and zeros for the system on the s plane with the aid of a diagram.

Dengan merujuk kepada rajah A2(b), nyatakan semua nilai bagi kutub dan sifar untuk sistem pada s-plane dengan bantuan gambarajah

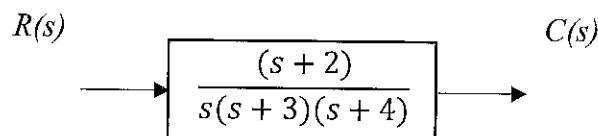


Figure A2(b)/Rajah A2(b)

[6 marks]

[6 markah]

- CLO1 (c) A system has the following transfer function. Show the unit step input response with zero initial condition.

Sistem mempunyai fungsi pemindahan berikut. Tunjukkan tindak balas masukan unit langkah dengan keadaan awal sifar.

$$\frac{C(s)}{R(s)} = \frac{8}{s(s+4)}$$

[10 marks]

[10 markah]

QUESTION 3 SOALAN 3

- CLO1 (a) Define steady-state response and transient response of the control system.
Tentukan tindak balas keadaan mantap dan tindak balas sementara sistem kawalan

[4 marks]

[4 markah]

- CLO1 (b) Express the equation of steady state error for **THREE (3)** different types of input.
*Nyatakan persamaan ralat keadaan mantap bagi **TIGA (3)** jenis masukan yang berbeza.*

[6 marks]

[6 markah]

- CLO1 (c) A unity feedback system has the open loop transfer function $G(s) = \frac{A}{s(s+p)}$. Calculate the value of A and p so that the settling time and peak overshoot will be 4 seconds and 10% respectively.
Sistem maklum balas perpaduan mempunyai fungsi pemindahan gelung terbuka $G(s) = \frac{A}{s(s+p)}$. Kira nilai A dan p supaya masa penggenapan, T_s dan Lajakan maksima, M_p masing-masing ialah 4 saat dan 10%.

[10 marks]

[10 markah]

QUESTION 4
SOALAN 4

- CLO1 (a) Identify **FOUR (4)** advantages of Proportional plus Integral plus Derivative (P+ I + D) controller mode.

*Kenal pasti **EMPAT (4)** kelebihan pengawal Perkadaran + Kamilan + Pembezaan (P+ I + D) mod kawalan.*

[4 marks]

[4 markah]

- CLO1 (b) Explain the derivative control mode with **TWO (2)** of its characteristics.

*Terangkan mod kawalan pembezaan dan **DUA(2)** cirinya.*

[6 marks]

[6 markah]

- CLO1 (c) By referring to Figure A4(c), calculate the output value of PD controller when $K_p = 6\%$ and $K_d = 0.4\%$ with $p(0) = 25\%$.

Berdasarkan kepada rajah A4 (c), kirakan nilai keluaran bagi pengawal jenis P+D, apabila $K_p = 6\%$, $K_D = 0.4\%$ and $P(0) = 25\%$.

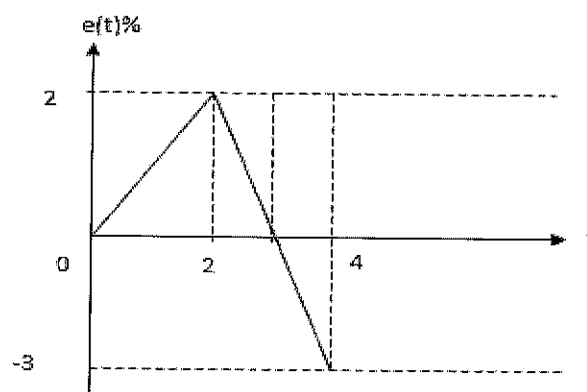


Figure A4(c)/ Rajah A4(c).

[10 marks]

[10 markah]

SECTION B : 20 MARKS**BAHAGIAN B : 20 MARKAH****INSTRUCTION:**

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

ARAHAN:

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

QUESTION 1**SOALAN 1**

CLO1

The block diagram reduction process takes more time for complicated systems. So, we must draw the (partially simplified) block diagram after each step. In order to overcome this drawback, use signal flow graphs with certain rules (representation). Solve the transfer function of the system shown in figure B1 by using the Mason Gain Rule.

Pengurangan gambarajah blok akan mengambil lebih banyak masa bagi satu sistem yang rumit kerana kita perlu melukis gambarajah blok (separa dipermudahkan) untuk setiap langkah. Dengan itu bagi mengatasi kelemahan ini, graf aliran isyarat digunakan dengan peraturan tertentu (perwakilan). Selesaikan rangkap pindah yang ditunjukkan dalam rajah B1 dengan menggunakan hukum gandaan mason.

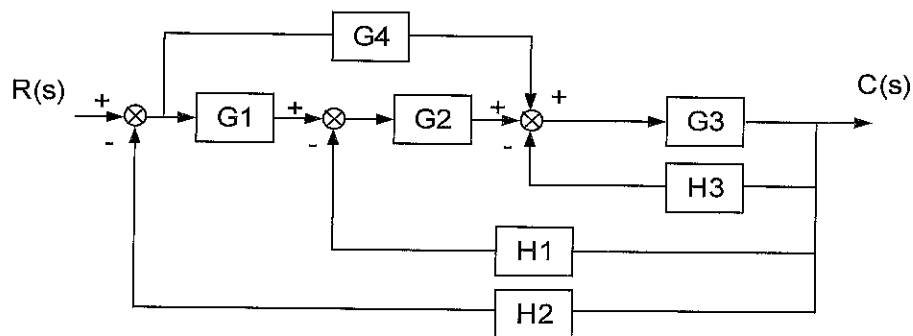


Figure B1/Rajah B1

[20 marks]

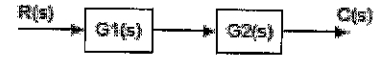
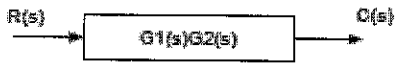
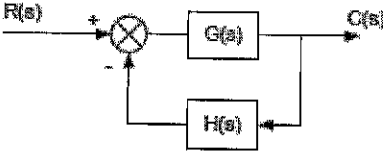
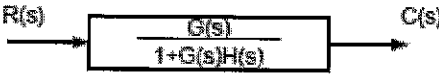
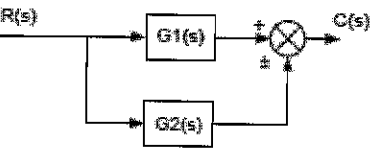
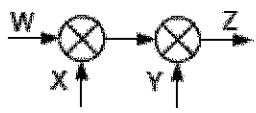
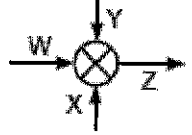
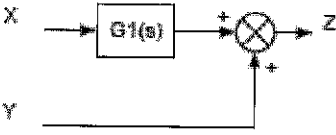
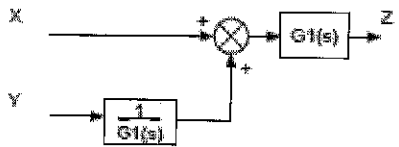
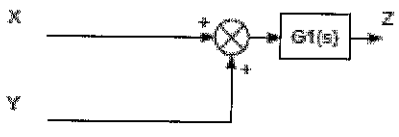
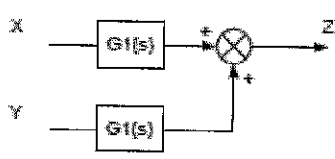
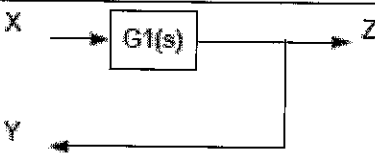
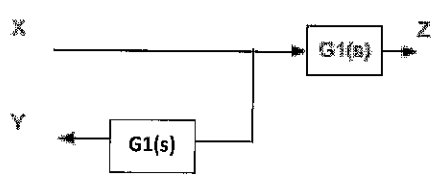
[20 markah]

SOALAN TAMAT

Standard Laplace Transform Pairs

$f(t) = \mathcal{L}^{-1}\{F(s)\}(t)$	$F(s) = \mathcal{L}\{f(t)\}(s) = \int_0^{\infty} e^{-st} f(t) dt$
1	$\frac{1}{s}, \quad s > 0$
$t^n, \quad n \text{ an integer}$	$\frac{n!}{s^{n+1}}, \quad s > 0$
e^{at}	$\frac{1}{s-a}, \quad s > a$
$\sin bt$	$\frac{b}{s^2 + b^2}, \quad s > 0$
$\cos bt$	$\frac{s}{s^2 + b^2}, \quad s > 0$
$e^{at} f(t)$	$F(s-a)$
$e^{at} t^n, \quad n \text{ an integer}$	$\frac{n!}{(s-a)^{n+1}}, \quad s > a$
$e^{at} \sin bt$	$\frac{b}{(s-a)^2 + b^2}, \quad s > a$
$e^{at} \cos bt$	$\frac{(s-a)}{(s-a)^2 + b^2}, \quad s > a$
$t \sin bt$	$\frac{2bs}{(s^2 + b^2)^2}, \quad s > 0$
$t \cos bt$	$\frac{s^2 - b^2}{(s^2 + b^2)^2}, \quad s > 0$
$y' = \dot{y} = \frac{dy}{dt}$	$sY(s) - y(0)$
$y'' = \ddot{y} = \frac{d^2 y}{dt^2}$	$s^2 Y(s) - sy(0) - \dot{y}(0)$

BLOCK DIAGRAM REDUCTION TABLE

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