

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 I : 2023/2024

DEJ40043 : CONTROL SYSTEMS

TARIKH : 21 DISEMBER 2023

MASA : 11.15 AM – 1.15 PM (2 JAM)

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

Bahagian A: Struktur (3 soalan)

Bahagian B: Esei (2 soalan)

Dokumen sokongan yang disertakan : Kertas Graf

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SULIT

SECTION A: 60 MARKS
BAHAGIAN A: 60 MARKAH

INSTRUCTION:

This section consists of **THREE (3)** subjective questions. Answer **ALL** questions.

ARAHAN:

Bahagian ini mengandungi TIGA (3) soalan subjektif. Jawab SEMUA soalan.

QUESTION 1

SOALAN 1

- CLO1 (a) Explain two position controller (ON OFF).
Terangkan pengawal dua kedudukan (ON OFF).
- [5 marks]
[5 markah]
- CLO1 (b) Based on the Operational Amplifier (Integrator), simplify the time value if the voltage is given, $V_{in} = 5\text{Volt}$, $V_{out} = -15\text{Volt}$, $C = 0.01\mu\text{F}$, and $R = 10\text{k}\Omega$.
Berdasarkan Penguat Kendalian (Kamiran), kirakan nilai masa jika diberi nilai $V_{in} = 5\text{Volt}$, $V_{out} = -15\text{Volt}$, $C = 0.01\mu\text{F}$, and $R = 10\text{k}\Omega$.
- [5 marks]
[5 markah]
- CLO1 (c) With the aid of graph, sketch the differences between the Ziegler-Nichols reaction curve tuning method and Ziegler-Nichols continuous tuning method.
Dengan bantuan lakaran graf, lakarkan perbezaan di antara kaedah penalaan lengkuk tindakbalas Ziegler-Nichols dan kaedah Ziegler-Nichols penalaan berterusan.
- [10 marks]
[10 markah]

QUESTION 2**SOALAN 2**

- CLO1 (a) Explain the principles of Routh Hurwitz Criterion.
Terangkan prinsip Kriteria Routh Hurwitz.
- [5 marks]
[5 markah]
- CLO1 (b) The characteristic equation for a system is given as $s^4 + 2s^3 + 3s^2 + 4s + 5 = 0$. Express the types of stability by using the Routh-Hurwitz Criterion.
Persamaan ciri bagi sistem diberi sebagai $s^4 + 2s^3 + 3s^2 + 4s + 5 = 0$. Nyatakan jenis kestabilan dengan menggunakan kaedah Kriteria Routh-Hurwitz.
- [5 marks]
[5 markah]
- CLO1 (c) Calculate the magnitude and the phase angle of the feedback control below using the asymptotic approximation method.
Given that, frequency, ω (rad/s) : 0.1, 1, 2, 10
- Kirakan nilai bagi magnitud dan sudut fasa bagi kawalan suap balik dengan menggunakan kaedah penghampiran asimptot.*
Diberi, frekuensi, ω (rad/s) : 0.1, 1, 2, 10
- $$G(j\omega)H(j\omega) = \frac{1}{j\omega (1 + 0.5j\omega)(1 + 0.1j\omega)}$$
- [10 marks]
[10 markah]

QUESTION 3**SOALAN 3**

- CLO1 (a) Explain **FIVE (5)** characteristics of Polar Plot.

Terangkan LIMA (5) ciri bagi plot Polar.

[5 marks]

[5 markah]

- CLO1 (b) Simplify the phase of the system at input frequency, $\omega^{(\text{rads}^{-1})} = 2.0$. The transfer function is given as:

Permudahkan nilai fasa untuk sistem pada frekuensi, $\omega^{(\text{rads}^{-1})} = 2.0$. Rangkap pindah diberi sebagai:

$$G(s)H(s) = \frac{100s(s + 1)}{s(2s + 1)(0.4s + 1)}$$

[5 marks]

[5 markah]

- CLO1 (c) Based on the open loop transfer function given, calculate the value of asymptotes and centroid.

Berdasarkan pada rangkap pindah gelung terbuka yang diberi, kirakan nilai asimptot dan sentroid σ_a

$$G(s)H(s) = \frac{Ks(s + 3)}{s(s + 5)(s - 7)}$$

[10 marks]

[10 markah]

SECTION B : 40 MARKS**BAHAGIAN B : 40 MARKAH****INSTRUCTION:**

This section consists of **TWO (2)** essay questions. Answer **ALL** questions.

ARAHAN:

*Bahagian ini mengandungi **DUA (2)** soalan esei. Jawab **SEMUA** soalan.*

QUESTION 1**SOALAN 1**

CLO1

Calculate an open loop transfer function for the following number of branches that terminates at infinity, Centroid, σ_a and angle of asymptotes, angle of departure of root loci from the poles, breakaway point, the value of K at which root locus crosses the imaginary axis and the root loci plot of the system.

Kirakan rangkap pindah gelung terbuka untuk perkara-perkara berikut iaitu bilangan cabang yang tamat di infiniti, centroid, σ_a dan sudut asimptot, sudut berlepas dari punca-punca kutub, titik pecah, nilai K di mana londar punca memotong pada paksi khayalan dan plot londar punca sistem

$$G(s) = \frac{K}{s(s^2 + 4s + 13)}$$

(Scale x axis and y axis: 2cm: 1 unit)

(Skala paksi x dan paksi y: 2cm: 1 unit)

[20 marks]

[20 markah]

QUESTION 2**SOALAN 2**

CLO1

The Polar Plot is a way of showing frequency response of linear system. Analyze the polar plot of a system to determine the gain margin and phase margin and the stability of the system.

Plot Kutub ialah satu cara untuk menunjukkan tindak balas frekuensi sistem linear. Analisa bagi plot kutub sistem. Tentukan jidar gandaan dan jidar fasa dan kestabilan sistem.

$$G(s) = \frac{2}{s(s+1)(0.5s+1)}$$

(Frequency ω (rads^{-1}) : 0.5, 1.0, 1.09)

(Scales of x and y axis : 5cm : 1 unit)

(Frekuensi ω (rads^{-1}) : 0.5, 1.0, 1.09)

(Skala x and y axis : 5cm : 1 unit)

[20 marks]

[20 markah]

SOALAN TAMAT