SULIT

KEMENTERIAN PENDIDIKAN TINGGI
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI

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

JABATAN KEJURUTERAAN ELEKTRIK

PEPERIKSAAN AKHIR

SESI I : 2023/2024

DEE40113: SIGNAL AND SYSTEM

TARIKH : 21 DISEMBER 2023
MASA : 11.15 AM – 1.15 PM (2 JAM)

Kertas ini mengandungi **TUJUH (7)** halaman bercetak.
Bahagian A: Subjektif (3 soalan)
Bahagian B: Esei (2 soalan)
Dokumen sokongan yang disertakan : FORMULA

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SECTION A : 60 MARKS

BAHAGIAN A : 60 MARKAH

INSTRUCTION:

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

ARAHAN :

*Bahagian ini mengandungi **TIGA (3)** soalan struktur. Jawab **SEMUA** soalan.*

QUESTION 1

SOALAN 1

CLO1 (a) Explain the discrete-time signal with suitable graphical representation diagram.
Terangkan isyarat masa-diskret dengan gambar rajah perwakilan grafik yang sesuai.

[4 marks]
[*4 markah*]

CLO1 (b) A discrete-time signal *x[n]* is shown in Figure A1(b) below. Sketch the signal transformation for dependent variable
Isyarat masa-diskrit x[n] ditunjukkan dalam Rajah A1(b) dibawah. Lakarkan penjelmaan isyarat bagi pembolehubah bersandar.

i) $x[2n]$

ii) $x[-n]$

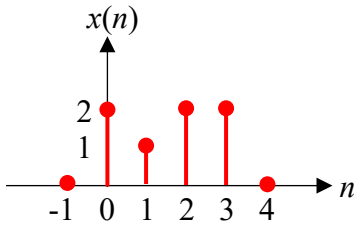


Figure A1(b) / *Rajah A1(b)*

[8 marks]
[*8 markah*]

CLO1 (c) Show whether the following system is time variant or time-invariant.

Tunjukkan sama ada sistem berikut merupakan varian pemasa atau varian-bukan pemasa.

i) $y(t) = 4t^2x(t)$

ii) $y(t) = 5e^{2x(t)}$

[8 marks]

[*8 markah*]

QUESTION 2

SOALAN 2

CLO1 (a) Explain convolution of Continuous-Time Linear Time-Invariant (LTI) system.

Terangkan konvolusi sistem Masa-Berterusan Linear Varian-Bukan Pemasa.

[4 marks]

[*4 markah*]

CLO1 (b) Sketch the graphical sequence of $y(n)$ generated by the convolution of the LTI sequence $x[n] = \{1, 0, 2\}$ and $h[n] = \{1, 2, 1\}$. The $x[n]$ has only non-zero values at $n = 0, 1, 2$ and impulse response, $h[n]$ is at not zero at $n = -1, 0, 1$.

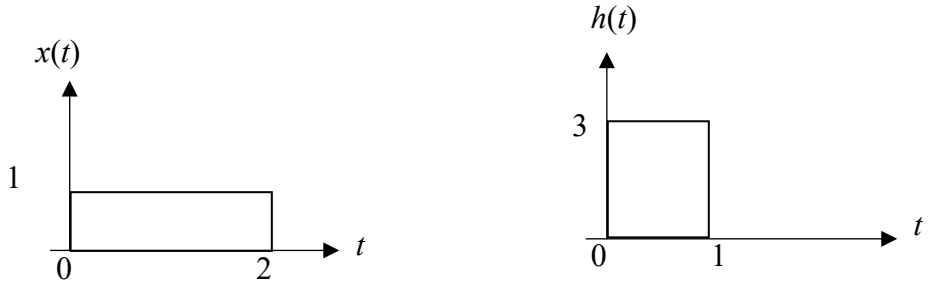
Lakarkan urutan grafik y(n) yang dijana oleh konvolusi LTI bagi jujukan x[n] = {1, 0, 2} dan h[n] = {1, 2, 1}. Nilai x[n] bukan-sifar pada n = 0, 1, 2 dan respon impuls, h[n] berada pada bukan-sifar pada n = -1, 0, 1

[8 marks]

[*8 markah*]

CLO1 (c) Figure 2 (C) shows input signal, x(t) and impulse respond of a system.Sketch the output y(t) using convolation integral with graphical method.

Rajah 2 (c) menunjukkan isyarat masukan x(t) dan impuls respon h(t) sbagi bagi suatu sistem,Lakarkan keluaran y(t) menggunakan konvolusi kamilan bagi sistem tersebut.



Input, *x(t)* Impulse respond, *h(t)*

Figure 2(c) / Rajah 2(c)

[8 marks]

[*8 markah*]

QUESTION 3

SOALAN 3

CLO1 (a) Explain with the aid of diagram, the region of convergence (ROC) in Laplace Transform of Continuous-Time LTI System.

Terangkan dengan bantuan gambar rajah, Rantau penumpuan (ROC) dalam Jelmaan Laplace bagi Sistem LTI Masa Berterusan.

[4 marks]

[*4 markah*]

CLO1 (b) Show the unit step function, u(t), signal transformation using Laplace Transform.

Tunjukkan unit Langkah fungsi, u(t), penjelmaan isyarat menggunakan Penjelmaan Laplace.

[8 marks]

[*8 markah*]

CLO1

(c) The LTI system given x[n] = {1, 2} and h[n] = {0, 2}. Compute the convolution of Discrete-Time LTI using analytical method - A

Sistem LTI diberi x[n] = {1, 2} dan h[n] = {0, 2}. Kira konvulasi LTI Masa Diskret menggunakan kaedah analisis - A

[8 marks]

[*8 markah*]

SECTION B : 40 MARKS

BAHAGIAN B :40 MARKAH

INSTRUCTION:

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

ARAHAN:

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

QUESTION 1

SOALAN 1

CLO1

A signal $F(s) = \frac{3s^2+2s+5}{s^3+9s^2+23s+15}$ was notified at output of a Continues-Time LTI system. Analyze the input signal of the system using partial-fraction Inverse Laplace Transform.

Isyarat $F(s) = \frac{3s^2+2s+5}{s^3+9s^2+23s+15}$ *ditemui pada keluaran sistem Pemasa-Berterusan LTI. Analisa isyarat masukan system tersebut menggunakan Pecahan-Separa Jelmaan Laplace Songsang.*

[20 marks]

[*20 markah*]

QUESTION 2

SOALAN 2

CLO1

In a filter circuit, TWO (2) continuous continues-time signals are used to test the operation of the filter.

$$x_1(t) = \sin\left(2\pi t + \frac{\pi}{4}\right) \text{ and } \quad x_2 = 1 + \cos\left(6\pi t + \frac{\pi}{8}\right)$$

Evaluate the frequency response of both continues-time signals using Fourier Transform

.Dalam litar penapis, DUA (2) isyarat berterusan-masa digunakan untuk menguji operasi penapis.

$$x_1(t) = \sin\left(2\pi t + \frac{\pi}{4}\right) \text{ and } \quad x_2 = 1 + \cos\left(6\pi t + \frac{\pi}{8}\right)$$

Nilaikan respon frequensi bagi kedua-dua isyarat berterusan-masa menggunakan Transformasi Fourier.

[20 marks]

[*20 markah*]

SOALAN TAMAT

Laplace Transform Pairs

$x(t)$	$X(s)$	ROC
$\delta(t)$	1	All s
$u(t)$	$\frac{1}{s}$	$\mathrm{Re}(s) > 0$
$-u(-t)$	$\frac{1}{s}$	$\mathrm{Re}(s) < 0$
$tu(t)$	$\frac{1}{s^2}$	$\mathrm{Re}(s) > 0$
$t^k u(t)$	$\frac{k!}{s^{k+1}}$	$\mathrm{Re}(s) > 0$
$e^{-at}u(t)$	$\frac{1}{s+a}$	$\mathrm{Re}(s) > -\mathrm{Re}(a)$
$-e^{-at}u(-t)$	$\frac{1}{s+a}$	$\mathrm{Re}(s) < -\mathrm{Re}(a)$
$te^{-at}u(t)$	$\frac{1}{(s+a)^2}$	$\mathrm{Re}(s) > -\mathrm{Re}(a)$
$-te^{-at}u(-t)$	$\frac{1}{(s+a)^2}$	$\mathrm{Re}(s) < -\mathrm{Re}(a)$
$\cos \omega_0 tu(t)$	$\frac{s}{s^2+\omega_0^2}$	$\mathrm{Re}(s) > 0$
$\sin \omega_0 tu(t)$	$\frac{\omega_0}{s^2+\omega_0^2}$	$\mathrm{Re}(s) > 0$
$e^{-at}\cos \omega_0 tu(t)$	$\frac{s+a}{(s+a)^2+\omega_0^2}$	$\mathrm{Re}(s) > -\mathrm{Re}(a)$
$e^{-at}\sin \omega_0 tu(t)$	$\frac{\omega_0}{(s+a)^2+\omega_0^2}$	$\mathrm{Re}(s) > -\mathrm{Re}(a)$

z-Transform Pairs

$x[n]$	$X(z)$	ROC
$\delta[n]$	1	All z
$u[n]$	$\frac{1}{1-z^{-1}}, \frac{z}{z-1}$	$\lvert z\rvert > 1$
$-u[-n-1]$	$\frac{1}{1-z^{-1}}, \frac{z}{z-1}$	$\lvert z\rvert < 1$
$\delta[n-m]$	z^{-m}	All z except 0 if $(m > 0)$ or ∞ if $(m < 0)$
$a^n u[n]$	$\frac{1}{1-az^{-1}}, \frac{z}{z-a}$	$\lvert z\rvert > \lvert a\rvert$
$-a^n u[-n-1]$	$\frac{1}{1-az^{-1}}, \frac{z}{z-a}$	$\lvert z\rvert < \lvert a\rvert$
$na^n u[n]$	$\frac{az^{-1}}{(1-az^{-1})^2}, \frac{az}{(z-a)^2}$	$\lvert z\rvert > \lvert a\rvert$
$-na^n u[-n-1]$	$\frac{az^{-1}}{(1-az^{-1})^2}, \frac{az}{(z-a)^2}$	$\lvert z\rvert < \lvert a\rvert$
$(n+1)a^n u[n]$	$\frac{1}{(1-az^{-1})^2}, \left[\frac{z}{z-a}\right]^2$	$\lvert z\rvert > \lvert a\rvert$
$(\cos \Omega_0 n)u[n]$	$\frac{z^2 - (\cos \Omega_0)z}{z^2 - (2\cos \Omega_0)z + 1}$	$\lvert z\rvert > 1$
$(\sin \Omega_0 n)u[n]$	$\frac{(\sin \Omega_0)z}{z^2 - (2\cos \Omega_0)z + 1}$	$\lvert z\rvert > 1$
$(r^n \cos \Omega_0 n)u[n]$	$\frac{z^2 - (r\cos \Omega_0)z}{z^2 - (2r\cos \Omega_0)z + r^2}$	$\lvert z\rvert > r$
$(r^n \sin \Omega_0 n)u[n]$	$\frac{(r\sin \Omega_0)z}{z^2 - (2r\cos \Omega_0)z + r^2}$	$\lvert z\rvert > r$
$\begin{cases} a^n & 0 \le n \le N-1 \\ 0 & \text{otherwise} \end{cases}$	$\frac{1 - a^N z^{-N}}{1 - az^{-1}}$	$\lvert z\rvert > 0$