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 : 2025/2026

BEU50503: SIGNAL AND SYSTEM

TARIKH : 03 FEBRUARI 2026
MASA : 9.00 PAGI – 12.00 TENGAH HARI (3 JAM)

Kertas soalan ini mengandungi **SEPULUH (10)** 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 MARK
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) Define Continuous Signal (CT) signals with related graphic representation.

Takrifkan isyarat berterusan dengan perwakilan grafik yang berkaitan.

[4 marks]
[4 *markah*]

CLO1 (b) Figure A1(b) shows a discrete-time signal $x[n]$. Based on the given signal $x[n]$, outline the output for the following signals:

Rajah A1(b) menunjukkan satu isyarat masa diskrit x[n]. Berdasarkan isyarat x[n] yang diberikan, lakarkan keluarannya:

i) $x[-n]$
ii) $x[-n+3]$
iii) $x[-n-3]$

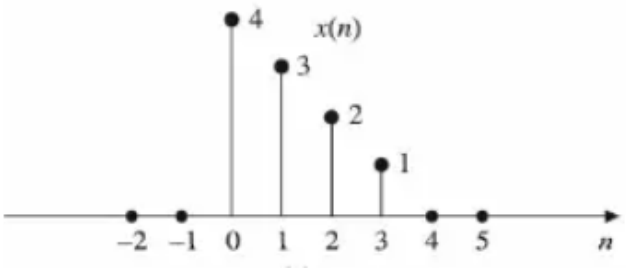

Figure A1(b) / *Rajah A1(b)*

[6 marks]
[6 *markah*]

CLO1

(c) A continuous-time signals, $x(t)$ is shown in Figure A1(ci) & Figure A1(cii)

Satu isyarat masa berterusan, $x(t)$ *ditunjukkan dalam Rajah A1(ci) & Rajah A1(cii).*

(i) Sketch the output for the addition of these two signals:

Lakarkan isyarat keluaran bagi operation penambahan kedua-dua isyarat berikut:

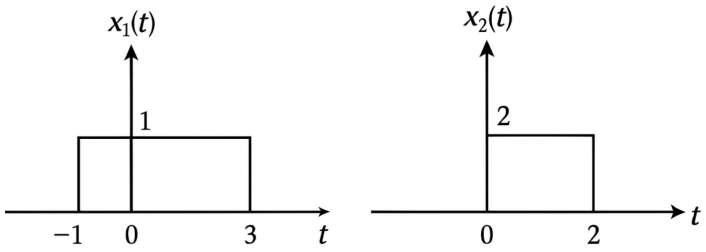

Figure A1(ci) / *Rajah A1(ci)*

(ii) Sketch the output for the multiplication of these two signals:

Lakarkan isyarat keluaran bagi operation pendaraban kedua-dua isyarat berikut:

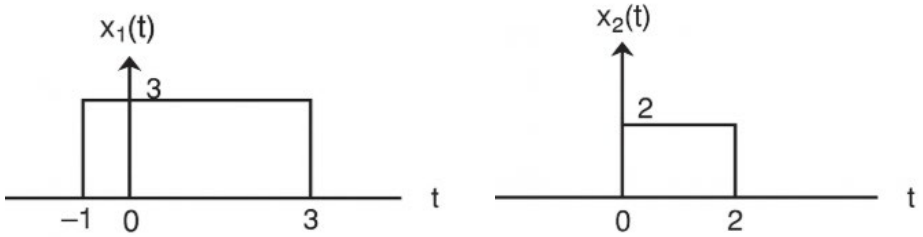

Figure A1(cii) / *Rajah A1(cii)*

[10 marks]

[10 *markah*]

QUESTION 2
SOALAN 2

CLO1 (a) Express the Laplace Transform for the following equation:

Tentukan Penjelmaan Laplace bagi persamaan berikut:

$$x(t) = e^{-5t}\,u(t)$$

[4 marks]
[4 *markah*]

CLO1 (b) Write the inverse Laplace for the following equation:

Tuliskan Penjelmaan Songsang Laplace untuk persamaan berikut:

$$X(s) = \frac{s+4}{s^2+5s+6}$$

[6 marks]
[6 *markah*]

CLO1 (c) Find the Z- Transform and the Region of Convergence (ROC) for the following equation:

Cari Penjelmaan Z dan kawasan penumpuannya (ROC) bagi persamaan berikut:

$$x[n] = 2^n u[n] + 3^n u[-n-1]$$

[10 marks]
[10 *markah*]

SOALAN 3

CLO1 (a) Express the Fourier transform for the signal below:

Tentukan jelmaan Fourier bagi isyarat dibawah:

$$x_1(t) = 3e^{-6t}u(t)$$

.

[4 marks]
[4 *markah*]

CLO1

(b) By using the discrete-time Fourier Transform, show the frequency response $H(\Omega)$ of the system below.

Dengan menggunakan jelmaan Fourier masa diskret, tunjukkan sambutan frequensi $H(\Omega)$ bagi *sistem di bawah*

$$y(n) - 5y(n-1) = x(n) + 4x(n-1)$$

[6 marks]
[6 *markah*]

CLO1

(c) By using the fourier transform, determine the output signal, $y(t)$ for the following LTI system if the signal is given by $x(t) = 3e^{-5t}u(t)$.

Dengan menggunakan jelmaan Fourier, tentukan isyarat keluaran, $y(t)$ *untuk LTI sistem berikut jika isyarat masukan diberikan oleh* $x(t) = 3e^{-5t}u(t)$.

$$\frac{dy(t)}{dt} + 6y(t) = 2x(t)$$

[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

Given an LTI system with the impulse signal h[n] and input x[n] as shown in Figure B1. If an output $y[n]$ is the response of the discrete convolution sum LTI system, determine the expression of discrete convolution sum using graphical method.

Diberi LTI sistem dengan isyarat h[n] dan x[n] seperti dalam Rajah B1. Jika keluaran $y[n]$ adalah tindak balas sistem LTI isyarat masa berjujukan, tentukan ungkapan dengan menggunakan isyarat masa berjujukan konvolusi jumlah secara graphikal.

[20 marks]
[20 markah]

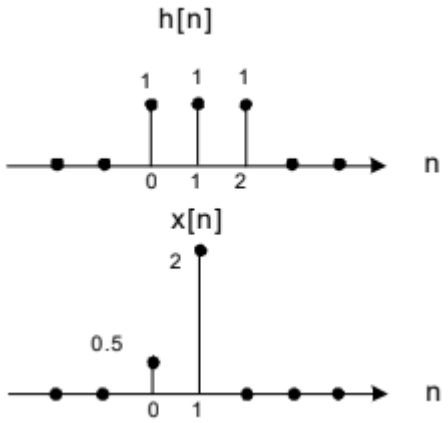

Figure B1/ *Rajah B1*

QUESTION 2
SOALAN 2

CLO1 Determine the Laplace Transform using formula, then sketch the pole-zero plots in the s-plane with the region of convergence (ROC) for the following function.

Tentu jelmaan Laplace dan lakarkan plot kutub-sifar dalam satah bersama kawasan penumpuan (ROC) untuk fungsi berikut.

$$x(t) = e^{-t}u(t) + e^{-4t}u(t)$$

[20 marks]
[*20 markah*]

SOALAN TAMAT

FORMULA FOR BEU50503 SIGNAL AND SYSTEM

Sl. No.	Time Domain f(t)	S Domain F(s)
	$F(s) = \int_0^\infty e^{-st} f(t) dt$	
1	Unit impulse $\delta(t)$	1
2	Unit step	$\frac{1}{s}$
3	t	$\frac{1}{s^2}$
4	t^n	$\frac{n!}{s^{n+1}}$
5	$f'(t)$	$sF(s) - f(0)$
6	$f''(t)$	$s^2F(s) - sf(0) - f'(0)$
7	e^{at}	$\frac{1}{s-a}$; s > a
8	$t^n e^{at}$	$\frac{n!}{(s-a)^{n+1}}$
9	$\sin at$	$\frac{a}{s^2+a^2}$; $s > 0$
10	$\cos at$	$\frac{s}{s^2+a^2}$; $s > 0$
11	$\sinh at$	$\frac{a}{s^2-a^2}$; $s > \lvert a \rvert$
12	$\cosh at$	$\frac{s}{s^2-a^2}$; $s > \lvert a \rvert$
13	$e^{at} \sin bt$	$\frac{b}{(s-a)^2+b^2}$
14	$e^{at} \cos bt$	$\frac{(s-a)}{(s-a)^2+b^2}$
15	$e^{at} \sinh bt$	$\frac{b}{(s-a)^2-b^2}$
16	$e^{at} \cosh bt$	$\frac{(s-a)}{(s-a)^2-b^2}$
17	nth derivative	$s^nF(s) - s^{n-1}f(0) - s^{n-2}f'(0) \ldots - f^{n-1}(0)$
18	$\int_0^t f(\tau)\, d\tau$	$\frac{1}{s}F(s)$
19	$\int_0^t f(t-\tau)\, g(\tau) d\tau$	$F(s)G(s)$
20	$f(at)$	$\frac{1}{a}F\left(\frac{s}{a}\right)$
21	$e^{at}f(t)$	$F(s-a)$
22	$\delta(t-a)$	$\frac{1}{s}e^{-as}$
23	$\frac{t^{n-1}}{(n-1)!}$	$\frac{1}{s^n}$; $n = 1,2,3,\ldots$
24	$\frac{t^{n-1}}{(n-1)!}e^{at}$	$\frac{1}{(s+a)^n}$; $n = 1,2,3,\ldots$
25	$\frac{1}{a^2}[1 - \cos at]$	$\frac{1}{s(s^2+a^2)^2}$
26	$e^{-at} \sin \omega t$	$\frac{\omega}{(s+a)^2+\omega^2}$

z-TRANSFORM PAIRS

The index-domain signal is $x[n]$ for $-\infty < n < \infty$; and the z-transform is:

$$X(z) = \sum_{n=-\infty}^{\infty} x[n]\, z^{-n} \qquad \Longleftrightarrow \qquad x[n] = \frac{1}{2\pi j} \oint X(z)\, z^{n}\, \frac{dz}{z}$$

The ROC is the set of complex numbers z where the z-transform sum converges.

Signal: $x[n]$ $\quad -\infty < n < \infty$	z-Transform: $X(z)$	Region of Convergence
$\delta[n]$	1	All z
$\delta[n - n_\circ]$	$z^{-n_\circ}$	$\lvert z\rvert > 0$, if $n_\circ > 0$ $\lvert z\rvert < \infty$, if $n_\circ < 0$
$u[n]$	$\dfrac{1}{1 - z^{-1}}$	$\lvert z\rvert > 1$
$-u[-n-1]$	$\dfrac{1}{1 - z^{-1}}$	$\lvert z\rvert < 1$
$a^n\, u[n]$	$\dfrac{1}{1 - az^{-1}}$	$\lvert z\rvert > \lvert a\rvert$
$-a^n\, u[-n-1]$	$\dfrac{1}{1 - az^{-1}}$	$\lvert z\rvert < \lvert a\rvert$
$n\, a^n\, u[n]$	$\dfrac{az^{-1}}{(1 - az^{-1})^2}$	$\lvert z\rvert > \lvert a\rvert$
$-n\, a^n\, u[-n-1]$	$\dfrac{az^{-1}}{(1 - az^{-1})^2}$	$\lvert z\rvert < \lvert a\rvert$
$(n+1)\, a^n\, u[n]$	$\dfrac{1}{(1 - az^{-1})^2}$	$\lvert z\rvert > \lvert a\rvert$
$[\cos \omega_\circ n]\, u[n]$	$\dfrac{1 - [\cos \omega_\circ] z^{-1}}{1 - 2[\cos \omega_\circ] z^{-1} + z^{-2}}$	$\lvert z\rvert > 1$
$[\sin \omega_\circ n]\, u[n]$	$\dfrac{[\sin \omega_\circ] z^{-1}}{1 - 2[\cos \omega_\circ] z^{-1} + z^{-2}}$	$\lvert z\rvert > 1$
$[r^n \cos \omega_\circ n]\, u[n]$	$\dfrac{1 - [r \cos \omega_\circ] z^{-1}}{1 - 2r[\cos \omega_\circ] z^{-1} + r^2 z^{-2}}$	$\lvert z\rvert > \lvert r\rvert$
$[r^n \sin \omega_\circ n]\, u[n]$	$\dfrac{[r \sin \omega_\circ] z^{-1}}{1 - 2r[\cos \omega_\circ] z^{-1} + r^2 z^{-2}}$	$\lvert z\rvert > \lvert r\rvert$
$x[n] = \begin{cases} a^n, & 0 \le n < L \\ 0, & \text{otherwise} \end{cases}$	$\dfrac{1 - a^L z^{-L}}{1 - az^{-1}}$	$\lvert z\rvert > 0$

Table 3.1

Short Table of Fourier Transforms

	$g(t)$	$G(\omega)$	
1	$e^{-at}u(t)$	$\frac{1}{a+j\omega}$	$a>0$
2	$e^{at}u(-t)$	$\frac{1}{a-j\omega}$	$a>0$
3	$e^{-a\|t\|}$	$\frac{2a}{a^2+\omega^2}$	$a>0$
4	$te^{-at}u(t)$	$\frac{1}{(a+j\omega)^2}$	$a>0$
5	$t^n e^{-at}u(t)$	$\frac{n!}{(a+j\omega)^{n+1}}$	$a>0$
6	$\delta(t)$	1	
7	1	$2\pi\delta(\omega)$	
8	$e^{j\omega_0 t}$	$2\pi\delta(\omega-\omega_0)$	
9	$\cos\ \omega_0 t$	$\pi[\delta(\omega-\omega_0)+\delta(\omega+\omega_0)]$	
10	$\sin\ \omega_0 t$	$j\pi[\delta(\omega+\omega_0)-\delta(\omega-\omega_0)]$	
11	$u(t)$	$\pi\delta(\omega)+\frac{1}{j\omega}$	
12	$\operatorname{sgn} t$	$\frac{2}{j\omega}$	
13	$\cos\omega_0 t\ u(t)$	$\frac{\pi}{2}[\delta(\omega-\omega_0)+\delta(\omega+\omega_0)]+\frac{j\omega}{\omega_0^2-\omega^2}$	
14	$\sin\omega_0 t\ u(t)$	$\frac{\pi}{2j}[\delta(\omega-\omega_0)-\delta(\omega+\omega_0)]+\frac{\omega_0}{\omega_0^2-\omega^2}$	
15	$e^{-at}\sin\omega_0 t\ u(t)$	$\frac{\omega_0}{(a+j\omega)^2+\omega_0^2}$	$a>0$
16	$e^{-at}\cos\omega_0 t\ u(t)$	$\frac{a+j\omega}{(a+j\omega)^2+\omega_0^2}$	$a>0$
17	$\operatorname{rect}\left(\frac{t}{\tau}\right)$	$\tau\ \operatorname{sinc}\left(\frac{\omega\tau}{2}\right)$	
18	$\frac{W}{\pi}\operatorname{sinc}(Wt)$	$\operatorname{rect}\left(\frac{\omega}{2W}\right)$	
19	$\Delta\left(\frac{t}{\tau}\right)$	$\frac{\tau}{2}\operatorname{sinc}^2\left(\frac{\omega\tau}{4}\right)$	
20	$\frac{W}{2\pi}\operatorname{sinc}^2\left(\frac{Wt}{2}\right)$	$\Delta\left(\frac{\omega}{2W}\right)$	
21	$\sum_{n=-\infty}^{\infty}\delta(t-nT)$	$\omega_0\sum_{n=-\infty}^{\infty}\delta(\omega-n\omega_0)$	$\omega_0=\frac{2\pi}{T}$
22	$e^{-t^2/2\sigma^2}$	$\sigma\sqrt{2\pi}e^{-\sigma^2\omega^2/2}$	