SULIT

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

JABATAN KEJURUTERAAN ELEKTRIK

PEPERIKSAAN AKHIR

SESI I : 2022/2023

DEE40113: SIGNAL AND SYSTEM

TARIKH : 22 DISEMBER 2022
MASA : 8.30 AM – 10.30 AM (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)** subjective questions. Answer **ALL** Questions

ARAHAN:
*Bahagian ini mengandungi **TIGA (3)** soalan subjektif. Jawab semua soalan*

QUESTION 1
SOALAN 1

CLO1
C2

a) Explain the properties of Continuous Time LTI system with memory. Interpret whether the following system are with memory or without memory.

Terangkan ciri sistem LTI masa selanjar dengan ingatan. Tafsirkan samada sistem berikut mempunyai ingatan atau tanpa ingatan.

$$y(t) = 7x(t+5)$$

[4 marks]
[4 markah]

CLO1
C3, DP3

b) Sketch $x(t) * [u(t) - u(t-3)]$ for the continuous time signal shown in Figure A1(b)

*Lakarkan x (t) * [u (t) - u (t-3)] untuk isyarat masa berterusan yang ditunjukkan dalam rajah A1(b)*

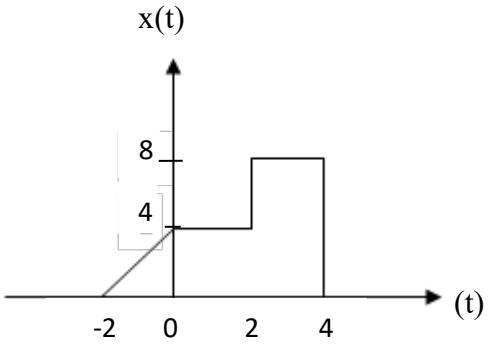

Figure A1(b) / *Rajah A1(b)*

[8 marks]
[*8 markah*]

CLO1
C3, DP1

c) Draw the even and odd component of x(t) and f(t) in Figure A1(c-i) and Figure A1(c-ii).

Lukiskan komponen genap dan ganjil bagi Rajah A1(c-i) dan Rajah A1(c-ii).

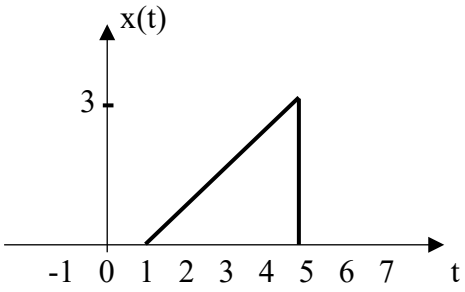

Figure A1(c-i) / *Rajah A1(c-i)*

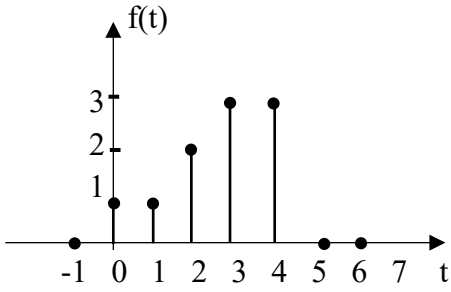

Figure A1(c-ii) / *Rajah A1(c-ii)*

[8 marks]
[*8 markah*]

QUESTION 2
SOALAN 2

CLO1
C2

a) Explain four(4) steps of convolution sum operation in LTI systems.

Terangkan empat (4) langkah operasi kaedah konvolusi tambah dalam sistem LTI.

[4 marks]
[*4 markah*]

CLO1
C3 , DP3

b) Sketch the output $y(t) = f_1(t) * f_2(t)$ of the functions in Figure A2(b).

Lakarkan keluaran $y(t) = f_1(t) * f_2(t)$ untuk fungsi-fungsi dalam Rajah A2(b)

$f_1(t) = f_2(t)$

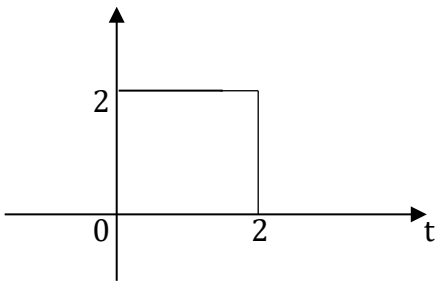

Figure A2(b) / *Rajah A2(b)*

[8 marks]
[*8 markah*]

CLO1
C3 , DP1

c) Calculate y[n] = x[n]*h[n] by using analytical technique.
*Kirakan y [n] = x [n] * h [n] dengan menggunakan teknik analisis.*

h[n] = δ[n] + δ[n-1] + δ[n-2]

x[n] = 3δ[n-2] + 3δ[n-3] + 2δ[n-4] + 2δ[n-5] + δ[n-6] + δ[n-7]

[8 marks]
[*8 markah*]

QUESTION 3
SOALAN 3

CLO1
C2

a) Convert the signal of x[n] into z-domain.
Tukarkan isyarat x[n] dalam satah-z:

$$X(n) = \begin{cases} 1, & n = -1 \\ 2, & n = 0 \\ -1, & n = 1 \\ 1, & n = 2 \\ 0, & \text{otherwise} \end{cases}$$

[4 marks]
[*4 markah*]

CLO1
C3, DP3

b) Calculate the following inverse Laplace Transform by using partial fraction
Kirakan Jelmaan Laplace Songsang berikut dengan menggunakan pecahan separa

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

[8 marks]
[*8 markah*]

CLO1
C3, DP3

c) Sketch the output y[n] = x[n] * h[n], where x [n] = [2, 2, 2] and h[n] = [2, **3**, 2, -1]. Use the graphical method to find y(n).
*Lakarkan keluaran y[n] = x[n] * h[n], dimana x[n] = [2, 2, 2] dan h[n] = [2, **3**, 2, -1]. Gunakan kaedah grafik untuk mencari y(n).*

[8 marks]
[*8 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
C4, DP1,
DP3,DP4

The input output signal relationship in a certain network is:

Hubungan isyarat masukan keluaran dalam rangkaian tertentu ialah:

$$y[n] + y[n-1] - 12y[n-2] = 4x[n]$$

Determine the frequency response H(Ω) and the impulse response h[n] of the systems.

Tentukan sambutan frekuensi H(Ω) dan sambutan dedenyut h[n] bagi sistem tersebut.

[20 marks]
[*20 markah*]

QUESTION 2

SOALAN 2

CLO1
C5, DP1
DP3, DP4

Figure B2 is the example of a continuous rectangular signal. The function of the signal can be expressed in Trigonometric Fourier Reries and Complex Exponential Fourier series. Evaluate the signal x(t) in the Complex exponential Fourier Series.

Rajah B2 adalah merupakan contoh isyarat terus segiempat. Fungsi bagi isyarat ini boleh dinyatakan di dalam Siri Fourier Trigonometrik dan Siri Fourier Ekxponen Kompleks. Nilaikan isyarat kompleks eksponen siri fourier bagi x(t).

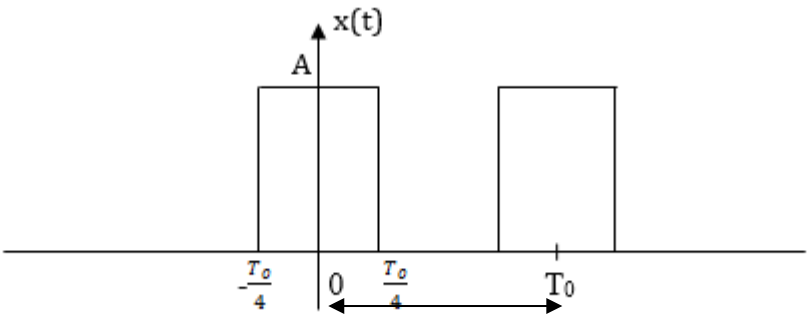

Figure B2 / *Rajah B2*

[20 marks]
[*20 markah*]

SOALAN TAMAT

FORMULA FOR DEE40113 SIGNAL AND SYSTEM

LAPLACE TRANSFORM PAIRS

$f(t)$	$F(s)$
$\partial(t)$	1
$u(t)$	$\frac{1}{s}$
a	$\frac{a}{s}$
$t^n,\ n=1,2,3,...$	$\frac{n!}{s^{n+1}}$
e^{at}	$\frac{1}{s-a}$
$\sin at$	$\frac{a}{s^2+a^2}$
$\cos at$	$\frac{s}{s^2+a^2}$
$\sin(at+\theta)$	$\frac{s\sin\theta+a\cos\theta}{s^2+a^2}$
$\cos(at+\theta)$	$\frac{s\cos\theta-a\sin\theta}{s^2+a^2}$
$e^{-at}\sin bt$	$\frac{b}{(s+a)^2+b^2}$
$e^{-at}\cos bt$	$\frac{s+a}{(s+a)^2+b^2}$
$t^n e^{-at}$	$\frac{n!}{(s+a)^{n+1}}$
$\sinh at$	$\frac{a}{s^2-a^2}$
$\cosh at$	$\frac{s}{s^2-a^2}$

FORMULA FOR DEE40113 SIGNAL AND SYSTEM

Z TRANSFORM PAIRS

$x(t)$	$X(s)$	$X(z)$
$\partial(t)=\begin{cases}1 & t=0\\ 0 & t=kT,\ k\neq 0\end{cases}$	1	1
$\partial(t-kT)=\begin{cases}1 & t=kT\\ 0 & t\neq kT\end{cases}$	e^{-kTs}	Z^{-k}
$u(t),\quad unit\ step$	$\frac{1}{s}$	$\frac{z}{z-1}$
t	$\frac{1}{s^2}$	$\frac{Tz}{(z-1)^2}$
t^2	$\frac{2}{s^3}$	$\frac{T^2z(z+1)}{(z-1)^3}$
e^{-at}	$\frac{1}{s+a}$	$\frac{z}{z-e^{-aT}}$
$1-e^{-at}$	$\frac{a}{s(s+a)}$	$\frac{(1-e^{-aT})z}{(z-1)(z-e^{-aT})}$
te^{-at}	$\frac{1}{(s+a)^2}$	$\frac{Tze^{-aT}}{(z-e^{-aT})^2}$
t^2e^{-at}	$\frac{2}{(s+a)^3}$	$\frac{T^2e^{-aT}z(z+e^{-aT})}{(z-e^{-aT})^3}$
$\sin\omega t$	$\frac{\omega}{s^2+\omega^2}$	$\frac{z\sin\omega T}{z^2-2z\cos\omega T+1}$
$\cos\omega t$	$\frac{s}{s^2+\omega^2}$	$\frac{z(z-\cos\omega T)}{z^2-2z\cos\omega T+1}$
$e^{-at}\sin\omega t$	$\frac{\omega}{(s+a)^2+\omega^2}$	$\frac{(ze^{-aT}\sin\omega T)}{z^2-2ze^{-aT}\cos\omega T+e^{-2aT}}$
$e^{-at}\cos\omega t$	$\frac{s+a}{(s+a)^2+\omega^2}$	$\frac{(z^2-ze^{-aT}\cos\omega T)}{z^2-2ze^{aT}\cos\omega T+e^{2aT}}$

FORMULA FOR DEE40113 SIGNAL AND SYSTEM

FOURIER TRANSFORM PAIRS

$f(t)$	$F(\omega)$
$\partial(t)$	1
1	$2\pi\partial(\omega)$
$u(t)$	$\pi\partial(\omega)+\frac{1}{j\omega}$
$u(t+\tau)-u(t-\tau)$	$2\frac{\sin\omega\tau}{\omega}$
$\lvert t\rvert$	$\frac{-2}{\omega^2}$
$\text{sgn}(t)$	$\frac{2}{j\omega}$
$e^{-at}u(t)$	$\frac{1}{a+j\omega}$
$e^{-at}u(-t)$	$\frac{1}{a-j\omega}$
$t^n e^{-at}u(t)$	$\frac{n!}{(a+j\omega)^{n+1}}$
$e^{-a\lvert t\rvert}$	$\frac{2a}{a^2+\omega^2}$
$e^{j\omega_o t}$	$2\pi\partial(\omega-\omega_o)$
$\sin\omega_o t$	$j\pi[\partial(\omega+\omega_o)-\partial(\omega-\omega_o)]$
$\cos\omega_o t$	$\pi[\partial(\omega+\omega_o)+\partial(\omega-\omega_o)]$
$\sin(\omega t+\theta)$	$\frac{s\sin\theta+\omega\cos\theta}{s^2+\omega^2}$
$\cos(\omega t+\theta)$	$\frac{s\cos\theta-\omega\sin\theta}{s^2+\omega^2}$
$e^{-at}\sin\omega_o t\ u(t)$	$\frac{\omega_o}{(a+j\omega)^2+\omega_o{}^2}$
$e^{-at}\cos\omega_o t\ u(t)$	$\frac{a+j\omega}{(a+j\omega)^2+\omega_o{}^2}$