SULIT

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

JABATAN KEJURUTERAAN ELEKTRIK

PEPERIKSAAN AKHIR

SESI II : 2021/2022

DEE40113: SIGNAL AND SYSTEM

TARIKH : 15 JULAI 2022
MASA : 8.30 PAGI - 10.30 PAGI (2 JAM)

Kertas ini mengandungi **TUJUH (7)** halaman bercetak.
Bahagian A: Struktur (2 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 **TWO (2)** subjective questions. Answer **ALL** questions.

ARAHAN :
*Bahagian ini mengandungi **DUA (2)** soalan subjektif. Jawab **SEMUA** soalan.*

QUESTION 1

SOALAN 1

CLO1
C3

(a) A continuous-time signal $x(t)$ is shown in Figure A1(a). Write the mathematical equation in terms of Unit Step Function.
Isyarat masa selanjar x(t) ditunjukkan dalam Rajah A1(a). Tuliskan persamaan matematik dalam istilah Fungsi Unit Langkah.

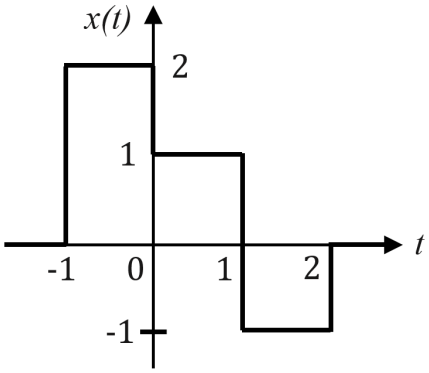

Figure A1(a) / *Rajah A1(a)*

[10 marks]
[10 *markah*]

CLO1
C3

(b) Figure A1(b) shows a discrete-time signal x[n]. Sketch the signals of x[n + 3], x[0.5n] and 2x[n].
Rajah A1(b) menunjukkan isyarat masa diskrit x[n]. Lakar dan labelkan isyarat bagi x[n + 3], x[0.5n] and 2x[n].

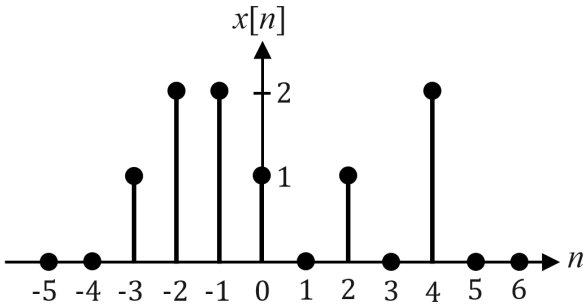

Figure A1(b) / *Rajah A1(b)*

[10 marks]

[10 *markah*]

CLO1
C3

(c) Solve the problem for Continuous-Time Signal shown in Figure A1(c). Sketch the output signal of $y(t) = x_1(t) + x_2(t)$.

Selesaikan masalah bagi Isyarat Masa Selanjar ditunjukkan dalam Rajah A1(c). Lakarkan isyarat keluaran bagi $y(t) = x_1(t) + x_2(t)$.

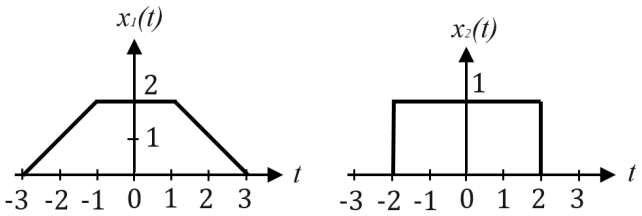

Figure A1(c) / *Rajah A1(c)*

[10 marks]

[10 *markah*]

QUESTION 2

SOALAN 2

CLO1
C3

(a) Draw a block diagram of an LTI system to show the input-output relationship that has an impulse response $h_1(t)$ were connected in parallel with the cascade impulse responses $h_2(t)$ and $h_3(t)$. Write the expression output of the system if input is unit step u(t).

Lukis gambarajah blok sistem LTI untuk menunjukkan hubungan masukan-keluaran. Sistem LTI mempunyai sambutan dedenyut $h_1(t)$ yang disambungkan selari dengan sambungan dedenyut lata $h_2(t)$ dan $h_3(t)$. Tulis persamaan keluaran bagi sistem tersebut jika masukan adalah unit langkah u(t).

[10 marks]

[10 *markah*]

CLO1 C3

(b) Carryout the convolution integral to Continuous-Time system as shown in Figure A2(b) using analytical technique.

Laksanakan kamiran pelingkaran bagi sistem Masa Selanjar seperti ditunjukkan dalam Rajah A2(b).

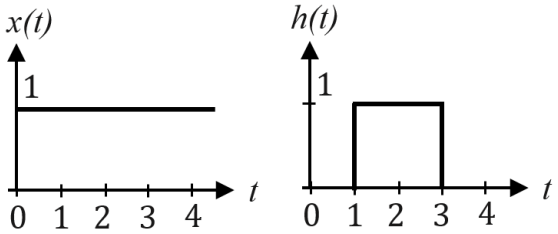

Figure A2(b) / *Rajah A2(b)*

[10 marks]

[10 *markah*]

CLO1 C3

(c) Figure A2(c) shows the discrete-time LTI system with impulse response h[n] for an input x[n]. Sketch the output y[n] of this system for convolution sum without using the convolution technique.

Rajah A2(c) menunjukkan sistem masa diskrit LTI dengan sambutan dedenyut h[n] bagi masukan x[n]. Lakarkan keluaran y[n] bagi jumlah pelingkaran tanpa menggunakan teknik convolution.

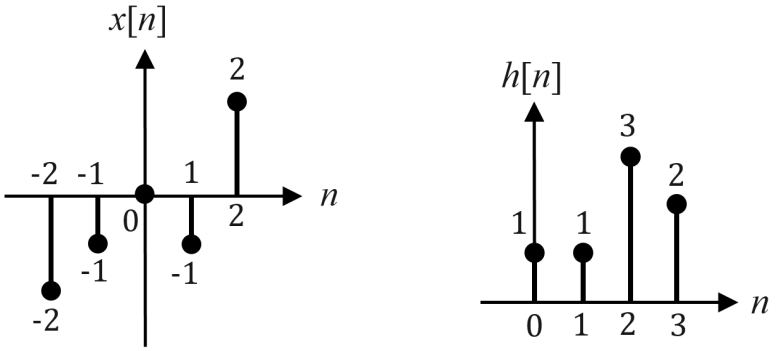

Figure A2(c) / *Rajah A2(c)*

[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.*

CLO1
C4

QUESTION 1
SOALAN 1

Figure B1 shows a simple RL circuit with a 12V DC voltage source, and given value $R = 4\Omega$ and $L = 0.5H$. The loop equation for this circuit is given as below. Investigate the current $i(t)$ flows in the circuit using transfer function. Show all calculations.

Rajah B1 menunjukkan litar RL asas dengan sumber voltan 12V DC dan diberi nilai $R = 4\Omega$ dan $L = 0.5H$. Gelung persamaan bagi litar ini diberikan seperti di bawah. Siasat arus $i(t)$ yang mengalir dalam litar menggunakan rangkap pindah. Tunjukkan semua pengiraan.

$$0.5\frac{di(t)}{dt} + 4i(t) = v_c(t)$$

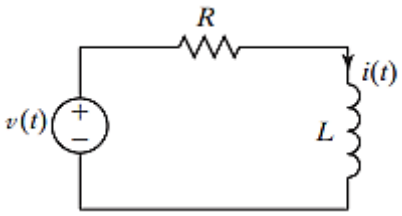

Figure B1/*Rajah B1*

[20 marks]
[*20 markah*]

CLO1
C5

QUESTION 2
SOALAN 2

The Fourier transform is allowed to convert convolution in the time domain into multiplication in the frequency domain. Evaluate the output y(t) of the operation of a Continuous-Time LTI system that is described by the differential equation as follows if the input signal is given by $x(t) = e^{-t}u(t)$.

$$\frac{dy(t)}{dt} + 3y(t) = 2x(t)$$

Jelmaan Fourier dibenarkan untuk menukar konvolusi dalam domain waktu menjadi pendaraban dalam domain frekuensi. Tentukan keluaran y(t) bagi operasi sistem LTI Berterusan-Masa yang diterangkan oleh persamaan pembezaan seperti berikut jika isyarat masukan diberikan oleh $x(t) = e^{-t}u(t)$.

$$\frac{dy(t)}{dt} + 3y(t) = 2x(t)$$

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