POLITEKNIK
MALAYSIA

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI
KEMENTERIAN PENDIDIKAN MALAYSIA

JABATAN KEJURUTERAAN ELEKTRIK

PEPERIKSAAN AKHIR

SESI JUN 2018

DEE6122: SIGNAL AND SYSTEMS

TARIKH : 03 NOVEMBER 2018
MASA : 8.30 PAGI - 10.30 PAGI (2 JAM)

Kertas ini mengandungi LAPAN (8) halaman bercetak.
Bahagian A: Struktur (4 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 **FOUR (4)** structured questions. Answer **ALL** questions.

ARAHAN:
*Bahagian ini mengandungi **EMPAT (4)** soalan berstruktur. Jawab semua soalan.*

QUESTION 1
SOALAN 1

CLO1
C1

a) Define the terms of periodic signal and causal system.

Definisikan isyarat berkala dan sistem kausal.

[3 marks]
[*3 markah*]

CLO1
C2

b) Determine the even and odd components for Figure A1b (i) and Figure A1b (ii).

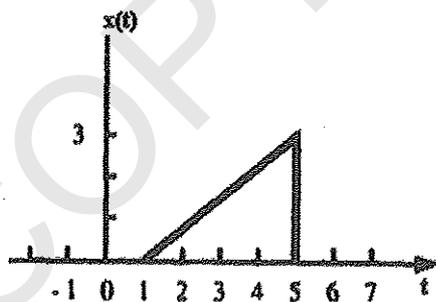*Tentukan komponen genap dan ganjil bagi isyarat seperti Rajah A1b(i) dan Rajah A1b(ii).*
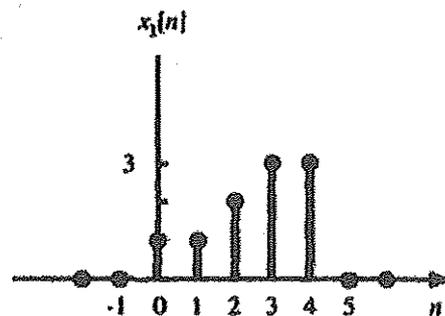

Figure A1b (i) /*Rajah A1b (i)*

Figure A1b (ii) /*Rajah A1b (ii)*

[5 marks]
[*5 markah*]

CLO1
C3

c) A continuous time signal $x(t)$ is shown in Figure A1(c). Sketch correctly each of the following signals, $x(t)\delta\left(t-\frac{3}{2}\right)$ and $x(t)[u(t+1)-u(t-1)]$.

Isyarat masa selanjar ditunjukkan dalam Rajah A1(c). Lakar dengan betul bagi setiap isyarat yang berikut, $x(t)\delta\left(t-\frac{3}{2}\right)$ dan $x(t)[u(t+1)-u(t-1)]$.
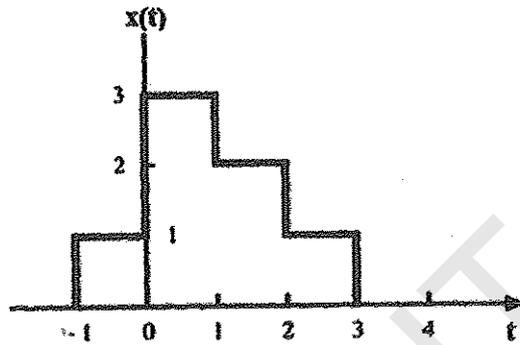

Figure A1(c) /*Rajah A1(c)*

[7 marks]
[*7 markah*]

3

QUESTION 2
SOALAN 2

CLO1
C1

a) Referring to Figure A2(a), state the input-output relationship for the block diagram of LTI system.

Merujuk kepada Rajah A2(a), nyatakan hubungan masukan-keluaran bagi gambarajah blok sistem lelurus LTI.
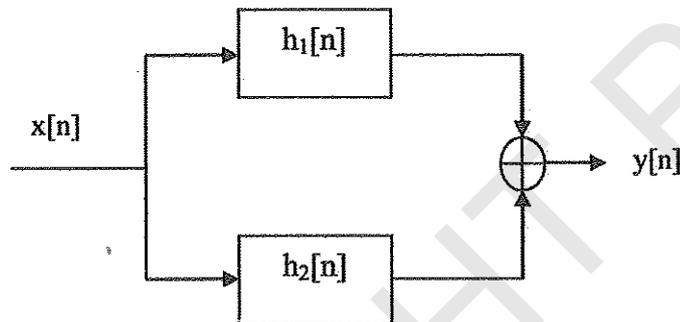

Figure A2(a) / *Rajah A2(a)*

[3 marks]
[3 *markah*]

CLO1
C2

b) Compute the convolution from 0 to t if $h(t) = u(t)$ and $x(t) = t^2 u(t)$.

Kirakan hasil konvolusi bagi 0 sehingga t jika h(t) = u(t) dan x(t) = t^2 u(t).

[5 marks]
[5 *markah*]

4

CLO1
C3

c) The impulse response for a discrete time LTI signal is

Sambutan denyut bagi isyarat Discrete Time LTI adalah

$$h[n] = 2\delta[n + 3] + 2\delta[n] + \delta[n - 1]$$

Sketch the output of this system when the input signal is

Lakarkan keluaran bagi sistem ini jika isyarat masukan diberikan seperti berikut

$$x[n] = \delta[n] + 3\delta[n - 1] - 2\delta[n - 2]$$

[7 marks]
[*7markah*]

QUESTION 3
SOALAN 3

CLO2
C1

a) For the following z –transform, determine the inverse z-transform.

Bagi jelmaan z dibawah, tentukan nilai jelmaan z songsang.

$$X(z) = 7 + \frac{z}{z - \frac{1}{2}}$$

[3 marks]
[3 markah]

CLO2
C2

b) Compute the inverse of the following Laplace Transform:

Kirakan songsangan Jelmaan Laplace yang berikut:

$$Y(s) = \frac{3}{(s+2)(S+5)} + \frac{-2}{s+5}$$

[5 marks]
[5 markah]

CLO2
C3

c) Consider the LTI signal, $x(t) = e^{-2t}u(t) + e^{-3t}u(t)$. Calculate the Laplace Transform X(s) and sketch the zero-pole plots with the ROC for that signal.

Diberi isyarat LTI, $x(t) = e^{-2t}u(t) + e^{-3t}u(t)$. Kirakan Jelmaan Laplace X(s) dan plotkan kutub-sifar bersama ROC bagi isyarat tersebut.

[7 marks]
[7 markah]

QUESTION 4
SOALAN 4

CLO3
C2

a) Compute the Fourier series coefficients for the following signal $x(t)$:

Kirakan Fourier series coefficients bagi isyarat $x(t)$ di bawah:

$$x(t) = \sin \omega_0(t)$$

[3 marks]
[3 *markah*]

CLO3
C3

b) The input output relationship in a certain network is shown as below. Calculate the Fourier transform for output signal, Vout when $Vin(t) = e^{-t}u(t)$

Hubungan masukan keluaran di dalam sesetengah rangkaian ditunjukkan seperti di bawah. Kirakan isyarat keluaran Jelmaan fourier , Vout bila $Vin(t) = e^{-t}u(t)$

$$\frac{d^2Vout\,(t)}{dt^2} + 4\frac{dVout(t)}{dt} + 4Vout(t) = 10Vin(t)$$

[5 marks]
[5 *markah*]

CLO3
C4

c) Continuous Time LTI can be described as per below:

Isyarat berterusan LTI boleh dinyatakan seperti berikut:

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

Using Fourier Transform, calculate output y(t) if $x(t) = e^{-t}\,u(t)$

Menggunakan Jelmaan Fourier, kira keluaran $y(t)$ jika $x(t) = e^{-t}\,u(t)$

[7 marks]
[7 *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 sahaja.

QUESTION 1
SOALAN 1

CLO2
C3

Calculate the Z transform for the sequence

Kirakan jelmaan Z bagi jujukan

$$x[n] = -a^n \, u[-n-1]$$

and a sequence

dan jujukan

$$x[n] = a^{-n} \, u[-n-1].$$

[20 marks]
[*20 markah*]

QUESTION 2
SOALAN 2

CLO3
C4

Solve the sequence of $x[n] = \sum_{k=-\infty}^{\infty} \delta[n - 4k]$ by sketching the x[n] and calculate the Fourier coefficients C_k from x[n] and sketch the C_k.

Selesaikan masalah yang melibatkan turutan $x[n] = \sum_{k=-\infty}^{\infty} \delta[n - 4k]$ dengan melakarkan x[n] dan kirakan koefisien C_k dari x[n] dan lakarkan juga C_k.

[20 marks]
[*20 markah*]

SOALAN TAMAT

FORMULA FOR DEE6122 : 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^{-kT_s}	Z^{-k}
$u(t)$, unit step	$\dfrac{1}{s}$	$\dfrac{z}{z-1}$
t	$\dfrac{1}{s^2}$	$\dfrac{Tz}{(z-1)^2}$
t^2	$\dfrac{2}{s^3}$	$\dfrac{T^2 z(z+1)}{(z-1)^3}$
e^{-at}	$\dfrac{1}{s+a}$	$\dfrac{z}{z-e^{-aT}}$
$1-e^{-at}$	$\dfrac{a}{s(s+a)}$	$\dfrac{(1-e^{-aT})z}{(z-1)(z-e^{-aT})}$
te^{-at}	$\dfrac{1}{(s+a)^2}$	$\dfrac{Tze^{-aT}}{(z-e^{-aT})^2}$
$t^2 e^{-at}$	$\dfrac{2}{(s+a)^3}$	$\dfrac{T^2 e^{-aT} z(z+e^{-aT})}{(z-e^{-aT})^3}$
$\sin \omega t$	$\dfrac{\omega}{s^2+\omega^2}$	$\dfrac{z \sin \omega T}{z^2 - 2z \cos \omega T + 1}$
$\cos \omega t$	$\dfrac{s}{s^2+\omega^2}$	$\dfrac{z(z-\cos \omega T)}{z^2 - 2z \cos \omega T + 1}$
$e^{-at} \sin \omega t$	$\dfrac{\omega}{(s+a)^2+\omega^2}$	$\dfrac{(ze^{-aT} \sin \omega T)}{z^2 - 2ze^{-aT} \cos \omega T + e^{-2aT}}$
$e^{-at} \cos \omega t$	$\dfrac{s+a}{(s+a)^2+\omega^2}$	$\dfrac{(z^2 - ze^{-aT} \cos \omega T)}{z^2 - 2ze^{aT} \cos \omega T + e^{2aT}}$

FORMULA FOR DEE6122 : SIGNAL AND SYSTEM

FOURIER TRANSFORM PAIRS

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

FORMULA FOR DEE6122 : SIGNAL AND SYSTEM

LAPLACE TRANSFORM PAIRS

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