# 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).*
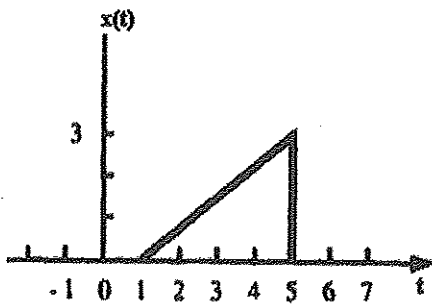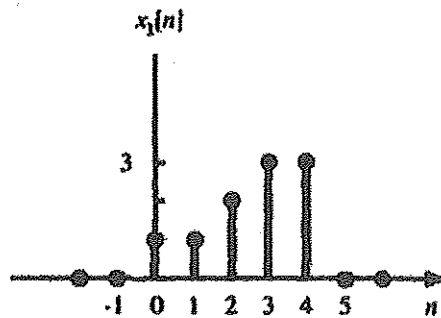


Figure A1b (i) /*Rajah A1b (i)*          Figure A1b (ii) /*Rajah A1b (ii)*

[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 $x(t)[u(t+1)-u(t-1)]$.*
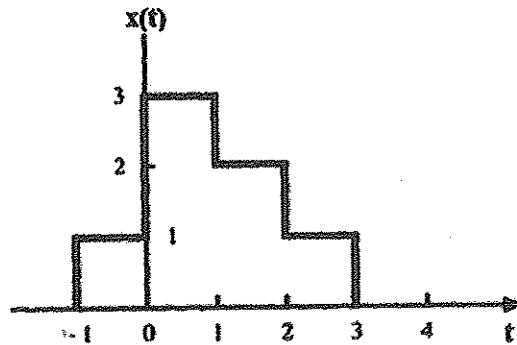


Figure A1(c) /*Rajah A1(c)*

[7 marks]
[*7 markah*]

**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.*
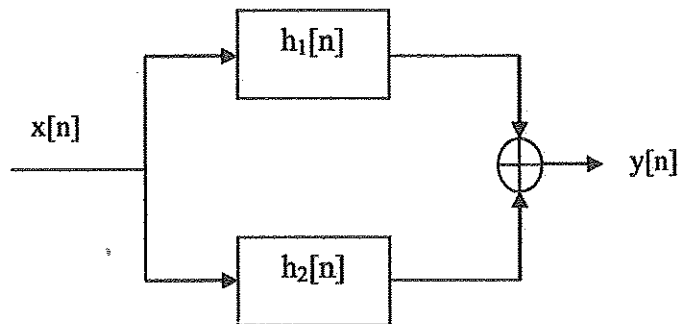


Figure A2(a) / *Rajah A2(a)*

[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*]

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

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

# FORMULA FOR DEE6122 : SIGNAL AND SYSTEM

## FOURIER TRANSFORM PAIRS

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

# FORMULA FOR DEE6122 : SIGNAL AND SYSTEM

## LAPLACE TRANSFORM PAIRS

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