



**BAHAGIAN PEPERIKSAAN DAN PENILAIAN  
JABATAN PENDIDIKAN POLITEKNIK  
KEMENTERIAN PENDIDIKAN TINGGI**

**JABATAN KEJURUTERAAN ELEKTRIK**

**PEPERIKSAAN AKHIR  
SESI DISEMBER 2017**

**DEE6122 : SIGNAL AND SYSTEMS**

**TARIKH : 06 APRIL 2018  
MASA : 8.30 PAGI - 10.30 PAGI (2 JAM)**

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Kertas ini mengandungi ENAM (6) halaman bercetak.

Bahagian A: Struktur (4 soalan)  
Bahagian B: Esei (2 soalan)

Dokumen sokongan yang disertakan : Formula Dan Jadual Laplace

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**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 meaning of a system.  
*Takrifkan maksud sistem.*
- [3 marks]  
[3 markah]
- CLO1  
C2 (b) Explain the continuous time system and discrete-time system with related diagram.  
*Terangkan sistem masa selanjara dan sistem masa diskret dengan rajah berkaitan.*
- [5 marks]  
[5 markah]
- CLO1  
C3 (c) A discrete-time signal  $x(n)$  is shown in Figure A1(c). Sketch and label the signal for :  $x(n-2)$ ,  $x(2n)$  and  $x(-n)$ .  
*Satu isyarat masa diskret  $x(n)$  adalah seperti di dalam Rajah A1(c). Lukis dan labelkan isyarat bagi :  $x(n-2)$ ,  $x(2n)$  and  $x(-n)$ .*

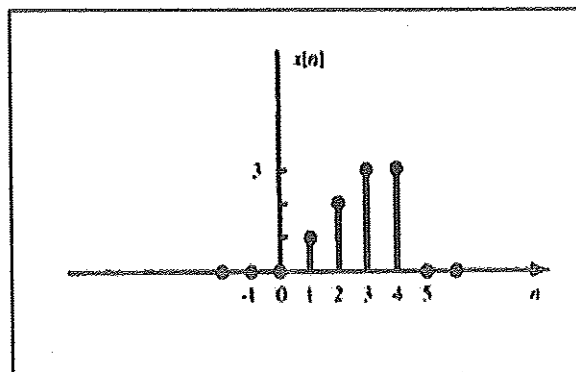


Figure A1(c) / Rajah A1(c)

[7 marks]

[7 markah]

## QUESTION 2

## SOALAN 2

CLO1  
C1

- (a) Refer Figure A2(a), identify the input-output relationship for the block diagram of LTI system.

Rujuk Rajah A2(a), kenalpasti hubungan masukan-keluaran bagi rajah blok sistem LTI.

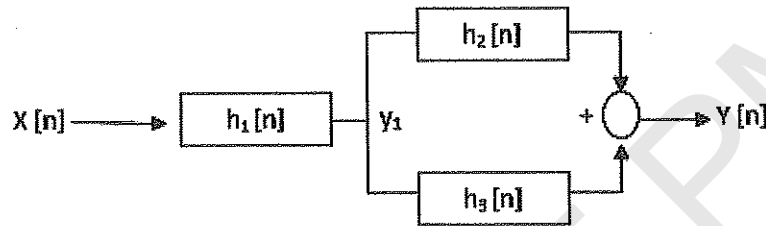


Figure A2( a) / Rajah A2( a)

[3 marks]

[3 markah]

CLO1  
C2

- (b) Explain the properties of Continuous-Time LTI systems with memory. Identify whether the following systems are with memory or without memory.

Terangkan ciri sistem LTI masa selanjar dengan ingatan. Kenalpasti samada sistem di bawah mempunyai ingatan atau tidak mempunyai ingatan.

$$y(t) = 8x(t) + 7x(t+5)$$

[5 marks]

[5 markah]

CLO1  
C3

- (c) The input output is given by  $y(t) = tx(t)$ . Interpret whether the system is time-invariant or not.

Diberi masukan keluaran adalah  $y(t) = tx(t)$ . Tafsirkan samada sistem ini adalah sistem LTI masa selanjar atau pun tidak.

[7 marks]

[7 markah]

## QUESTION 3

## SOALAN 3

CLO2  
C1

- (a) Laplace transform
- $X(s)$
- of the signal is given as:

$$X(s) = \frac{1}{s+a} \quad \text{Re}(s) > -a$$

Draw the region of convergence (ROC) in a complex plane (S-plane).

*Jelmaan Laplace  $X(s)$  bagi isyarat adalah:*

$$X(s) = \frac{1}{s+a} \quad \text{Re}(s) > -a$$

*Lukiskan 'Region Of Convergence' (ROC) di dalam planar kompleks (S-plane).*

[3 marks]

[3 markah]

CLO2  
C2

- (b) Consider signal
- $x(t)$
- of LTI signal
- $x(t) = e^{-2t} + e^{-3t}u(t)$
- , determine the Laplace transform
- $X(s)$
- .

*Pertimbangkan isyarat LTI  $x(t) = e^{-2t} + e^{-3t}u(t)$ . Tentukan Jelmaan Laplace  $X(s)$ .*

[5 marks]

[5 markah]

CLO2  
C3

- (c) Compute the Inverse Laplace Transform
- $X(s) = \frac{2s+4}{s^2+4s+3}$

*Kirakan Jelmaan Laplace Songsang bagi  $X(s) = \frac{2s+4}{s^2+4s+3}$*

[7 marks]

[7 markah]

## QUESTION 4

## SOALAN 4

CLO3  
C2

- (a) Identify and draw the waveform for the function
- $f(t)$
- below :

*Kenalpasti dan lukiskan bentuk gelombang bagi fungsi  $f(t)$  di bawah:*

$$f(t) = \begin{cases} -1 & \text{for } -\pi \leq x \leq 0 \\ 1 & \text{for } 0 \leq x \leq \pi \end{cases}$$

[3 marks]

[3 markah]

CLO3  
C3

- (b) Calculate the
- $a_0$
- and
- $\omega_0$
- for function
- $f(x)$
- given.

$$f(x) = \begin{cases} 0 & -\pi < x < 0, \\ 1 & 0 < x < \pi \end{cases}$$

*Kirakan  $a_0$  dan  $\omega_0$  bagi fungsi  $f(x)$  yang diberikan.*

[5 marks]

[5 markah]

CLO3  
C4

- (c) Determine the Fourier Transform of a single pulse as given by the equation below using the integration method.

*Tentukan Jelmaan Fourier bagi dedenyut tunggal berdasarkan persamaan di bawah menggunakan kaedah pengamiran.*

$$x(t) = \begin{cases} 1, & -\frac{\tau}{2} < t < \frac{\tau}{2} \\ 0, & \text{elsewhere} \end{cases}$$

[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 soalan.*

**QUESTION 1**

**SOALAN 1**

CLO2  
C3

Calculate the Z transform for the sequence  $X[n] = -a^n u[-n - 1]$  and sequence  $X[n] = a^{-n} u[-n - 1]$

*Kirakan jelmaan Z bagi jujukan  $X[n] = -a^n u[-n - 1]$  dan jujukan  $X[n] = a^{-n} u[-n - 1]$*

[20 marks]

[20 markah]

**QUESTION 2**

**SOALAN 2**

CLO3  
C4

**Figure B2** is the example of a continuous rectangular signal. The function of the signal can be expressed in Trigonometric Fourier Series and Complex Exponential Fourier Series.

Summarize the signal  $x(t)$  shown below 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 Eksponen Kompleks.*

*Rumuskan isyarat  $x(t)$  di bawah di dalam Siri Fourier Eksponen Kompleks.*

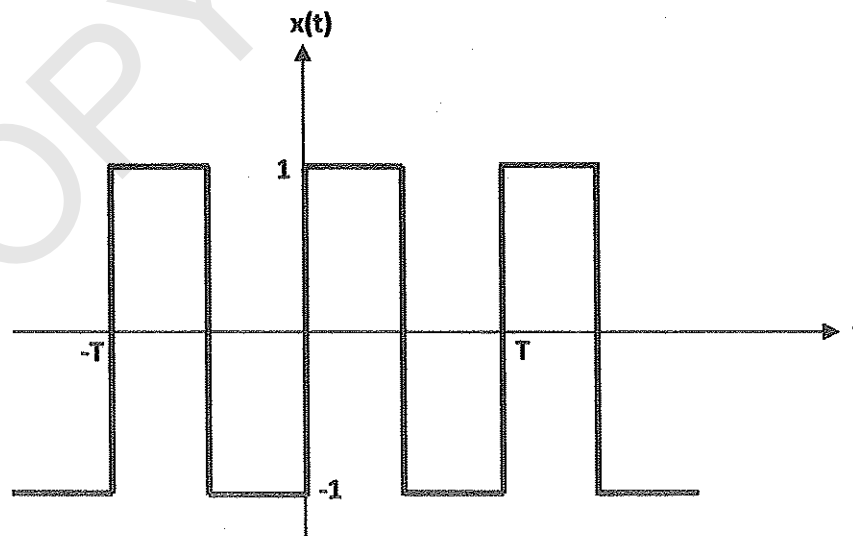


Figure B2/ Rajah B2

[20 marks]  
[20 markah]

**SOALAN TAMAT**

Table : Some Laplace Transform pairs

$x(t)$	$X(s)$	ROC
$\delta(t)$	1	All $s$
$u(t)$	$\frac{1}{s}$	$\text{Re}(s) > 0$
$-u(-t)$	$\frac{1}{s}$	$\text{Re}(s) < 0$
$tu(t)$	$\frac{1}{s^2}$	$\text{Re}(s) > 0$
$t^k u(t)$	$\frac{k!}{s^{k+1}}$	$\text{Re}(s) > 0$
$e^{-at}u(t)$	$\frac{1}{s+a}$	$\text{Re}(s) > -\text{Re}(a)$
$-e^{-at}u(-t)$	$\frac{1}{s+a}$	$\text{Re}(s) < -\text{Re}(a)$
$te^{-at}u(t)$	$\frac{1}{(s+a)^2}$	$\text{Re}(s) > -\text{Re}(a)$
$-te^{-at}u(-t)$	$\frac{1}{(s+a)^2}$	$\text{Re}(s) < -\text{Re}(a)$
$\cos \omega_0 t u(t)$	$\frac{s}{s^2 + \omega_0^2}$	$\text{Re}(s) > 0$
$\sin \omega_0 t u(t)$	$\frac{\omega_0}{s^2 + \omega_0^2}$	$\text{Re}(s) > 0$
$e^{-at} \cos \omega_0 t u(t)$	$\frac{s+a}{(s+a)^2 + \omega_0^2}$	$\text{Re}(s) > -\text{Re}(a)$
$e^{-at} \sin \omega_0 t u(t)$	$\frac{\omega_0}{(s+a)^2 + \omega_0^2}$	$\text{Re}(s) > -\text{Re}(a)$

Table : Common Fourier Transforms Pairs

$x(t)$	$X(\omega)$
$\delta(t)$	1
$\delta(t - t_0)$	$e^{-j\omega t_0}$
1	$2\pi\delta(\omega)$
$e^{j\omega_0 t}$	$2\pi\delta(\omega - \omega_0)$
$\cos \omega_0 t$	$\pi[\delta(\omega - \omega_0) + \delta(\omega + \omega_0)]$
$\sin \omega_0 t$	$-j\pi[\delta(\omega - \omega_0) - \delta(\omega + \omega_0)]$
$u(t)$	$\pi\delta(\omega) + \frac{1}{j\omega}$
$u(-t)$	$\pi\delta(\omega) - \frac{1}{j\omega}$
$e^{-at}u(t), a > 0$	$\frac{1}{j\omega + a}$
$t e^{-at}u(t), a > 0$	$\frac{1}{(j\omega + a)^2}$
$e^{-a t }, a > 0$	$\frac{2a}{a^2 + \omega^2}$
$\frac{1}{a^2 + t^2}$	$e^{-a \omega }$
$e^{-at^2}, a > 0$	$\sqrt{\frac{\pi}{a}} e^{-\omega^2/4a}$
$p_a(t) = \begin{cases} 1 &  t  < a \\ 0 &  t  > a \end{cases}$	$2a \frac{\sin \omega a}{\omega a}$
$\frac{\sin at}{\pi t}$	$p_a(\omega) = \begin{cases} 1 &  \omega  < a \\ 0 &  \omega  > a \end{cases}$
$\text{sgn } t$	$\frac{2}{j\omega}$
$\sum_{k=-\infty}^{\infty} \delta(t - kT)$	$\omega_0 \sum_{k=-\infty}^{\infty} \delta(\omega - k\omega_0), \omega_0 = \frac{2\pi}{T}$