SULIT

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

JABATAN KEJURUTERAAN ELEKTRIK

PEPERIKSAAN AKHIR

**SESI JUN 2019**

# DEE40113: SIGNAL AND SYSTEM

**TARIKH : 4 NOVEMBER 2019**
**MASA : 2.30 PETANG – 4.30 PETANG (2 JAM)**

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Kertas ini mengandungi **ENAM (6)** halaman bercetak.
Bahagian A: Struktur (4 soalan)
Bahagian B: Esei (1 soalan)

Dokumen sokongan yang disertakan : **LAMPIRAN**

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**JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN**

(CLO yang tertera hanya sebagai rujukan)

**SECTION A : 80 MARKS**

***BAHAGIAN A : 80 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
C2

(a) Interpret and give **ONE (1)** example of the terms feedback system and periodic signal.

*Tafsirkan dan beri **SATU (1)** contoh untuk terma sistem suapbalik dan isyarat berkala.*

[5 marks]
[*5 markah*]

CLO1
C2

(b) Illustrate the odd signal of the Figure A1b(i) and the even signal of the Figure A1b(ii).

*Gambarkan isyarat ganjil bagi Rajah A1b(i) dan isyarat genap bagi Rajah A1b(ii)*

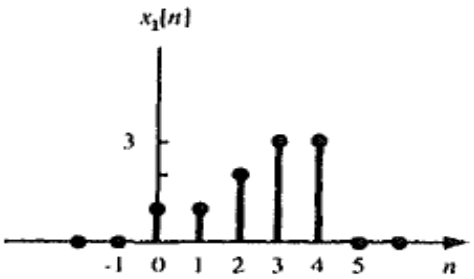


Figure A1b(i)/ *Rajah A1b(i)*

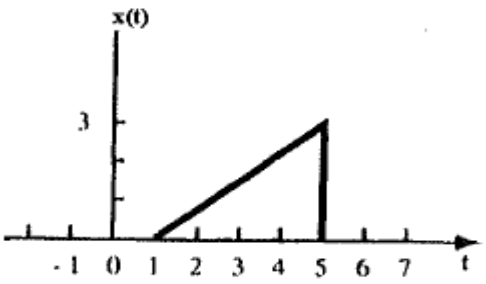


Figure A1b(ii)/ *Rajah A1b(ii)*

[5 marks]
[*5 markah*]

CLO1
C3

(c) The Figure Al(c) is a continuous time signal x(t). Plot each of the following signals, x(t)[u(t + 1) – u(t –1)] and x(t) δ (t = 3/2).

*Rajah A1c ialah isyarat selanjar x(t). Plotkan bagi isyarat yang berikut,* *x(t)[u(t + 1) – u(t – 1)] and x(t) δ (t = 3/2).*

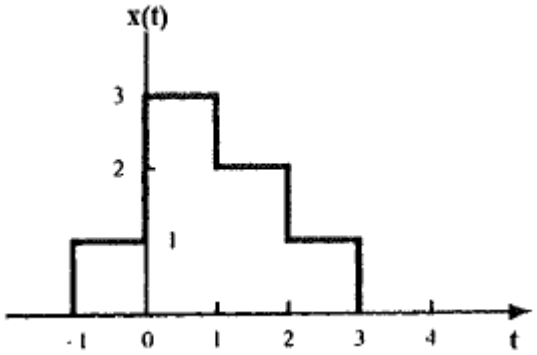


Figure A1(c)/ *Rajah A1(c)*

[10 marks]
[*10 markah*]

**QUESTION 2**
***SOALAN 2***

CLO1
C2

(a) The Figure A2(a) is a special class of a great system. Explain the input-output relationship for the block diagram of LTI systems.

*Rajah A2(a) ialah pengkelasan khas bagi sistem unggul. Nyatakan hubungan masukan-keluaran untuk rajah blok bagi sistem LTI.*

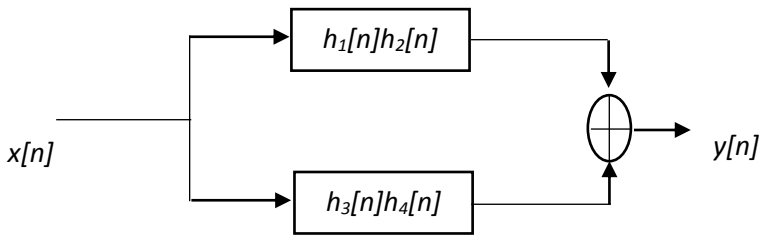


Figure A2(a)/ *Rajah A2(a)*

[5 marks]
[*5 markah*]

CLO1 C2

(b) Express the convolution in the time range from 0 to t if $h(t) = e^{-\alpha t} u(t)$ and $x(t) = u(t)$.

*Ungkapkan hasil konvolusi bagi julat masa 0 hingga t jika* $h(t) = e^{-\alpha t} u(t)$ *dan* $x(t) = u(t)$.

[5 marks]
[*5 markah*]

CLO1 C3

(c) The impulse response of a discrete time LTI signal as given. Sketch the output of this system if the input signal as below.

*Sambutan denyut bagi isyarat masa diskrit LTI seperti yang diberikan. Lakarkan keluaran sistem ini jika isyarat masukan seperti di bawah.*

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

[10 marks]
[*10 markah*]

**QUESTION 3**
***SOALAN 3***

CLO1 C2

(a) Explain the input signal $x[n] = 2^n u[n] - 3^n u[-n-1]$ to the Z – transform and locate the region of convergences (ROCs).

*Jelaskan isyarat masukan* $x[n] = 2^n u[n] - 3^n u[-n-1]$ *kepada Jelmaan Z dan dapatkan kawasan pencapahan (ROCs).*

[4 marks]
[*4 markah*]

CLO1 C3

(b) Solve $y[n] = x[n]*h[n]$ if $x[n]$ and $h[n]$ as given by using the analytical technique.

*Selesaikan* $y[n] = x[n]*h[n]$ *jika diberi* $x[n]$ *dan* $h[n]$ *seperti yang dinyatakan dengan menggunakan teknik analitik.*

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

[8 marks]
[*8 markah*]

CLO1 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 with the ROC for that signal.

*Andai isyarat, $x(t)=e^{-2t}u(t) + e^{-3t}u(t)$. Kira Jelmaan Laplace X(s) dan lakarkan kutub-sifar dengan ROC bagi isyarat itu.*

[8 marks]
[*8 markah*]

**QUESTION 4**
***SOALAN 4***

CLO1 C2

a) Detail the Fourier series coefficients for the signal of $x(t) = \sin \omega_0(t)$.

*Dapatkan pekali siri Fourier bagi isyarat $x(t) = \sin \omega_0(t)$.*

[4 marks]
[*4 markah*]

CLO1 C3

(b) Calculate a Fourier transform for the signal $x(t) = e^{-3|t|} \sin 2t$ by using the Fourier transform table.

*Hitung Jelmaan Fourier bagi isyarat $x(t) = e^{-3|t|} \sin 2t$ menggunakan Jadual Jelmaan Fourier.*

[8 marks]
[*8 markah*]

CLO1 C3

(c) A transmission signal consists of a pulse-width modulation signal $v(t) = V_1(t) \cos \omega_c t$. Solve the Fourier transform for the following signal.

*Isyarat penghantaran mempuyai isyarat pemodulatan lebar $v(t) = V_1(t) \cos \omega_c t$. Selesaikan jelmaan Fourier bagi isyarat tersebut.*

[8 marks]
[8 markah]

**SECTION B : 20 MARKS**

***BAHAGIAN B : 20 MARKAH***

**INSTRUCTION:**

This section consists of **ONE (1)** essay question. Answer the question.

***ARAHAN:***

*Bahagian ini mengandungi **SATU (1)** soalan esei. Jawab soalan tersebut.*

**QUESTION 1**
***SOALAN 1***

CLO1
C5

The volumes and frequencies in a musical chord is an example of Fourier Transform. Continuous Time Linear Invariant (LTI) as $\frac{dy(t)}{dt} + 2y(t) = x(t)$. Evaluate the output y(t) if the input is x(t) = $e^{t}$ u(t).

*Magnitud dan frekuensi suara dalam kod muzik adalah salah satu contoh Jelmaan Fourier. Isyarat berterusan (LTI) sebagai* $\frac{dy(t)}{dt} + 2y(t) = x(t)$ *. Nilaikan keluaran y(t) jika masukan ialah x(t) =* $e^{t}$ *u(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

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