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).

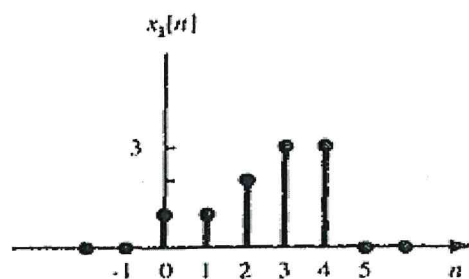*Gambarkan isyarat ganjil bagi Rajah A1b(i) dan isyarat genap bagi Rajah A1b(ii)*
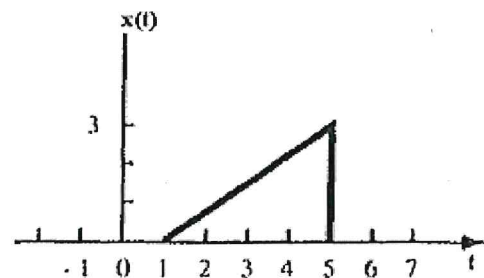

Figure A1b(i)/ *Rajah A1b(i)*   Figure A1b(ii)/ *Rajah A1b(ii)*

[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).
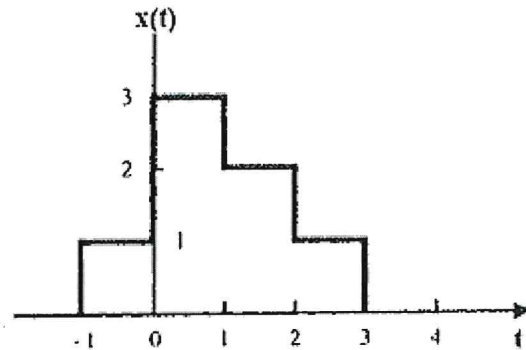

Figure A1(c)/ *Rajah A1(c)*

[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.
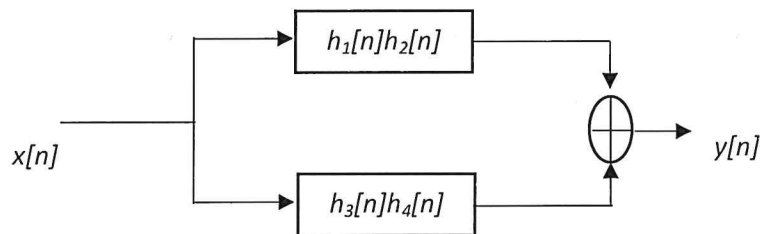

Figure A2(a)/ *Rajah A2(a)*

[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 $\dfrac{dy(t)}{dt} + 2y(t) = x(t)$. 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 $\dfrac{dy(t)}{dt} + 2y(t) = x(t)$. 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
$u(t)$	$\dfrac{1}{s}$
a	$\dfrac{a}{s}$
$t^n, n=1,2,3,...$	$\dfrac{n!}{s^{n+1}}$
e^{at}	$\dfrac{1}{s-a}$
$\sin at$	$\dfrac{a}{s^2+a^2}$
$\cos at$	$\dfrac{s}{s^2+a^2}$
$\sin(at+\theta)$	$\dfrac{s\sin\theta+a\cos\theta}{s^2+a^2}$
$\cos(at+\theta)$	$\dfrac{s\cos\theta-a\sin\theta}{s^2+a^2}$
$e^{-at}\sin bt$	$\dfrac{b}{(s+a)^2+b^2}$
$e^{-at}\cos bt$	$\dfrac{s+a}{(s+a)^2+b^2}$
$t^n e^{-at}$	$\dfrac{n!}{(s+a)^{n+1}}$
$\sinh at$	$\dfrac{a}{s^2-a^2}$
$\cosh at$	$\dfrac{s}{s^2-a^2}$

FORMULA FOR DEE40113 SIGNAL AND SYSTEM

Z TRANSFORM PAIRS

$x(t)$	$X(s)$	$X(z)$
$\partial(t) = \left\{ \begin{array}{ll} 1 & t=0 \\ 0 & t=kT,\, k\neq 0 \end{array} \right.$	1	1
$\partial(t-kT) = \left\{ \begin{array}{ll} 1 & t=kT \\ 0 & t\neq kT \end{array} \right.$	e^{-kTs}	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 DEE40113 SIGNAL AND SYSTEM

FOURIER TRANSFORM PAIRS

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