SULIT

POLITEKNIK MALAYSIA

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN KEJURUTERAAN ELEKTRIK

PEPERIKSAAN AKHIR

SESI JUN 2015

EE605 : SIGNAL AND SYSTEM

TARIKH : 02 NOVEMBER 2015
TEMPOH : 11.15 AM - 1.15 PM (2 JAM)

Kertas ini mengandungi DUA PULUH **(21)**halaman bercetak.
Bahagian A: Struktur (10 soalan)
Bahagian B: Esei (3 soalan)
Dokumen sokongan yang disertakan : Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SULIT

SECTION A : 40 MARKS
BAHAGIAN A : 40 MARKAH

INSTRUCTION:
This section consists of **TEN (10)** structured questions. Answer ALL questions.

ARAHAN :
Bahagian ini mengandungi ***SEPULUH (10)*** *soalan berstruktur. Jawab semua soalan.*

CLO1
C3

QUESTION 1

A continuous-time signal $x(t)$ is shown in Figure A1. Sketch and label each of the following signal.

SOALAN 1

Rajah A1 menunjukkan isyarat masa selanjar. Lakar dan label bagi isyarat-isyarat berikut.

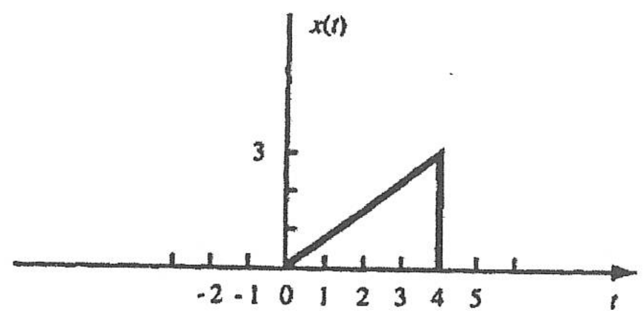


Figure A1/*Rajah A1*

(a) $x(t-2)$
(b) $x(2t)$

[4 marks]

[4 *markah*]

CLO1
C3

QUESTION 2

Sketch the even and odd components of the following signals.

SOALAN 2

Tentukan komponen genap dan ganjil bagi isyarat-isyarat berikut.

(a)

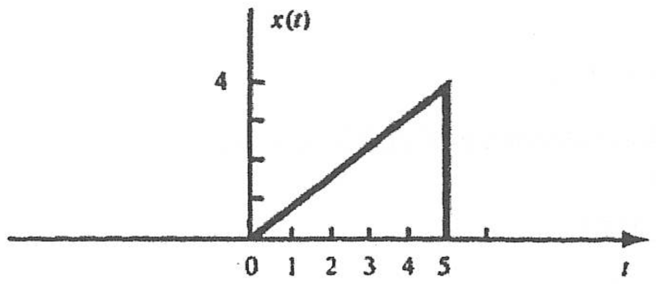


Figure A2(a)/Rajah A2(a)

(b)

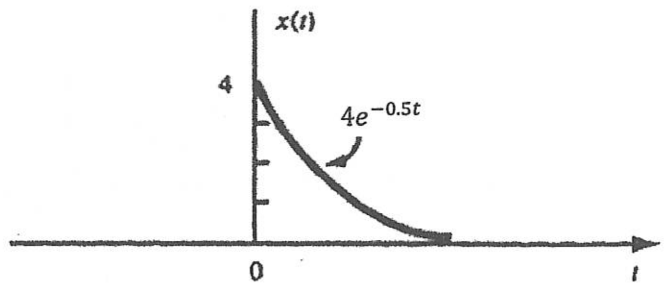


Figure A2(b)/Rajah A2(b)

[4 marks]

[4 *markah*]

CLO2
C3

QUESTION 3

By referring to Figure A3, produce the input-output relationship for the block diagram of LTI system.

SOALAN 3

Merujuk kepada Rajah A3, dapatkan hubungan masukan-keluaran bagi gambarajah blok sistem lelurus LTI.

[4 marks]

[4 *markah*]

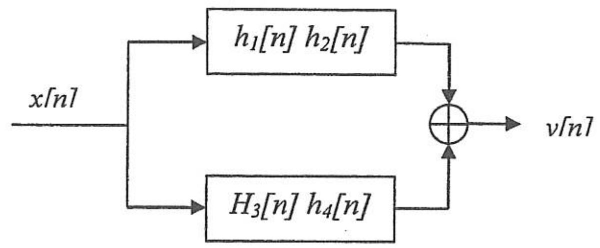


Figure A3/Rajah A3

CLO2
C3

QUESTION 4

Solve the convolution from *0* to *t* if $h(t) = e^{-at}u(t)$ and $x(t) = u(t)$.

SOALAN 4

Selesaikan hasil konvolusi bagi 0 sehingga t jika $h(t) = e^{-at}u(t)$ *dan* $x(t) = u(t)$.

[4 marks]

[4 *markah*]

CLO3
C3

QUESTION 5

Solve the Laplace Transform, X(s) of the signal $x(t) = e^{-3t}u(t) + e^{2t}u(-t)$.

SOALAN 5

Selesaikan Jelmaan Laplace, X(s) bagi isyarat $x(t) = e^{-3t}u(t) + e^{2t}u(-t)$.

[4 marks]

[4 *markah*]

CLO3
C3

QUESTION 6

Show the time function $x(t)$ for Laplace Transform.

$$X(s) = \frac{s+1}{s(s+2)} \quad , \quad Re\{s\} > -2$$

SOALAN 6

Tunjukkan fungsi masa x(t) bagi penukaran Laplace.

$$X(s) = \frac{s+1}{s(s+2)} \quad , \quad Re\{s\} > -2$$

[4 marks]
[4 *markah*]

CLO3
C3

QUESTION 7

Transform the input signal $x[n]$ to the Z-transform and state the region of convergences (ROCs).

$$x[n] = 2^n u[n] - 3^n u[-n-1]$$

SOALAN 7

Terjemahkan masukan isyarat $x[n]$ *kepada jelmaan-Z dan nyatakan kawasan penumpuannya (ROCs).*

$$x[n] = 2^n u[n] - 3^n u[-n-1]$$

[4 marks]
[4 *markah*]

CLO3
C3

QUESTION 8

Solve the complex exponential Fourier Series representation for the following signal.

$$x(t) = \sin 3t$$

SOALAN 8

Selesaikan 'complex exponential' siri Fourier yang mewakili isyarat berikut.

$$x(t) = \sin 3t$$

[4 marks]
[4 *markah*]

CLO3
C3

QUESTION 9

Show that the Fourier Transform for the causal exponential sequence $x[n] = a^n u[n]$ is

$$X(\Omega) = \frac{1}{1-ae^{-j\Omega}}.$$

SOALAN 9

Tunjukkan Jelmaan Fourier bagi jujukan causal exponential $x[n] = a^n u[n]$ *adalah*

$$X(\Omega) = \frac{1}{1-ae^{-j\Omega}}$$

[4 marks]
[4 *markah*]

CLO3
C2

QUESTION 10

Determine the frequency response $H(\Omega)$ and impulse response $h[n]$ of the system.

$$y[n] - \frac{1}{5}y[n-1] = 2x[n]$$

SOALAN 10

Tentukan sambutan frekuensi $H(\Omega)$ *dan sambutan dedenyut* $h[n]$ *bagi sistem.*

$$y[n] - \frac{1}{5}y[n-1] = 2x[n]$$

[4 marks]
[4*markah*]

SECTION B : 60 MARKS
BAHAGIAN B : 60 MARKAH

INSTRUCTION:
This section consists of **THREE (3)** essay questions. Answer **ALL** questions.

ARAHAN:
*Bahagian ini mengandungi **TIGA (3)** soalan esei. Jawab **SEMUA** soalan sahaja.*

QUESTION 1
SOALAN 1

CLO1
C1

(a) With an example, define the following terms:

Dengan beserta contoh takrifkan terma-terma berikut:

i) Even Signal
Isyarat genap

ii) Odd signal
Isyarat ganjil

[4 marks]
[4 *markah*]

CLO1
C3

(b) A Continuous-time signal *x(t)* is shown in Figure B1. Sketch the signals.

Isyarat masa berterusan *x(t)* ditunjukkan seperti Rajah B1. Lakarkan isyarat yang berikut

i) $x(t)[u(t)-u(t-3)]$

ii) $x(t)\delta(t+2)$

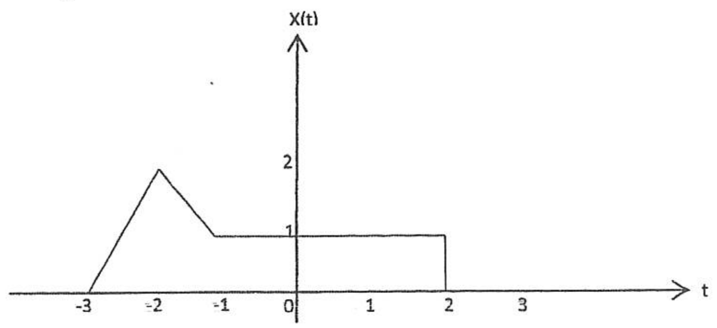


Figure B1/Rajah B1

[6 marks]
[*6 markah*]

CLO1
C1

(c) Proof that

(i) $x[n] * \delta[n] = x[n]$

(ii) $x[n] * \delta[n-n_0] = x[n-n_0]$

(c) Buktikan

(i) $x[n] * \delta[n] = x[n]$

(ii) $x[n] * \delta[n-n_0] = x[n-n_0]$

[3 marks]
[3 markah]

CLO 2
C3

(d) Solve y[n]=x[n]*h[n] where x[n] and h[n] are given, use an analytical technique.

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

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

*(d) Selesaikan y[n]=x[n]*h[n] di mana x[n] and h[n] diberi, gunakan teknik analitikal*

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

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

[7 marks]
[*7 markah*]

QUESTION 2
SOALAN 2

CLO3 C1

(a) Find the following Z-transform:

i. $x[n] = -a^n u[-n-1]$
ii. $x[n] = a^{-n} u[-n-1]$

Dapatkan Jelmaan Z yang berikut:

i. $x[n] = -a^n u[-n-1]$
ii. $x[n] = a^{-n} u[-n-1]$

[12 marks]
[12 markah]

CLO3 C2

(b) Compute the inverse Z-transform of the signal ,

$$X(z) = \frac{1}{(1-az^{-1})^2} \quad ,\text{if } |z| > |a|$$

Dapatkan Jelmaan Z songsang bagi isyarat berikut:

$$X(z) = \frac{1}{(1-az^{-1})^2} \quad ,\text{if } |z| > |a|$$

[8 marks]
[8 markah]

QUESTION 3

SOALAN 3

CLO3 C2

(a) The RC circuit in Figure B3(a) is described by

Litar RC dalam Rajah B3(a) diterangkan oleh

$$\frac{dy(t)}{dt} + \frac{1}{RC} y(t) = \frac{1}{RC} x(t).$$

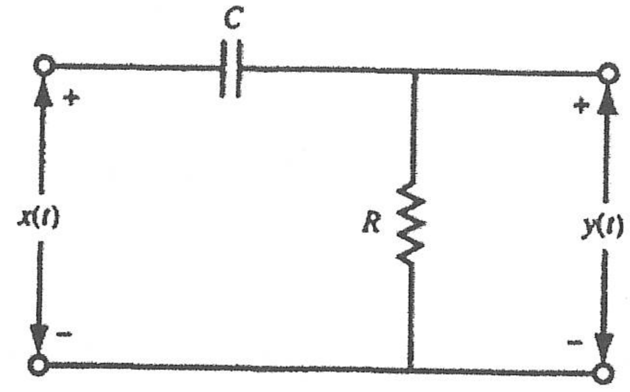


Figure B3(a)/*Rajah B3(a)*

i. Compute the system function $H(\omega)$ of the system.

Kirakan fungsi sistem bagi $H(\omega)$ sistem ini.

[5 marks]

[5 markah]

ii. Compute the output of $y(t)$ when the input $x(t)$ is a unit impulse, $\delta(t)$.

Dapatkan keluaran $y(t)$ apabila masukan $x(t)$ adalah unit denyut, $\delta(t)$.

[3 marks]
[3 markah]

CLO3 C2

(b) Determine the Fourier transform $X(\Omega)$ of the signal $x[n]$ shown in Figure B3(b).

Tentukan jelmaan Fourier $X(\Omega)$ bagi isyarat $x[n]$ pada Rajah B3(b).

[4 marks]

[4 markah]

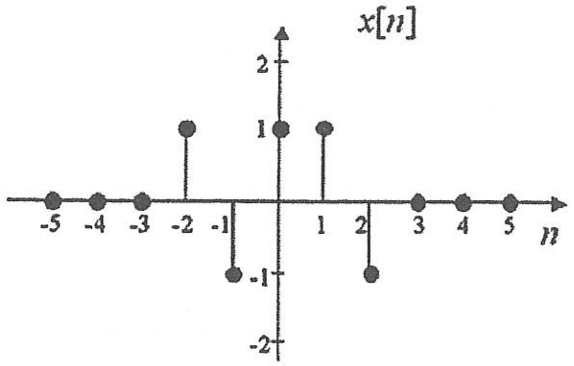


Figure B3(b)/Rajah B3(b)

(c) Given an LTI system with $h[n] = (0.2)^n u[n]$ and the input $x[n] = (0.8)^n u[n]$.

By using DTFT, compute the output, $y[n]$ of this system.

Diberi sistem LTI dengan $h[n] = (0.2)^n u[n]$ dan masukan $x[n] = (0.8)^n u[n]$.

Dengan menggunakan DTFT, dapatkan keluaran $y[n]$ bagi sistem ini.

[8 marks]

[8 markah]

SOALAN TAMAT

Energy and Power of Signal

$$E_x = \int_{-T/2}^{T/2} x(t)x^*(t)dt = \int_{-T/2}^{T/2} |x(t)|^2 dt$$

$$P_x = \frac{1}{T}\int_{-T/2}^{T/2} x(t)x^*(t)dt = \frac{1}{T}\int_{-T/2}^{T/2} |x(t)|^2 dt = \frac{1}{T}E_x$$

Trigonometric of Signal in terms of Complex Exponential of Signal

$$x(t) = \cos\omega_1 t = \frac{e^{j\omega_1 t} + e^{-j\omega_1 t}}{2}$$

$$x(t) = \sin\omega_1 t = \frac{e^{j\omega_1 t} - e^{-j\omega_1 t}}{2j}$$

Complex Exponential Fourier Series

$$f(t) = \sum_{n=-\infty}^{\infty} C_n e^{jn\omega t} \qquad C_n = \frac{1}{T}\int_0^T f(t)e^{-jn\omega t}dt$$

$$\int \cos at\,dt = \frac{1}{a}\sin at$$

$$\int \sin at\,dt = -\frac{1}{a}\cos at$$

$$\int t\cos at\,dt = \frac{1}{a^2}\cos at + \frac{1}{a}t\sin at$$

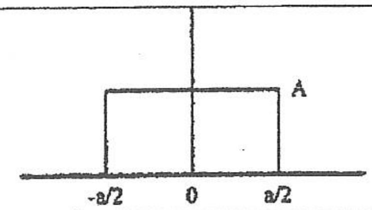
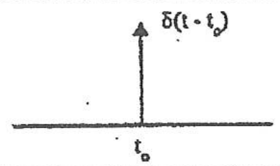
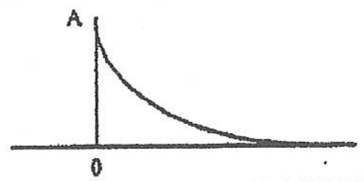
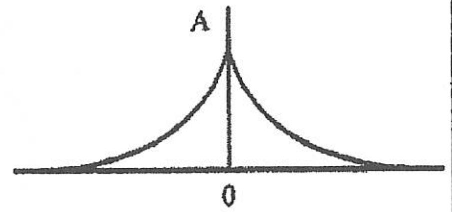
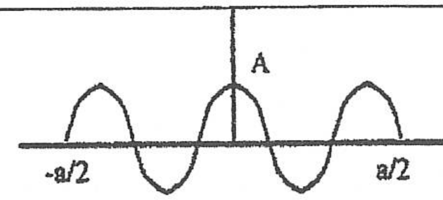
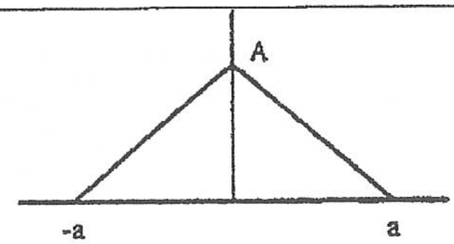
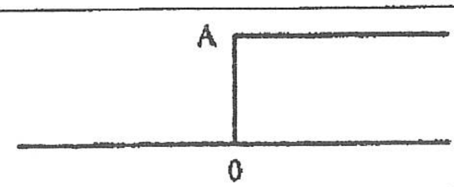
$$\int t\sin at\,dt = \frac{1}{a^2}\sin at - \frac{1}{a}t\cos at$$

$$\int e^{-at}dt = \frac{e^{-at}}{-a}$$

Properties Of Fourier Transform

Theorem	Jika $\mathcal{F}[f(t)] = F(\omega)$, maka:
Definition	$F(\omega) = \int_{-\infty}^{\infty} f(t)\, e^{-j\omega t}\, dt$ $f(t) = \frac{1}{2\pi} \int_{-\infty}^{\infty} F(\omega)\, e^{j\omega t}\, d\omega$
Linearity	$\mathcal{F}[af_1(t) + bf_2(t)] = aF_1(\omega) + bF_2(\omega)$
Symmetry	$F(\omega) = 2\int_0^{\infty} f(t) \cos \omega t\, dt \quad : f(t)\text{ even}$ $F(\omega) = -2j\int_0^{\infty} f(t) \sin \omega t\, dt \quad : f(t)\text{ odd}$
Time Shifting	$\mathcal{F}\, f(t-a) = F(\omega)e^{-j\omega a}$
Time Scaling	$\mathcal{F}\, f(at) = \frac{1}{\lvert a\rvert} F\left(\frac{\omega}{a}\right)$
Magnitude Scaling	$\mathcal{F}\, a\, f(t) = a\, F(\omega)$
Frequency Shifting (or Amplitude Modulation)	$\mathcal{F}\, f(t)e^{j\omega_o t} = F(\omega - \omega_o)$ $\mathcal{F}\, f(t) \cos \omega_o t = \frac{1}{2}[F(\omega - \omega_o) + F(\omega + \omega_o)]$ $\mathcal{F}\, f(t) \sin \omega_o t = \frac{1}{2} j [F(\omega - \omega_o) - F(\omega + \omega_o)]$
Time differentiation	$\mathcal{F}\left[\frac{d^n}{dt^n} f(t)\right] = (j\omega)^n F(\omega)$
Convolution in t Convolution in ω	$\mathcal{F}^{-1}[F_1(\omega) F_2(\omega)] = \int_{-\infty}^{\infty} f_1(\tau) f_2(t-\tau)\, d\tau$ $\mathcal{F}[f_1(t) f_2(t)] = \frac{1}{2\pi} \int_{-\infty}^{\infty} F_1(\lambda) F_2(\omega - \lambda)\, d\lambda$
Reversal	$\mathcal{F}\, f(-t) = F^*(\omega) = F(-\omega)$
Duality	$F(t) = 2\pi f(-\omega)$
Time Coefficient	$\mathcal{F}\, t^n f(t) = (j)^n \frac{d^n F(\omega)}{d\omega^n}$

Fourier Transform Pair

Pulse $f(t) = A\, u\left(t + \frac{a}{2}\right) - A\, u\left(t - \frac{a}{2}\right)$		$A\, a\, \mathrm{sinc}\left(\frac{\omega a}{2}\right)$
Impulse $\delta(t - t_o)$		$e^{-j\omega t_o}$
Decaying exponential $A\, e^{-at}\, u(t)$		$\frac{A}{a + j\omega}$
Symmetric decaying exponential $A\, e^{-a\lvert t\rvert}$		$\frac{2aA}{a^2 + \omega^2}$
Tone burst (gated cosine) $A\, f(t) \cos \omega_o t$		$\frac{Aa}{2}[\mathrm{sinc}(\omega - \omega_o) + \mathrm{sinc}(\omega + \omega_o)]$
Sawtooth		$A\, a\, \mathrm{sinc}^2\left(\frac{\omega a}{2}\right)$
Step input $A\, u(t)$		$A\left[\pi\, \delta(\omega) + \frac{1}{j\omega}\right]$

Fourier Transform Pairs

$f(t)$	$F(\omega)$
$\delta(t)$	1
1	$2\pi\delta(\omega)$
$u(t)$	$\pi\delta(\omega)+\frac{1}{j\omega}$
$u(t+\tau)-u(t-\tau)$	$2\frac{\sin\omega\tau}{\omega}$
$\lvert t\rvert$	$\frac{-2}{\omega^2}$
$\mathrm{sgn}(t)$	$\frac{2}{j\omega}$
$e^{-at}u(t)$	$\frac{1}{a+j\omega}$
$e^{at}u(-t)$	$\frac{1}{a-j\omega}$
$t^n e^{-at}u(t)$	$\frac{n!}{(a+j\omega)^{n+1}}$
$e^{-a\lvert t\rvert}$	$\frac{2a}{a^2+\omega^2}$
$e^{j\omega_0 t}$	$2\pi\delta(\omega-\omega_0)$
$\sin\ \omega_0 t$	$j\pi[\delta(\omega+\omega_0)-\delta(\omega-\omega_0)]$
$\cos\ \omega_0 t$	$\pi[\delta(\omega+\omega_0)+\delta(\omega-\omega_0)]$
$\sin(\omega t+\theta)$	$\frac{s\sin\theta+\omega\cos\theta}{s^2+\omega^2}$
$\cos(\omega t+\theta)$	$\frac{s\cos\theta-\omega\sin\theta}{s^2+\omega^2}$
$e^{-at}\sin\omega_0 t u(t)$	$\frac{\omega_0}{(a+j\omega)^2+\omega_0^2}$
$e^{-at}\cos\omega_0 t u(t)$	$\frac{a+j\omega}{(a+j\omega)^2+\omega_0^2}$

Properties of the Laplace Transform

Property	$f(t)$	$F(s)$
Linearity	$a_1 f_1(t)+a_2 f_2(t)$	$a_1F_1(s)+a_2F_2(s)$
Scaling	$f(at)$	$\frac{1}{a}F(\frac{s}{a})$
Time shift	$f(t-a)u(t-a)$	$e^{-as}F(s)$
Frequency shift	$e^{-at}f(t)$	$F(s+a)$
Time differentiation	$\frac{df}{dt}$	$sF(s)-f(0^-)$
	$\frac{d^2f}{dt^2}$	$s^2F(s)-sf(0^-)-f'(0^-)$
	$\frac{d^3f}{dt^3}$	$s^3F(s)-s^2f(0^-)-sf'(0^-)-f''(0^-)$
	$\frac{d^nf}{dt^n}$	$s^nF(s)-s^{n-1}f(0^-)-s^{n-2}f'(0^-)-...-f^{n-1}(0^-)$
Time integration	$\int_0^t f(t)dt$	$\frac{1}{s}F(s)$
Frequency differentiation	$tf(t)$	$-\frac{d}{ds}F(s)$
Frequency integration	$\frac{f(t)}{t}$	$\int_s^\infty F(s)ds$
Time periodicity	$f(t)=f(t+nT)$	$\frac{F_1(s)}{1-e^{-sT}}$
Initial value	$f(0^+)$	$\lim_{s\to\infty} sF(s)$
Final value	$f(\infty)$	$\lim_{s\to 0} sF(s)$
Convolution	$f_1(t)*f_2(t)$	$F_1(s)F_2(s)$

Laplace Transform Pairs

$f(t)$	$F(s)$
$\delta(t)$	1
$u(t)$	$\frac{1}{s}$
e^{-at}	$\frac{1}{s+a}$
t	$\frac{1}{s^2}$
t^n	$\frac{n!}{s^{n+1}}$
te^{-at}	$\frac{1}{(s+a)^2}$
$t^n e^{-at}$	$\frac{n!}{(s+a)^{n+1}}$
$\sin\ \omega t$	$\frac{\omega}{s^2+\omega^2}$
$\cos\ \omega t$	$\frac{s}{s^2+\omega^2}$
$\sin(\omega t+\theta)$	$\frac{s\sin\theta+\omega\cos\theta}{s^2+\omega^2}$
$\cos(\omega t+\theta)$	$\frac{s\cos\theta-\omega\sin\theta}{s^2+\omega^2}$
$e^{-at}(\sin\omega t)$	$\frac{\omega}{(s+a)^2+\omega^2}$
$e^{-at}(\cos\omega t)$	$\frac{s+a}{(s+a)^2+\omega^2}$
$\sinh(at)$	$\frac{a}{s^2-a^2}$

*Defined for $t \geq 0$, $f(t)=0$ for $t \langle 0$

Z-Transform Pairs

$x(t)$	$X(s)$	$X(z)$
1. $\delta(t) = \begin{cases} 1 & t=0, \\ 0 & t=kT,\ k\neq 0 \end{cases}$	1	1
2. $\delta(t-kT) = \begin{cases} 1 & t=kT, \\ 0 & t\neq kT \end{cases}$	e^{-kTs}	z^{-k}
3. $u(t)$, unit step	$1/s$	$\frac{z}{z-1}$
4. t	$1/s^2$	$\frac{Tz}{(z-1)^2}$
5. t^2	$2/s^3$	$\frac{T^2z(z+1)}{(z-1)^3}$
6. e^{-at}	$\frac{1}{s+a}$	$\frac{z}{z-e^{-aT}}$
7. $1-e^{-at}$	$\frac{a}{s(s+a)}$	$\frac{(1-e^{-aT})z}{(z-1)(z-e^{-aT})}$
8. te^{-at}	$\frac{1}{(s+a)^2}$	$\frac{Tze^{-aT}}{(z-e^{-aT})^2}$
9. t^2e^{-at}	$\frac{2}{(s+a)^3}$	$\frac{T^2e^{-aT}z(z+e^{-aT})}{(z-e^{-aT})^3}$
10. $be^{-bt}-ae^{-at}$	$\frac{(b-a)s}{(s+a)(s+b)}$	$\frac{z[z(b-a)-(be^{-aT}-ae^{-bT})]}{(z-e^{-aT})(z-e^{-bT})}$
11. $\sin\omega t$	$\frac{\omega}{s^2+\omega^2}$	$\frac{z\sin\omega T}{z^2-2z\cos\omega T+1}$
12. $\cos\omega t$	$\frac{s}{s^2+\omega^2}$	$\frac{z(z-\cos\omega T)}{z^2-2z\cos\omega T+1}$
13. $e^{-at}\sin\omega t$	$\frac{\omega}{(s+a)^2+\omega^2}$	$\frac{(ze^{-aT}\sin\omega T)}{z^2-2ze^{-aT}\cos\omega T+e^{-2aT}}$
14. $e^{-at}\cos\omega t$	$\frac{s+a}{(s+a)^2+\omega^2}$	$\frac{z^2-ze^{-aT}\cos\omega T}{z^2-2ze^{-aT}\cos\omega T+e^{-2aT}}$
15. $1-e^{-at}\left(\cos bt+\frac{a}{b}\sin bt\right)$	$\frac{a^2+b^2}{s[(s+a)^2+b^2]}$	$\frac{z(Az+B)}{(z-1)[z^2-2e^{-aT}(\cos bT)z+e^{-2aT}]}$ $A = 1-e^{-aT}\cos bT-\frac{a}{b}e^{-aT}\sin bT$ $B = e^{-2aT}+\frac{a}{b}e^{-aT}\sin bT-e^{-aT}\cos bT$

Properties of the Fourier Transform

Property	Sequence	Fourier transform
	$x[n]$	$X(\Omega)$
	$x_1[n]$	$X_1(\Omega)$
	$x_2[n]$	$X_2(\Omega)$
Periodicity	$x[n]$	$X(\Omega + 2\pi) = X(\Omega)$
Linearity	$a_1x_1[n] + a_2x_2[n]$	$a_1X_1(\Omega) + a_2X_2(\Omega)$
Time shifting	$x[n - n_0]$	$e^{-j\Omega n_0}X(\Omega)$
Frequency shifting	$e^{j\Omega_0 n}x[n]$	$X(\Omega - \Omega_0)$
Conjugation	$x^*[n]$	$X^*(-\Omega)$
Time reversal	$x[-n]$	$X(-\Omega)$
Time scaling	$x_{(m)}[n] = \begin{cases} x[n/m] & \text{if } n = km \\ 0 & \text{if } n \neq km \end{cases}$	$X(m\Omega)$
Frequency differentiation	$nx[n]$	$j\dfrac{dX(\Omega)}{d\Omega}$
First difference	$x[n] - x[n-1]$	$(1 - e^{-j\Omega})X(\Omega)$
Accumulation	$\sum_{k=-\infty}^{n} x[k]$	$\pi X(0)\delta(\Omega) + \dfrac{1}{1 - e^{-j\Omega}}X(\Omega)$
		$\lvert\Omega\rvert \le \pi$
Convolution	$x_1[n] * x_2[n]$	$X_1(\Omega)X_2(\Omega)$
Multiplication	$x_1[n]x_2[n]$	$\dfrac{1}{2\pi}X_1(\Omega) \otimes X_2(\Omega)$
Real sequence	$x[n] = x_e[n] + x_o[n]$	$X(\Omega) = A(\Omega) + jB(\Omega)$
		$X(-\Omega) = X^*(\Omega)$
Even component	$x_e[n]$	$\text{Re}\{X(\Omega)\} = A(\Omega)$
Odd component	$x_o[n]$	$j\,\text{Im}\{X(\Omega)\} = jB(\Omega)$
Parseval's relations		

$$\sum_{n=-\infty}^{\infty} x_1[n]x_2[n] = \frac{1}{2\pi}\int_{2\pi} X_1(\Omega)X_2(-\Omega)\,d\Omega$$

$$\sum_{n=-\infty}^{\infty} \lvert x[n]\rvert^2 = \frac{1}{2\pi}\int_{2\pi} \lvert X(\Omega)\rvert^2\,d\Omega$$

Common Fourier Transform Pairs

$x[n]$	$X(\Omega)$
$\delta[n]$	1
$\delta[n - n_0]$	$e^{-j\Omega n_0}$
$x[n] = 1$	$2\pi\delta(\Omega), \lvert\Omega\rvert \le \pi$
$e^{j\Omega_0 n}$	$2\pi\delta(\Omega - \Omega_0), \lvert\Omega\rvert, \lvert\Omega_0\rvert \le \pi$
$\cos \Omega_0 n$	$\pi[\delta(\Omega - \Omega_0) + \delta(\Omega + \Omega_0)], \lvert\Omega\rvert, \lvert\Omega_0\rvert \le \pi$
$\sin \Omega_0 n$	$-j\pi[\delta(\Omega - \Omega_0) - \delta(\Omega + \Omega_0)], \lvert\Omega\rvert, \lvert\Omega_0\rvert \le \pi$
$u[n]$	$\pi\delta(\Omega) + \dfrac{1}{1 - e^{-j\Omega}}, \lvert\Omega\rvert \le \pi$
$-u[-n-1]$	$-\pi\delta(\Omega) + \dfrac{1}{1 - e^{-j\Omega}}, \lvert\Omega\rvert \le \pi$
$a^n u[n], \lvert a\rvert < 1$	$\dfrac{1}{1 - ae^{-j\Omega}}$
$-a^n u[-n-1], \lvert a\rvert > 1$	$\dfrac{1}{1 - ae^{-j\Omega}}$
$(n+1)a^n u[n], \lvert a\rvert < 1$	$\dfrac{1}{(1 - ae^{-j\Omega})^2}$
$a^{\lvert n\rvert}, \lvert a\rvert < 1$	$\dfrac{1 - a^2}{1 - 2a\cos\Omega + a^2}$
$x[n] = \begin{cases} 1 & \lvert n\rvert \le N_1 \\ 0 & \lvert n\rvert > N_1 \end{cases}$	$\dfrac{\sin[\Omega(N_1 + \frac{1}{2})]}{\sin(\Omega/2)}$
$\dfrac{\sin Wn}{\pi n}, 0 < W < \pi$	$X(\Omega) = \begin{cases} 1 & 0 \le \lvert\Omega\rvert \le W \\ 0 & W < \lvert\Omega\rvert \le \pi \end{cases}$
$\sum_{k=-\infty}^{\infty} \delta[n - kN_0]$	$\Omega_0 \sum_{k=-\infty}^{\infty} \delta(\Omega - k\Omega_0), \Omega_0 = \dfrac{2\pi}{N_0}$