UNIVERSITI SAINS MALAYSIA

Peperiksaan Semester Pertama
Sidang Akademik 2008/2009

November 2008

EEE208 – TEORI LITAR II

Masa: 3 jam

Sila pastikan bahawa kertas peperiksaan ini mengandungi SEMBILAN muka surat dan EMPAT muka surat LAMPIRAN yang bercetak sebelum anda memulakan peperiksaan ini.

Kertas soalan ini mengandungi ENAM soalan.

Jawab LIMA soalan.

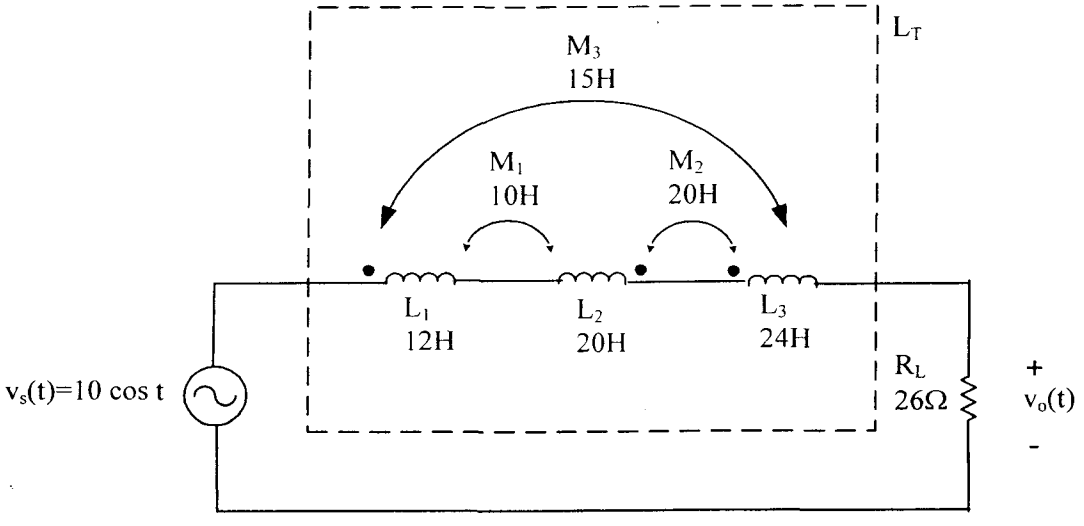
Mulakan jawapan anda untuk setiap soalan pada muka surat yang baru.

Agihan markah bagi setiap soalan diberikan di sudut sebelah kanan soalan berkenaan.

Jawab semua soalan dalam bahasa Malaysia atau bahasa Inggeris atau kombinasi kedua-duanya.

...2/-

1. (a)



Rajah 1
Figure 1

Berdasarkan Rajah 1,
Base on Figure 1,

(i) Kirakan nilai kearuhan setara, L_T.

Calculate the total inductance, L_T.

(20%)

(ii) Dapatkan nilai $v_o(t)$ pada masa t = 1s.

Find the value of $v_o(t)$ at time t = 1s.

(20%)

(iii) Kirakan nilai tenaga keseluruhan yang disimpan oleh L_1, L_2, dan L_3 pada masa t = 1s.

Calculate the total energy stored by L_1, L_2, and L_3 at time t = 1s.

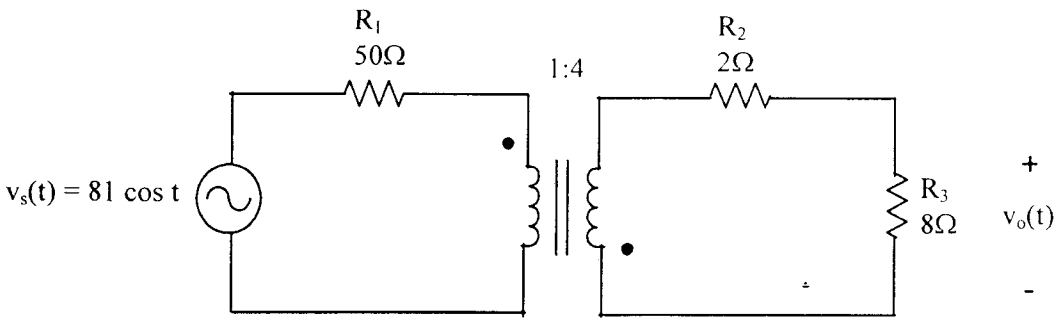
(25%)

...3/-

(b) Tentukan $v_o(t)$ dalam litar pengubah unggul yang ditunjukkan dalam Rajah 2.

Determine $v_o(t)$ in the ideal transformer circuit as shown in Figure 2.

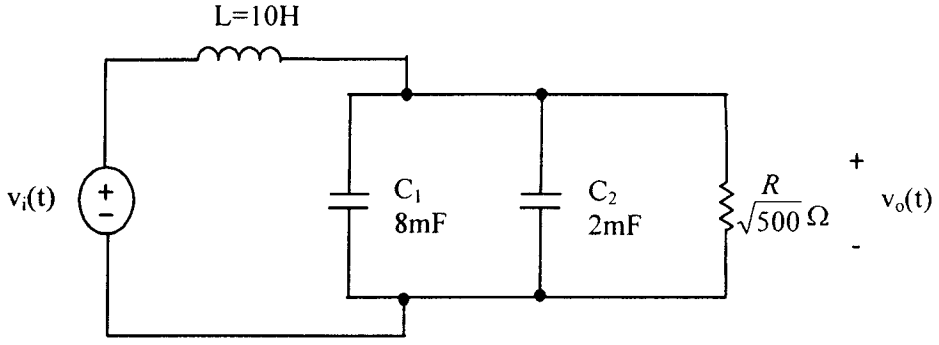
(35%)



Rajah 2
Figure 2

2. (a) Berdasarkan Rajah 3,

Base on Figure 3,



Rajah 3
Figure 3

(i) Dapatkan magnitud fungsi pindah $H(\omega)$ dalam sebutan ω. $H(\omega) = V_o(\omega) / V_i(\omega)$.

Find the magnitude of the transfer function $H(\omega)$ in term of ω. $H(\omega) = V_o(\omega) / V_i(\omega)$.

(30%)

(ii) Tentukan jenis filter yang diwakili $H(\omega)$.

Identify the type of filter presented by $H(\omega)$.

(15%)

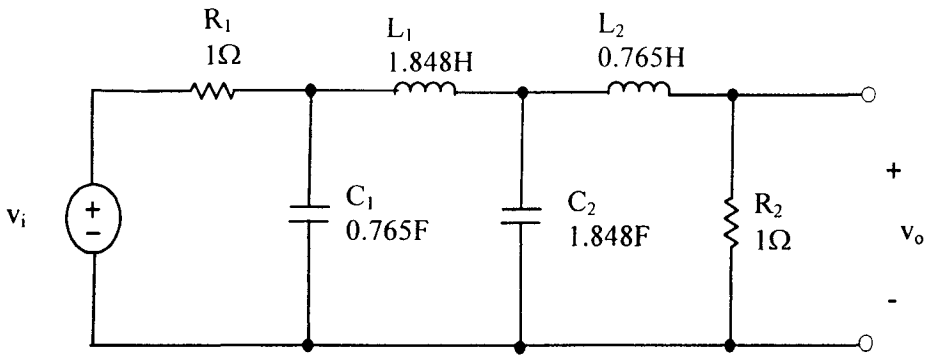
(iii) Kirakan nilai frekuensi potong, ω_c.

Calculate the cutoff frequency, ω_c.

(25%)

(b) Satu penapis dengan frekuensi potong ω_c = 1 rad/s ditunjukkan dalam Rajah 4. Skalakan litar tersebut kepada frekuensi potong 100 kHz dengan menggunakan perintang-perintang 32kΩ.

A filter with the cutoff frequency ω_c = 1 rad/s is shown in Figure 4. Scale the circuit for a cutoff frequency of 100 kHz using 32kΩ resistors.



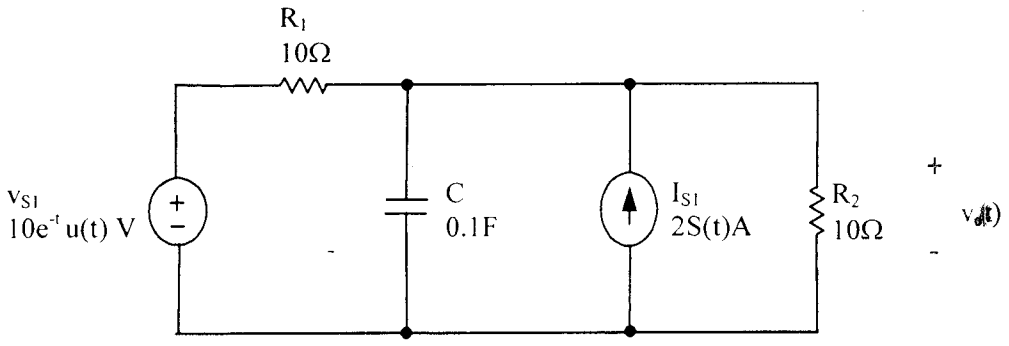
Rajah 4
Figure 4

(30%)

...5/-

3. (a) Berdasarkan Rajah 5, tentukan $v_o(t)$ dengan menggunakan jelmaan Laplace. Andaikan $v_o(0) = 5V$.

Base on Figure 5, determine $v_o(t)$ by using Laplace transform. Assume $v_o(0) = 5V$.

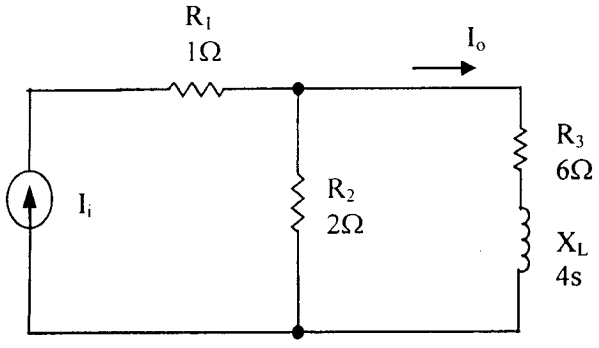


Rajah 5
Figure 5

(50%)

(b) Jika fungsi pindah litar dalam Rajah 6 diberikan sebagai $H(s) = I_o/I_i$, dapatkan sambutan dedenyut bagi litar tersebut.

If the transfer function for the circuit shown in Figure 6 is defined as $H(s) = I_o/I_i$, determine the impulse response for that circuit.

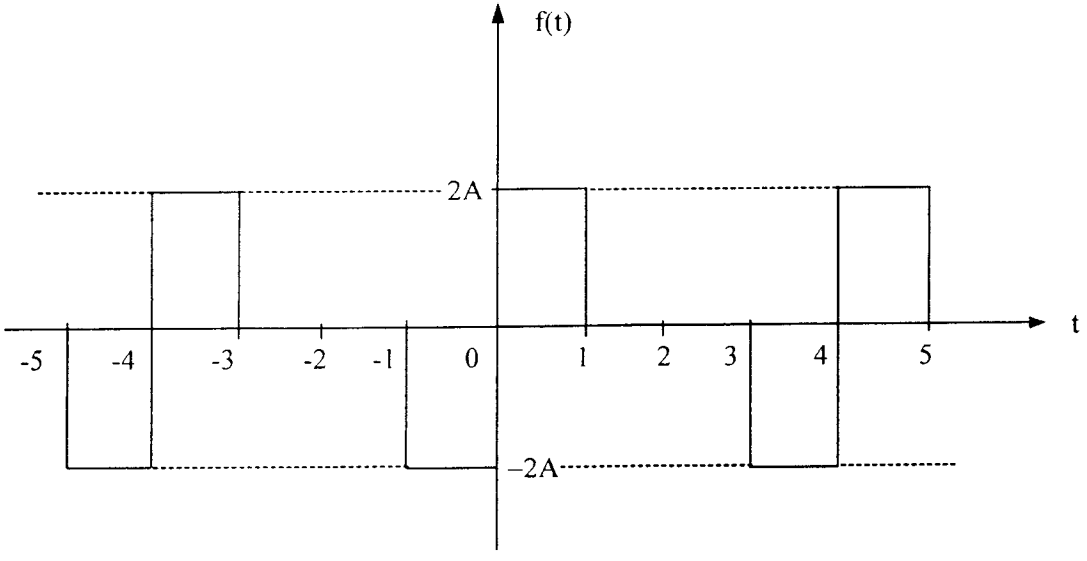


Rajah 6
Figure 6

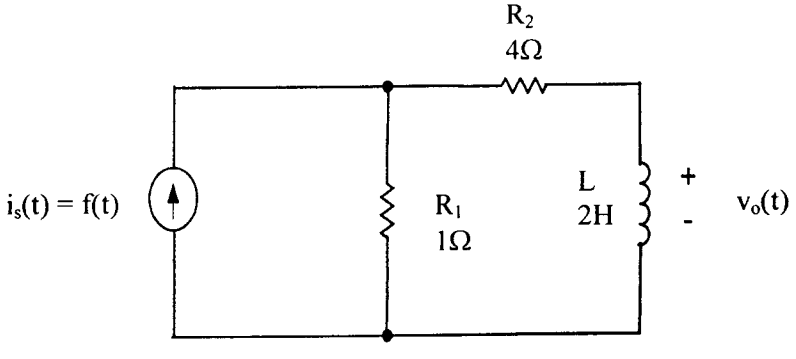
(40%)

4. Jika gelombang arus berkala seperti ditunjukkan dalam Rajah 7 dikenakan sebagai masukan kepada litar dalam Rajah 8, tentukan:

If a periodic current waveform as shown in Figure 7 is applied as input current to the circuit shown in Figure 8, determine:



Rajah 7
Figure 7



Rajah 8
Figure 8

(a) Siri Fourier trigonometri bagi arus masukan, $i_s(t)$.

The trigonometric Fourier series for the input current, $i_s(t)$.

(30%)

(b) Siri Fourier amplitud-fasa bagi arus masukan, $i_s(t)$.

The amplitude phase Fourier series for the input current, $i_s(t)$.

(20%)

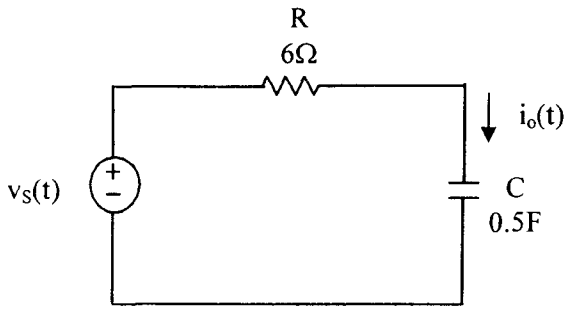
(c) Voltan keluaran, $v_o(t)$.

The output voltage, $v_o(t)$.

(50%)

5. Menggunakan kaedah jelmaan Fourier, tentukan $i_o(t)$ dalam Rajah 9, jika $v_s(t) = 20 \sin 2t$ A.

By using Fourier transform, determine $i_o(t)$ in Figure 9, if $v_s(t) = 20 \sin 2t$ A.



Rajah 9
Figure 9

(100%)

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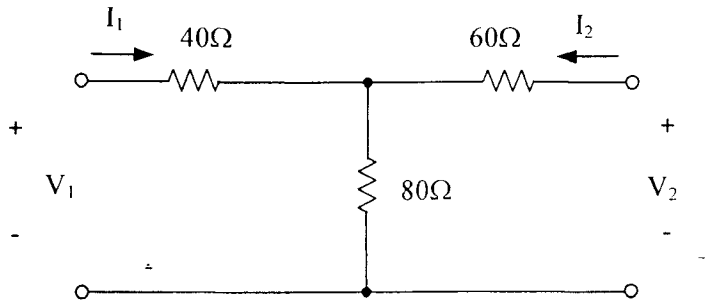
6. (a) Dapatkan parameter z bagi rangkaian yang ditunjukkan oleh Rajah 10.

Obtain the z parameters for the network shown in Figure 10.

(20%)

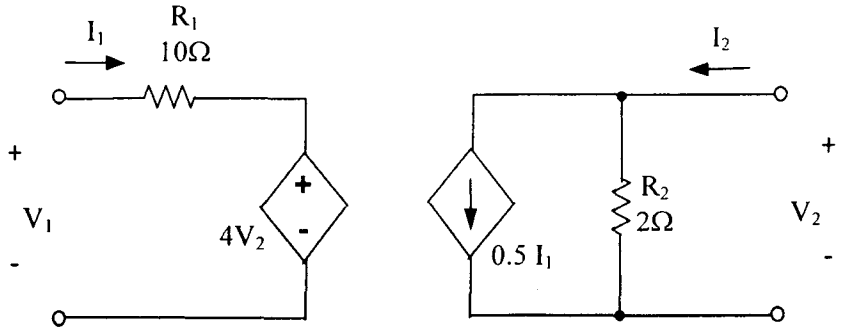


Rajah 10
Figure 10

(b) Dapatkan parameter T untuk rangkaian yang ditunjukkan oleh Rajah 11.

Obtain the T parameters for the network shown in Figure 11.

(40%)



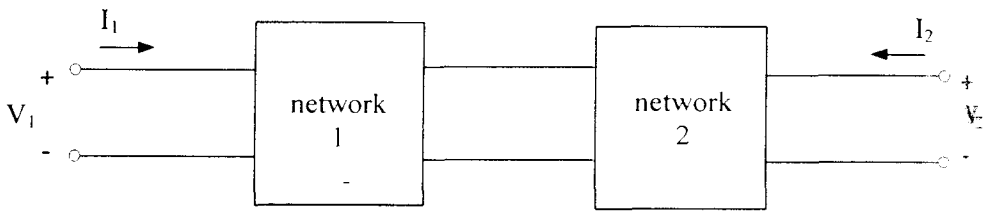
Rajah 11
Figure 11

...9/-

(c) Dapatkan parameter h untuk Rajah 12, sekiranya "network 1" ditunjukkan dalam Rajah 10 dan "network 2" ditunjukkan dalam Rajah 11.

Obtain the h parameters for Figure 12, if network 1 is shown in Figure 10 and network 2 is shown in Figure 11.

(40 %)



Rajah 12
Figure 12

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TABLE 1: PROPERTIES OF THE LAPLACE TRANSFORM

Property	$f(t)$	$F(s)$
Linearity	$a_1 f_1(t) + a_2 f_2(t)$	$a_1 F_1(s) + a_2 F_2(s)$
Scaling	$f(at)$	$\frac{1}{a} F\left(\frac{s}{a}\right)$
Time shift	$f(t-a)u(t-a)$	$e^{-as} F(s)$
Frequency shift	$e^{-at} f(t)$	$F(s+a)$
Time differentiation	$\frac{df}{dt}$	$sF(s) - f(0^-)$
	$\frac{d^2 f}{dt^2}$	$s^2 F(s) - sf(0^-) - f'(0^-)$
	$\frac{d^3 f}{dt^3}$	$s^3 F(s) - s^2 f(0^-) - sf'(0^-) - f''(0^-)$
	$\frac{d^n f}{dt^n}$	$s^n F(s) - s^{n-1} f(0^-) - s^{n-2} f'(0^-) - \cdots - f^{(n-1)}(0^-)$
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	$f_1(t) * f_1(t)$	$F_1(s)F_2(s)$

JADUAL PENGUBAHAN PARAMETER-PARAMETER RANGKAIAN DUA PENGKALAN

Two port parameters conversion table

	z		y		h		g		T		t	
z	z_{11}	z_{12}	$\frac{y_{22}}{\Delta_y}$	$-\frac{y_{12}}{\Delta_y}$	$\frac{\Delta_h}{h_{22}}$	$\frac{h_{12}}{h_{22}}$	$\frac{1}{g_{11}}$	$-\frac{g_{12}}{g_{11}}$	$\frac{A}{C}$	$\frac{\Delta_T}{C}$	$\frac{d}{c}$	$\frac{1}{c}$
	z_{21}	z_{22}	$-\frac{y_{21}}{\Delta_y}$	$\frac{y_{11}}{\Delta_y}$	$-\frac{h_{21}}{h_{22}}$	$\frac{1}{h_{22}}$	$\frac{g_{21}}{g_{11}}$	$\frac{\Delta_g}{g_{11}}$	$\frac{1}{C}$	$\frac{D}{C}$	$\frac{\Delta_t}{c}$	$\frac{a}{c}$
y	$\frac{z_{22}}{\Delta_z}$	$-\frac{z_{12}}{\Delta_z}$	y_{11}	y_{12}	$\frac{1}{h_{11}}$	$-\frac{h_{12}}{h_{11}}$	$\frac{\Delta_g}{g_{22}}$	$\frac{g_{12}}{g_{22}}$	$\frac{D}{B}$	$-\frac{\Delta_T}{B}$	$\frac{a}{b}$	$-\frac{1}{b}$
	$-\frac{z_{21}}{\Delta_z}$	$\frac{z_{11}}{\Delta_z}$	y_{21}	y_{22}	$\frac{h_{21}}{h_{11}}$	$\frac{\Delta_h}{h_{11}}$	$-\frac{g_{21}}{g_{22}}$	$\frac{1}{g_{22}}$	$-\frac{1}{B}$	$\frac{A}{B}$	$-\frac{\Delta_t}{b}$	$\frac{d}{b}$
h	$\frac{\Delta_z}{z_{22}}$	$\frac{z_{12}}{z_{22}}$	$\frac{1}{y_{11}}$	$-\frac{y_{12}}{y_{11}}$	h_{11}	h_{12}	$\frac{g_{22}}{\Delta_g}$	$-\frac{g_{12}}{\Delta_g}$	$\frac{B}{D}$	$\frac{\Delta_T}{D}$	$\frac{b}{a}$	$\frac{1}{a}$
	$-\frac{z_{21}}{z_{22}}$	$\frac{1}{z_{22}}$	$\frac{y_{21}}{y_{11}}$	$\frac{\Delta_y}{y_{11}}$	h_{21}	h_{22}	$-\frac{g_{21}}{\Delta_g}$	$\frac{g_{11}}{\Delta_g}$	$-\frac{1}{D}$	$\frac{C}{D}$	$\frac{\Delta_t}{a}$	$\frac{c}{a}$
g	$\frac{1}{z_{11}}$	$-\frac{z_{12}}{z_{11}}$	$\frac{\Delta_y}{y_{22}}$	$\frac{y_{12}}{y_{22}}$	$\frac{h_{22}}{\Delta_h}$	$-\frac{h_{12}}{\Delta_h}$	g_{11}	g_{12}	$\frac{C}{A}$	$-\frac{\Delta_T}{A}$	$\frac{c}{d}$	$-\frac{1}{d}$
	$\frac{z_{21}}{z_{11}}$	$\frac{\Delta_z}{z_{11}}$	$-\frac{y_{21}}{y_{22}}$	$\frac{1}{y_{22}}$	$-\frac{h_{21}}{\Delta_h}$	$\frac{h_{11}}{\Delta_h}$	g_{21}	g_{22}	$\frac{1}{A}$	$\frac{B}{A}$	$\frac{\Delta_t}{d}$	$-\frac{b}{d}$
T	$\frac{z_{11}}{z_{21}}$	$\frac{\Delta_z}{z_{21}}$	$-\frac{y_{22}}{y_{21}}$	$-\frac{1}{y_{21}}$	$-\frac{\Delta_h}{h_{21}}$	$-\frac{h_{11}}{h_{21}}$	$\frac{1}{g_{21}}$	$\frac{g_{22}}{g_{21}}$	A	B	$\frac{d}{\Delta_t}$	$\frac{b}{\Delta_t}$
	$\frac{1}{z_{21}}$	$\frac{z_{22}}{z_{21}}$	$-\frac{\Delta_y}{y_{21}}$	$-\frac{y_{11}}{y_{21}}$	$-\frac{h_{22}}{h_{21}}$	$-\frac{1}{h_{21}}$	$\frac{g_{11}}{g_{21}}$	$\frac{\Delta_g}{g_{21}}$	C	D	$\frac{c}{\Delta_t}$	$\frac{a}{\Delta_t}$
t	$\frac{z_{22}}{z_{12}}$	$\frac{\Delta_z}{z_{12}}$	$-\frac{y_{11}}{y_{12}}$	$-\frac{1}{y_{12}}$	$\frac{1}{h_{12}}$	$\frac{h_{11}}{h_{12}}$	$-\frac{\Delta_g}{g_{12}}$	$-\frac{g_{22}}{g_{12}}$	$\frac{D}{\Delta_T}$	$\frac{B}{\Delta_T}$	a	b
	$\frac{1}{z_{12}}$	$\frac{z_{11}}{z_{12}}$	$-\frac{\Delta_y}{y_{12}}$	$-\frac{y_{22}}{y_{12}}$	$\frac{h_{22}}{h_{12}}$	$\frac{\Delta_h}{h_{12}}$	$-\frac{g_{11}}{g_{12}}$	$-\frac{1}{g_{12}}$	$\frac{C}{\Delta_T}$	$\frac{A}{\Delta_T}$	c	d

$\Delta_z = z_{11}z_{22} - z_{12}z_{21}$, $\Delta_h = h_{11}h_{22} - h_{12}h_{21}$, $\Delta_T = AD - BC$

$\Delta_y = y_{11}y_{22} - y_{12}y_{21}$, $\Delta_g = g_{11}g_{22} - g_{12}g_{21}$, $\Delta_t = ad - bc$

TABLE 2: 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}	$\frac{1}{(s+a)^2}$
$t^n e^{-at}$	$\frac{n!}{(s+a)^{n+1}}$
$\sin \omega t$	$\frac{\omega}{s^2+\omega^2}$
$\cos \omega t$	$\frac{s}{s^2+\omega^2}$
$\sin(\omega t+\theta)$	$\frac{s\sin\theta+\omega\cos\theta}{s^2+\omega^2}$
$\cos(\omega t+\theta)$	$\frac{s\cos\theta-\omega\sin\theta}{s^2+\omega^2}$
$e^{-at}\sin \omega t$	$\frac{\omega}{(s+a)^2+\omega^2}$
$e^{-at}\cos \omega t$	$\frac{s+a}{(s+a)^2+\omega^2}$

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

Fourier Transform Pairs

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