UNIVERSITI SAINS MALAYSIA

Peperiksaan Semester Pertama
Sidang Akademik 2006/2007

Oktober/November 2006

EEE 208 – TEORI LITAR II

Masa: 3 jam

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

Kertas soalan ini mengandungi ENAM soalan.

Jawab **LIMA** soalan. Jika calon menjawab lebih daripada lima soalan hanya lima soalan pertama mengikut susunan dalam skrip jawapan akan diberi markah.

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 Inggeris. Walau bagaimanapun, SATU soalan dibenarkan dijawab dalam Bahasa Malaysia.

1. (a) Takrifkan Jelmaan Laplace. Tentukan Jelmaan Laplace bagi fungsi-fungsi berikut menggunakan Pengamiran.

Define Laplace Transform. Determine the Laplace Transform of following functions by Integration:

(i) $f(t) = t^2 \cos(2t)$

(ii) $f(t) = t.\sin(3t + 30)$

(30%)

(b) Cari jelmaan Laplace bagi fungsi-fungsi berikut mengunakan Jadual dan teoram-teoram.

Find Laplace transform of following functions using Table and theorems.
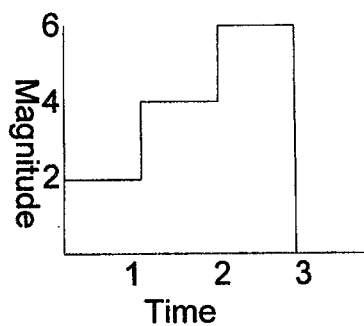
(i) $f(t) = 5\cos(3t - 5).u(t - 5)$

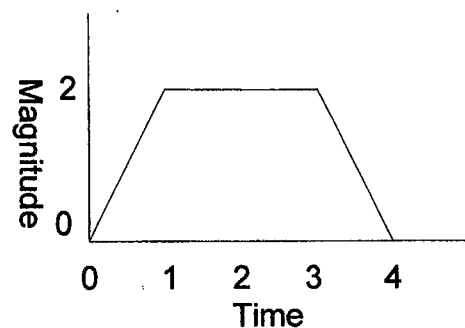(ii) $f(t) = t.e^{-(t-2)}.u(t - 2) - e^{-(t-2)}.u(t - 2)$

(25%)

(c) Cari Jelmaan Laplace bagi fungsi-fungsi berikut. Rajah1(a) dan (b).

Find the Laplace Transform of following functions. Figure1(a) and (b).

(45%)

(a)   (b)

Rajah 1
Figure 1

...3/-

2.   (a)   Cari Songsangan Laplace bagi fungsi-fungsi berikut.

Find Inverse Laplace of the following functions:
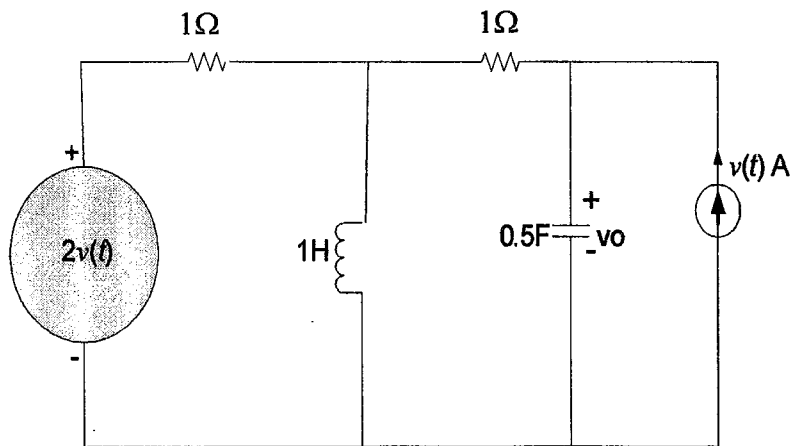
(i) $F(s) = \dfrac{20(s+2)}{s(s^2+6s+25)}$

(ii) $F(s) = \dfrac{2s^2+4s+1}{(s+1)(s+2)^3}$

(30%)

(b)   Cari $v_o(t)$ untuk semua $t > 0$, berdasarkan litar berikut Rajah 2(a).

Find $v_o(t)$ for all $t > 0$, in the following circuit Figure 2(a).
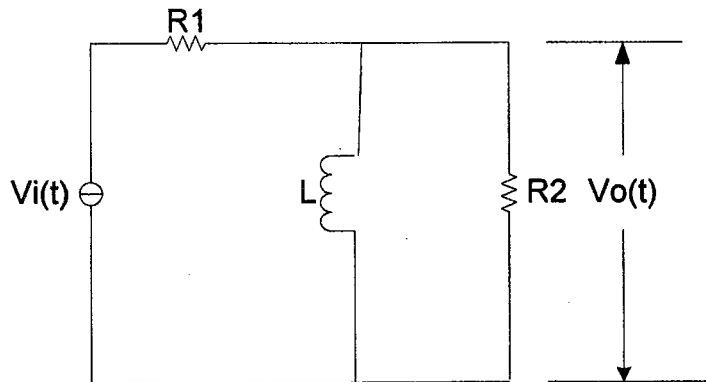
(30%)

Rajah 2(a)
Figure 2(a)

(c)   Apakah yang anda faham tentang satu penapis? Bagaimanakah ianya diklasifikasikan? Tentukan jenis dan juga frekuensi potong bagi penapis yang ditunjukkan dalam Rajah 2(b).

What do you understand by a filter? How is classified?. Determine the type as well as the cutoff frequency of the filter shown in Figure 2(b).

(40%)

Rajah 2 (b)
Figure 2(b)

3. (a) Apakah jenis-jenis alatubah yang berbeza-beza? Terangkan perbezaan antara alatubah linear dan alatubah ideal.

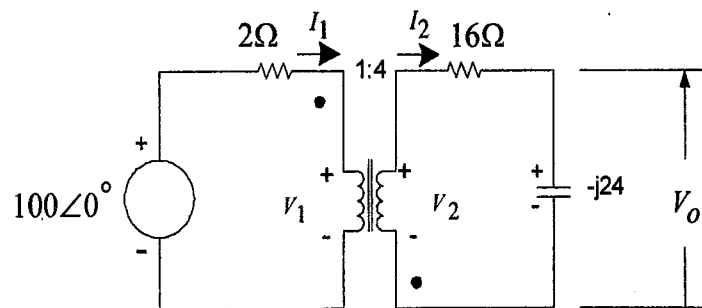*What are the different types of transformers? Explain the difference between linear and ideal transformer.*

(15%)

(b) Dalam Rajah 3 yang mengandungi alatubah ideal, tentukan V_o dan kuasa kompleks yang dibekalkan oleh sumber bekalan (100∠0° V).

Figure 3 shows an ideal transformer, find V_o and the complex power supplied by the source (100∠0° V).

(30%)

Rajah 3
Figure 3

(c)   Apakah kelebihan-kelebihan Lakaran Bode? Apakah kepentingan frekuensi sudut? Lukis Lakaran Bode untuk magnitud dan fasa bagi fungsi rangkaian berikut.

What are the advantages of Bode Plots? What is the importance of corner frequency? Draw the Bode Plots for magnitude and phase for the following network function.

$$H(\omega) = \frac{50(j\omega + 1)}{j\omega(-\omega^2 + 10j\omega + 25)}$$
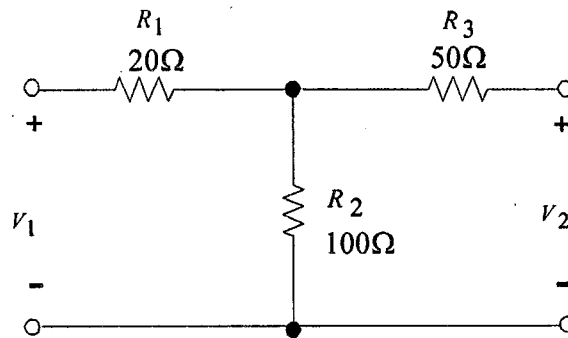
Berikan ulasan pada bentuk lakaran tersebut.
Comment on the shape of the Plots.

(55%)

4.   (a)   Dapatkan parameter-parameter Z bagi jaringan yang ditunjukkan dalam Rajah 4(a).

Determine the Z parameters for the circuit in Figure 4(a).

Rajah 4(a)
Figure 4(a)
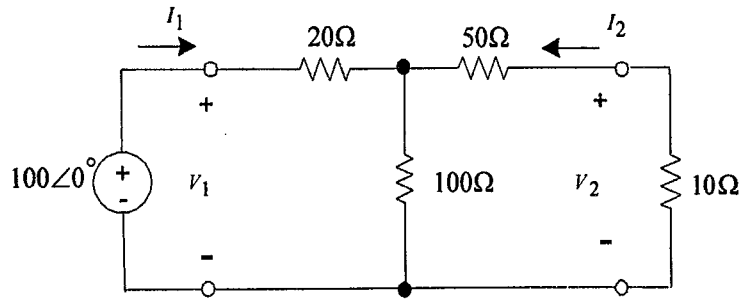
(30%)

(b)   Dapatkan I_1 dan I_2 dalam Rajah 4(b). Berikan jawapan anda dalam bentuk fasor.

Determine I_1 and I_2 in Figure 4(b). Present your answer in phasor form.

Rajah 4(b)
Figure 4(b)

(40%)

(c)   Dapatkan parameter-parameter y bagi jaringan dalam Rajah 4(c).

Obtain the y parameters for the network shown in Figure 4(c).
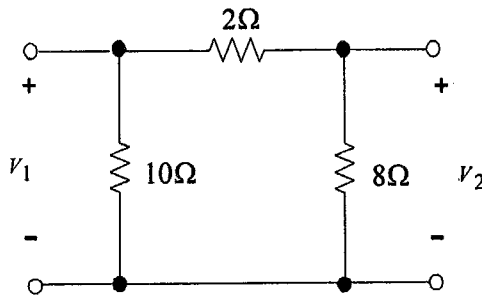
Rajah 4(c)
Figure 4(c)

(30%)

...7/-

5.   Gelombang voltan yang ditunjukkan dalam Rajah 5(a) merupakan voltan masukan yang dikenakan kepada litar dalam Rajah 5(b).

The voltage waveform shown in Figure 5(a) is the input voltage applied to the circuit in Figure 5(b).
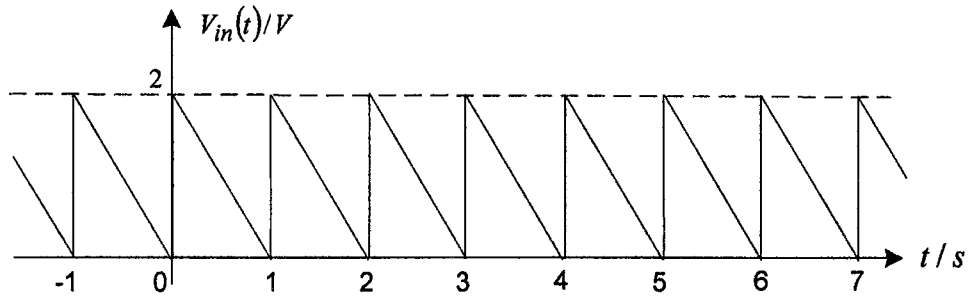
Rajah 5(a)
Figure 5(a)
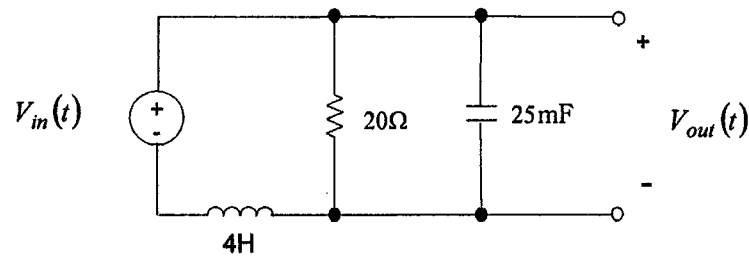
Rajah 5(b)
Figure 5(b)

(a)   Dapatkan siri Fourier dalam bentuk trigonometri untuk mewakilkan voltan masukan, $V_{in}(t)$. Tunjukkan kesemua langkah penyelesaian anda.

Find the trigonometric from of the Fourier series for the input voltage, $V_{in}(t)$. Show all your work.

(20%)

(b)   Wakilkan jawapan anda di bahagian (a) ke dalam bentuk siri Fourier amplitude-fasa.

Present your answer from part (a) in the amplitude-phase form of the Fourier series.

(10%)

(c)   Dapatkan siri Fourier dalam bentuk amplitud-fasa untuk mewakilkan voltan keluaran, $V_{out}(t)$. Tunjukkan kesemua langkah penyelesaian anda.

Find the amplitude-phase form of the Fourier series for the output voltage, $V_{out}(t)$. Show all your work.

(50%)

(d)   Wakilkan jawapan anda di bahagian (c) ke dalam bentuk siri Fourier trigonometri.

Present your answer from part (c) in the trigonometric form of the Fourier series.

(20%)

6. (a) Dapatkan jelmaan Fourier untuk fungsi $f(t)$ yang ditunjukkan dalam Rajah 6(a).

    Determine the Fourier Transform for the function $f(t)$ shown in Figure 6(a).   (20%)
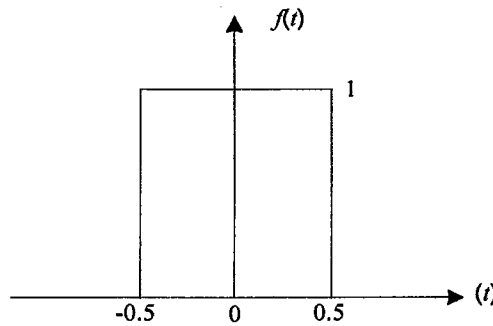
Rajah 6(a)
Figure 6(a)

(b) Berpandukan jawapan pada bahagian (a), dapatkan jelmaan Fourier untuk fungsi $g(t)$ yang ditunjukkan dalam Rajah 6(b). Gunakan ciri-ciri Jelmaan Fourier untuk menyelesaikan masalah ini.

Based on your answer in part (a), derive the Fourier Transform for the function $g(t)$ shown in Figure 6(b). Use the Fourier Transform properties to solve this question.

(20%)

Rajah 6(b)
Figure 6(b)

TABLE 1 : PROPERTIES OF THE LAPLACE TRANSFORM

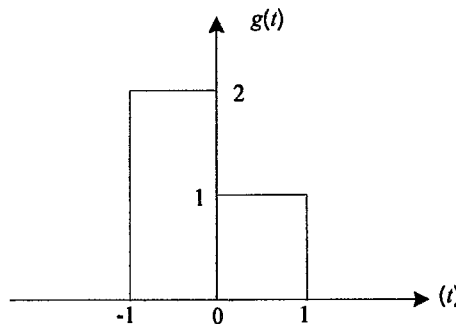| Property	$f(t)$	$F(s)$
Linearity	$a_1 f_1(t) + a_2 f_2(t)$	$a_1 F_1(s) + a_2 F_2(s)$
Scaling	$f(at)$	$\dfrac{1}{a} F\left(\dfrac{s}{a}\right)$
Time shift	$f(t-a)u(t-a)$	$e^{-as} F(s)$
Frequency shift	$e^{-at} f(t)$	$F(s+a)$
Time differentiation	$\dfrac{df}{dt}$	$sF(s) - f(0^-)$
	$\dfrac{d^2 f}{dt^2}$	$s^2 F(s) - sf(0^-) - f'(0^-)$
	$\dfrac{d^3 f}{dt^3}$	$s^3 F(s) - s^2 f(0^-) - sf'(0^-)$ $-f''(0^-)$
	$\dfrac{d^n f}{dt^n}$	$s^n F(s) - s^{n-1} f(0^-) - s^{n-2} f'(0^-)$ $- \cdots - f^{(n-1)}(0^-)$
Time integration	$\displaystyle\int_0^t f(t)\, dt$	$\dfrac{1}{s} F(s)$
Frequency differentiation	$tf(t)$	$-\dfrac{d}{ds} F(s)$
Frequency integration	$\dfrac{f(t)}{t}$	$\displaystyle\int_s^\infty F(s)\, ds$
Time periodicity	$f(t) = f(t + nT)$	$\dfrac{F_1(s)}{1 - e^{-sT}}$
Initial value	$f(0^+)$	$\displaystyle\lim_{s\to\infty} sF(s)$
Final value	$f(\infty)$	$\displaystyle\lim_{s\to 0} sF(s)$
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}	$\dfrac{y_{22}}{\Delta_y}$	$-\dfrac{y_{12}}{\Delta_y}$	$\dfrac{\Delta_h}{h_{22}}$	$\dfrac{h_{12}}{h_{22}}$	$\dfrac{1}{g_{11}}$	$-\dfrac{g_{12}}{g_{11}}$	$\dfrac{A}{C}$	$\dfrac{\Delta_T}{C}$	$\dfrac{d}{c}$	$\dfrac{1}{c}$
	z_{21}	z_{22}	$-\dfrac{y_{21}}{\Delta_y}$	$\dfrac{y_{11}}{\Delta_y}$	$\dfrac{h_{21}}{h_{22}}$	$\dfrac{1}{h_{22}}$	$\dfrac{g_{21}}{g_{11}}$	$\dfrac{\Delta_g}{g_{11}}$	$\dfrac{1}{C}$	$\dfrac{D}{C}$	$\dfrac{\Delta_t}{c}$	$\dfrac{a}{c}$
y	$\dfrac{z_{22}}{\Delta_z}$	$-\dfrac{z_{12}}{\Delta_z}$	y_{11}	y_{12}	$\dfrac{1}{h_{11}}$	$\dfrac{h_{12}}{h_{11}}$	$\dfrac{\Delta_g}{g_{22}}$	$\dfrac{g_{12}}{g_{22}}$	$\dfrac{D}{B}$	$-\dfrac{\Delta_T}{B}$	$\dfrac{a}{b}$	$\dfrac{1}{b}$
	$-\dfrac{z_{21}}{\Delta_z}$	$\dfrac{z_{11}}{\Delta_z}$	y_{21}	y_{22}	$\dfrac{h_{21}}{h_{11}}$	$\dfrac{\Delta_h}{h_{11}}$	$\dfrac{g_{21}}{g_{22}}$	$\dfrac{1}{g_{22}}$	$\dfrac{1}{B}$	$\dfrac{A}{B}$	$\dfrac{\Delta_t}{b}$	$\dfrac{d}{b}$
h	$\dfrac{\Delta_z}{z_{22}}$	$\dfrac{z_{12}}{z_{22}}$	$\dfrac{1}{y_{11}}$	$-\dfrac{y_{12}}{y_{11}}$	h_{11}	h_{12}	$\dfrac{g_{22}}{\Delta_g}$	$-\dfrac{g_{12}}{\Delta_g}$	$\dfrac{B}{D}$	$\dfrac{\Delta_T}{D}$	$\dfrac{b}{a}$	$\dfrac{1}{a}$
	$-\dfrac{z_{21}}{z_{22}}$	$\dfrac{1}{z_{22}}$	$\dfrac{y_{21}}{y_{11}}$	$\dfrac{\Delta_y}{y_{11}}$	h_{21}	h_{22}	$-\dfrac{g_{21}}{\Delta_g}$	$\dfrac{g_{11}}{\Delta_g}$	$-\dfrac{1}{D}$	$\dfrac{C}{D}$	$\dfrac{\Delta_t}{a}$	$\dfrac{c}{a}$
g	$\dfrac{1}{z_{11}}$	$-\dfrac{z_{12}}{z_{11}}$	$\dfrac{\Delta_y}{y_{22}}$	$\dfrac{y_{12}}{y_{22}}$	$\dfrac{h_{22}}{\Delta_h}$	$-\dfrac{h_{12}}{\Delta_h}$	g_{11}	g_{12}	$\dfrac{C}{A}$	$-\dfrac{\Delta_T}{A}$	$\dfrac{c}{d}$	$\dfrac{1}{d}$
	$\dfrac{z_{21}}{z_{11}}$	$\dfrac{\Delta_z}{z_{11}}$	$-\dfrac{y_{21}}{y_{22}}$	$\dfrac{1}{y_{22}}$	$\dfrac{h_{21}}{\Delta_h}$	$\dfrac{h_{11}}{\Delta_h}$	g_{21}	g_{22}	$\dfrac{1}{A}$	$\dfrac{B}{A}$	$\dfrac{\Delta_t}{d}$	$\dfrac{b}{d}$
T	$\dfrac{z_{11}}{z_{21}}$	$\dfrac{\Delta_z}{z_{21}}$	$\dfrac{y_{22}}{y_{21}}$	$\dfrac{1}{y_{21}}$	$\dfrac{\Delta_h}{h_{21}}$	$\dfrac{h_{11}}{h_{21}}$	$\dfrac{1}{g_{21}}$	$\dfrac{g_{22}}{g_{21}}$	A	B	$\dfrac{d}{\Delta_t}$	$\dfrac{b}{\Delta_t}$
	$\dfrac{1}{z_{21}}$	$\dfrac{z_{22}}{z_{21}}$	$\dfrac{\Delta_y}{y_{21}}$	$\dfrac{y_{11}}{y_{21}}$	$\dfrac{h_{22}}{h_{21}}$	$\dfrac{1}{h_{21}}$	$\dfrac{g_{11}}{g_{21}}$	$\dfrac{\Delta_g}{g_{21}}$	C	D	$\dfrac{c}{\Delta_t}$	$\dfrac{a}{\Delta_t}$
t	$\dfrac{z_{22}}{z_{12}}$	$\dfrac{\Delta_z}{z_{12}}$	$\dfrac{y_{11}}{y_{12}}$	$\dfrac{1}{y_{12}}$	$\dfrac{1}{h_{12}}$	$\dfrac{h_{11}}{h_{12}}$	$\dfrac{\Delta_g}{g_{12}}$	$\dfrac{g_{22}}{g_{12}}$	$\dfrac{D}{\Delta_T}$	$\dfrac{B}{\Delta_T}$	a	b
	$\dfrac{1}{z_{12}}$	$\dfrac{z_{11}}{z_{12}}$	$\dfrac{\Delta_y}{y_{12}}$	$\dfrac{y_{22}}{y_{12}}$	$\dfrac{h_{22}}{h_{12}}$	$\dfrac{\Delta_h}{h_{12}}$	$\dfrac{g_{11}}{g_{12}}$	$\dfrac{1}{g_{12}}$	$\dfrac{C}{\Delta_T}$	$\dfrac{A}{\Delta_T}$	c	d

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

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

Fourier Transform Pairs

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