UNIVERSITI SAINS MALAYSIA

Peperiksaan Kursus Semasa Cuti Panjang
Sidang Akademik 2006/2007

Jun 2007

EEE 208 – TEORI LITAR II

Masa: 3 jam

Sila pastikan bahawa kertas peperiksaan ini mengandungi SEMBILAN muka surat dan DUA muka surat LAMPIRAN 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 Inggeris. Jika calon hendak menjawab dalam bahasa Malaysia hanya satu soalan dibenarkan.

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1. (a) Apakah kebaikan-kebaikan dengan menggunakan Jelmaan Laplace dalam menyelesaikan masalah teori litar? Dapatkan Jelmaan Laplace dalam fungsi yang berikut menggunakan kaedah pengkamilan.

What are the advantages of using Laplace transform in solving problems of circuit theory? Find the Laplace transform of following functions using integration method.

(i) $f(t) = 15e^{-10t}u(t)$ (ii) $f(t) = t\cos(t)$

(35%)

(b) Dapatkan Jelmaan Laplace untuk fungsi-fungsi berikut menggunakan jadual dan teori.
Find the Laplace transform of the following functions using tables and theory

(i) $f(t) = t.e^{-(t-5)}u(t-5)$

(ii) $f(t) = e^{-6t}.\cos(5t).u(t)$

(iii) $f(t) = \delta(t) + \cos 2t + e^{-3t}$ (30%)

(c) Dapatkan Jelmaan Laplace bagi bentuk gelombang, terjana selepas penerusan separa gelombang, dari sumber sinus tulen.

Find the Laplace transform of the waveform, generated after half-wave rectification, of a purely sinusoidal supply.

(35%)

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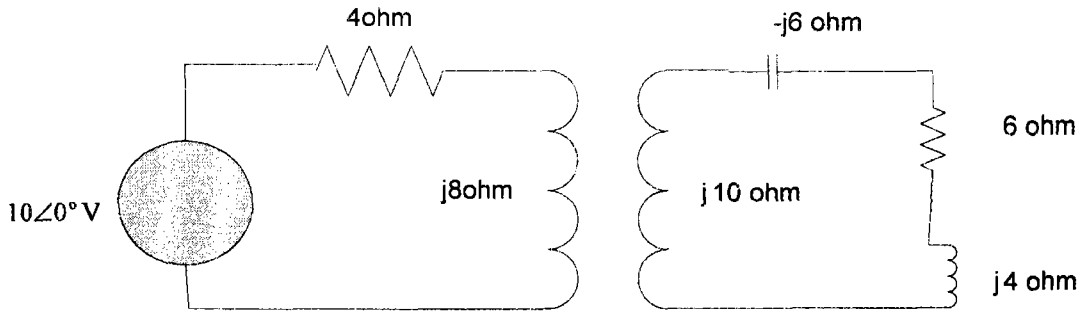
2. (a) Dapatkan songsangan Laplace bagi fungsi berikut:
Find the Laplace inverse of the following functions:

(i) $$F(S) = \frac{s^2 + 2s + 6}{s(s+1)^2(s+3)}$$

(ii) $$F(S) = \frac{10}{(s+1)(s^2 + 4s + 13)}$$ (50%)

(b) Apakah perbezaan-perbezaan jenis bagi pengubah? Hitungkan perbezaan-perbezaan utama di antara pengubah unggul dan pengubah lelurus. Dapatkan masukan galang bagi litar berikut sebagai pengubah lelurus (Rajah 1).

What are the different types of transformers? Enumerate the main differences between ideal transformer and linear transformer. Find the input impedance of the following circuit which is employing a linear transformer (Figure 1).



Rajah 1
Figure 1 (50%)

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3. (a) Kelaskan penuras. Apakah yang anda faham mengenai penuras? Rekabentuk sebuah penuras laluan tinggi yang mempunyai frekuensi potong rendah pada 20 KHz. Carikan frekuensi di mana keluarannya akan menjadi separuh daripada masukan sumber voltan.

Classify the filters. What do you understand by a filter? Design a high pass filter with its lower- cutoff frequency of 20 KHz. Find the frequency at which its output will be half of the input supply voltage.

(45%)

(b) Apakah yang anda faham mengenai sambutan frekuensi bagi sesebuah sistem? Apakah kepentingannya dalam rekabentuk bagi system elektrik yang berbeza? Bagaimana plot Bode boleh menolong penentuan frekuensi sambutan?
Lukiskan plot magnitud dan fasa bagi fungsi berikut:

What do you understand by the frequency response of a system? What is its importance in the design of different electrical systems? How does Bode plots help in the determination of frequency response?
Draw the magnitude and phase plots for the following function.

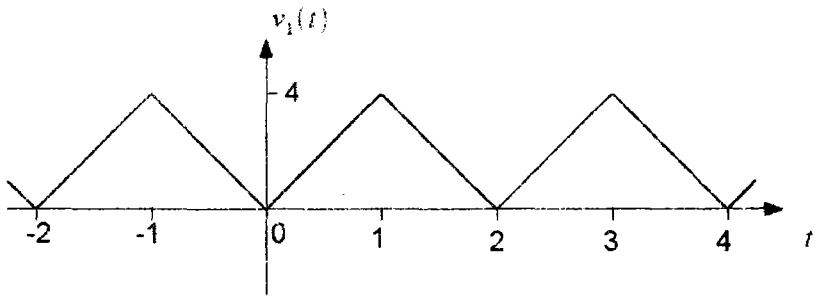
$$H(\omega) = \frac{\cdot\ 40(j\omega + 1)}{(j\omega + 2)(j\omega + 10)}$$

(55%)

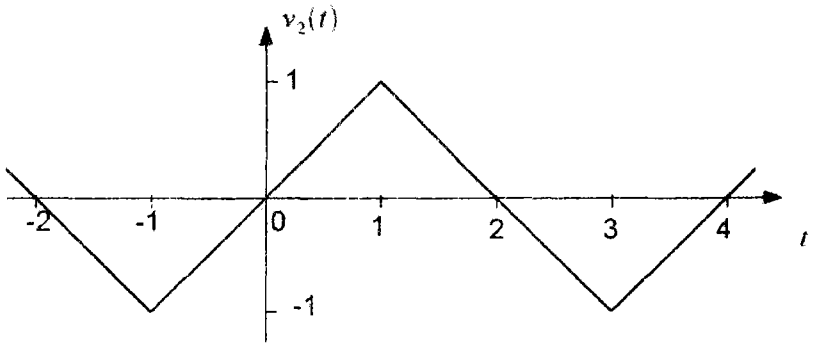
4. (a) Dapatkan siri Fourier untuk gelombang $v_2(t)$ yang ditunjukkan oleh Rajah 4(b), jika gelombang dalam Rajah 4(a) mempunyai oleh siri Fourier berikut:

Obtain the Fourier series of $v_2(t)$ in Figure 4(b), if the waveform shown in Figure 4(a) has the following Fourier series:

$$v_1(t) = 2 - \left(\frac{4}{\pi}\right)^2 \left(\cos \pi t + \frac{1}{9}\cos 3\pi t + \frac{1}{25}\cos 5\pi t + \ldots\right) \text{V}$$



(a)



(b)

Rajah 4
Figure 4

(30%)

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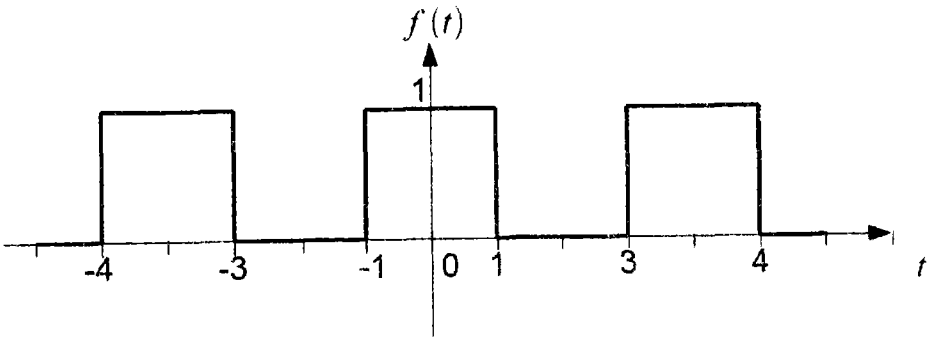
(b) Dapatkan siri trigonometri Fourier untuk isyarat yang ditunjukkan dalam Rajah 5.

Find the trigonometric Fourier series of the signal shown in Figure 5.



Rajah 5
Figure 5

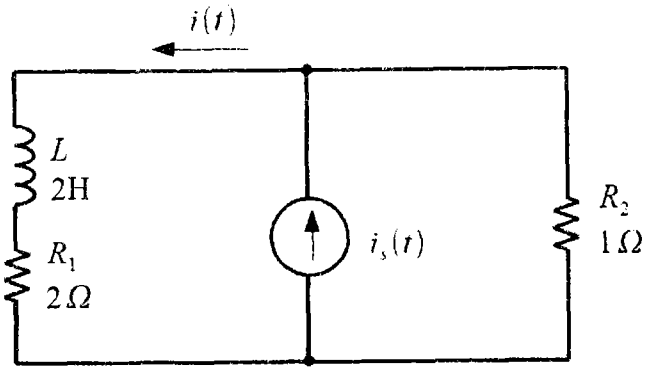
(30%)

(c) Dapatkan i(t) dalam litar yang ditunjukkan dalam Rajah 6, jika diberikan:

Find i(t) in the circuit shown in Figure 6, if given:

$$i_s(t) = 2 + \sum_{n=1}^{\infty} \frac{1}{n^2} \cos(3nt)\,\mathrm{A}$$

...7/-

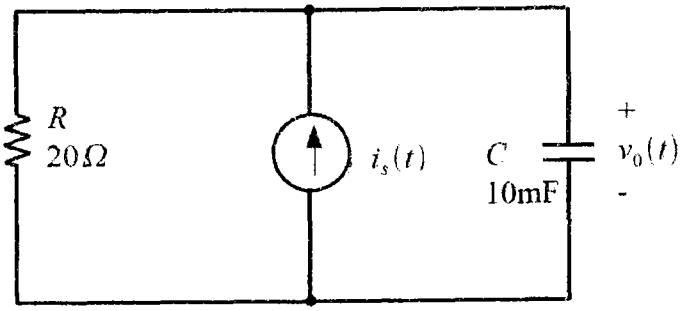


Rajah 6
Figure 6

(40%)

5. (a) Dengan menggunakan jelmaan Fourier, dapatkan $v_o(t)$ untuk litar yang ditunjukkan dalam Rajah 7, jika:
Use the Fourier transform to find $v_o(t)$ in the circuit shown in Figure 7, if:

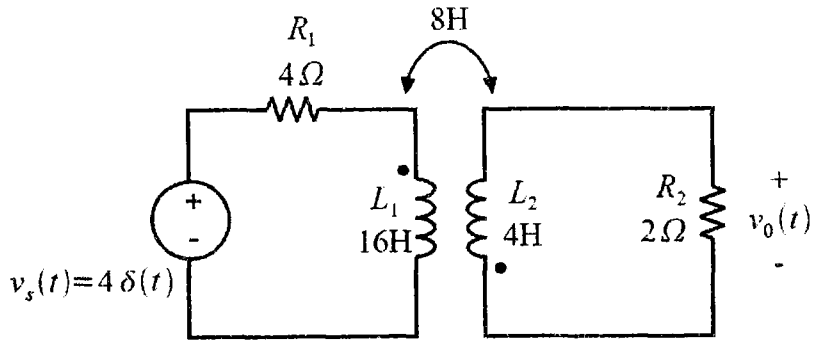
$$i_s(t) = 10\exp(-t)u(t)\ \text{A}$$



Rajah 7
Figure 7

(40%)

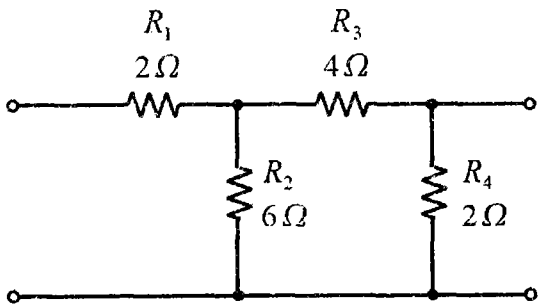
(b) Dengan menggunakan jelmaan Fourier, dapatkan $v_o(t)$ untuk litar yang ditunjukkan dalam Rajah 8.
Use the Fourier transform to find $v_o(t)$ in the circuit shown in Figure 8.



Rajah 8
Figure 8

(60%)

6. (a) Dapatkan parameter-parameter z bagi litar yang ditunjukan dalam Rajah 9.
Find the z parameters of the circuit shown in Figure 9.



Rajah 9
Figure 9

(40%)

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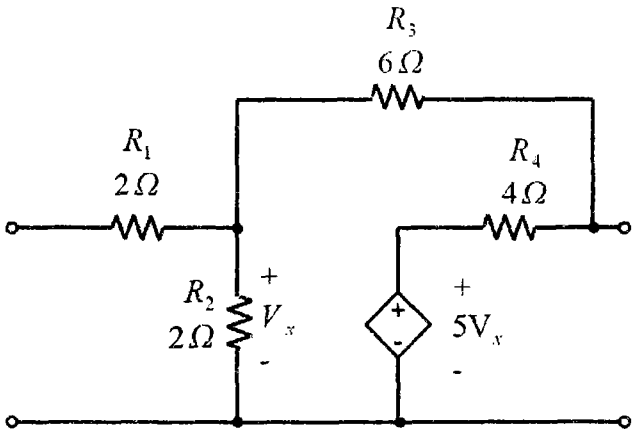
(b) Dapatkan parameter-parameter ABCD bagi litar yang ditunjukan dalam Rajah 10.
Find the ABCD parameters of the circuit shown in Figure 10.



Rajah 10
Figure 10

(60%)

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Lampiran 1 / *Appendix 1* **[EEE 208]**

Pasangan Jelmaan Fourier/ *Fourier Transform Pair*:

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

TABLE 19.1

	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

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

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