UNIVERSITI SAINS MALAYSIA

Peperiksaan Semester Pertama

Sidang Akademik 2009/2010

November 2009

EEE 208 – TEORI LITAR II

Masa : 3 Jam

Sila pastikan bahawa kertas peperiksaan ini mengandungi TUJUH muka surat beserta Lampiran EMPAT muka surat bercetak sebelum anda memulakan peperiksaan ini.

Kertas soalan ini mengandungi ENAM soalan.

Jawab **LIMA** soalan.

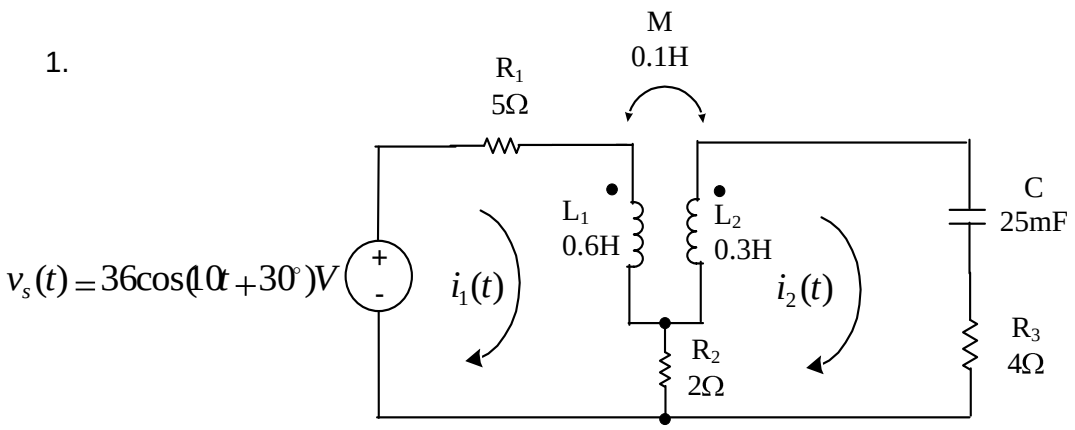
Mulakan jawapan anda untuk setiap soalan pada muka surat yang baru.

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.

[Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah diguna pakai].

1.



Rajah 1
Figure 1

Soalan 1 adalah berdasarkan Rajah 1
Question 1 is based on Figure 1.

(a) Tukarkan litar kepada domain frekuensi (i.e. dalam bentuk polar).
Change the circuit into frequency domain (i.e. in polar form).

(20%)

(b) Dapatkan $i_1(t)$.
Find $i_1(t)$.

(30%)

(c) Dapatkan $i_2(t)$.
Find $i_2(t)$.

(10%)

(d) Kirakan kuasa yang diserap oleh perintang R_3.
Calculate the power absorbed by resistor R_3.

(10%)

(e) Kirakan tenaga yang tersimpan di gegelung berganding pada $t = 10s$.
Calculate the energy stored at the coupled coils at $t = 10s$.

(30%)

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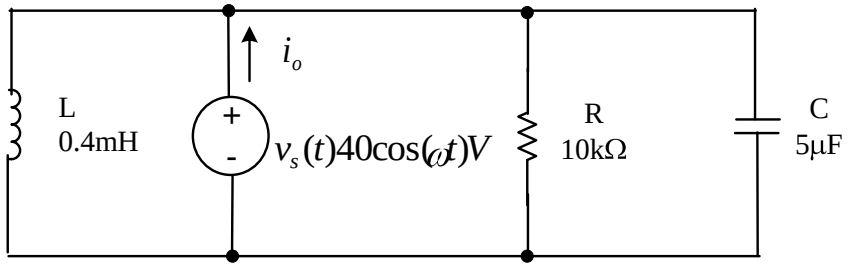
2. (a) Bahagian (a) adalah berdasarkan Rajah 2.

Part (a) is based on Figure 2.



Rajah 2
Figure 2

(i) Kirakan frekuensi salunan, ω_0.

Calculate the resonant frequency, ω_0. (10%)

(ii) Kirakan faktor kualiti Q.

Calculate the quality factor Q. (10%)

(iii) Kirakan lebar jalur B.

Calculate the bandwidth B. (10%)

(iv) Dapatkan frekuensi-frekuensi separuh kuasa, ω_1 dan ω_2.

Find the half-power frequencies, ω_1 *and* ω_2.

(20%)

(v) Kirakan kuasa yang dilesapkan semasa litar beroperasi pada ω_0.

Calculate the power dissipated when the circuit is operated at ω_0.

(10%)

(vi) Kirakan kuasa yang dilesapkan oleh litar semasa ω_1.

Calculate the power dissipated by the circuit at ω_1.

(10%)

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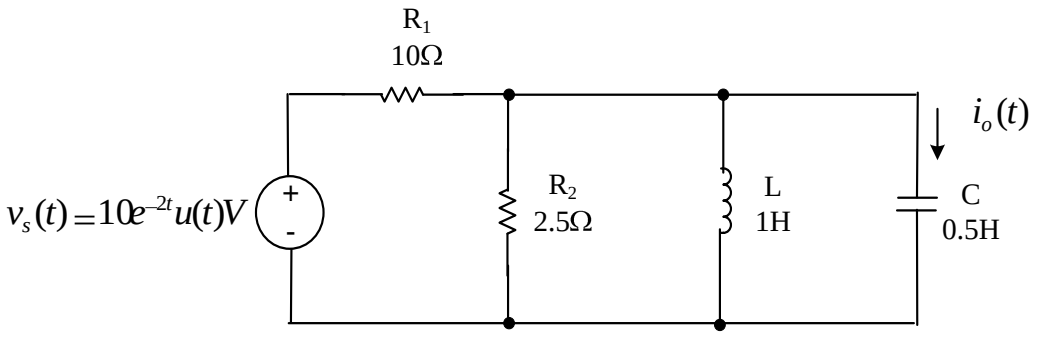
(b) Satu litar mempunyai $R_1 = 3\Omega, R_2 = 40\Omega, L = 12H$ dan $C = \frac{1}{50}F$. Litar melalui pengskalaan magnitud sebanyak 100 dan pengskalaan frekuensi sebanyak 10^6. Dapatkan nilai-nilai baru bagi setiap komponen.

A circuit has $R_1 = 3\Omega, R_2 = 40\Omega, L = 12H$ *and* $C = \frac{1}{50}F$. *The circuit is magnitude scaled by 100 and frequency scaled by* 10^6. *Find the new values of the circuit elements.*

(30%)

3. Berdasarkan Rajah 3, dapatkan $i_o(t)$ dengan menggunakan jelmaan Laplace. Andaikan keadaan permulaan sifar.

Based on Figure 3, find $i_o(t)$ *by using Laplace transform. Assuming zero initial conditions.*

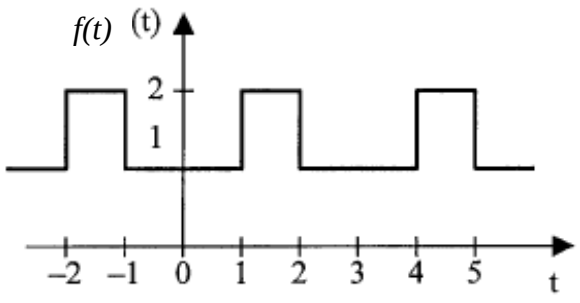


Rajah 3
Figure 3

(100%)

4. Rajah 4(a) menunjukkan bentuk gelombang segiempat tepat voltan berkala *f(t)* dengan amplitud bernilai 2.

Figure 4(a) shows the periodic voltage rectangular waveform f(t) with amplitude 2.



Rajah 4(a)
Figure 4(a)

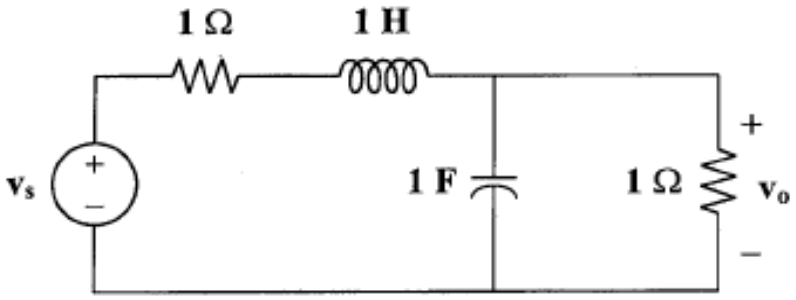
(a) Dapatkan siri Fourier trigonometrik bagi *f(t).*

Determine the trigonometric Fourier series for the f(t).

(20%)

(b) Jika *Vs* di dalam litar Rajah 4(b) sama seperti fungsi *f(t)* seperti ditunjukkan dalam Rajah 4(a), tentukan:

If Vs in the circuit of Figure 4(b) is the same as function f(t) in Figure 4(a), determine:



Rajah 4(b)
Figure 4(b)

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(i) Komponen arus terus.

The *DC component.* (40%)

(ii) Untuk tiga yang pertama harmonik bukan sifar *Vo(t).*

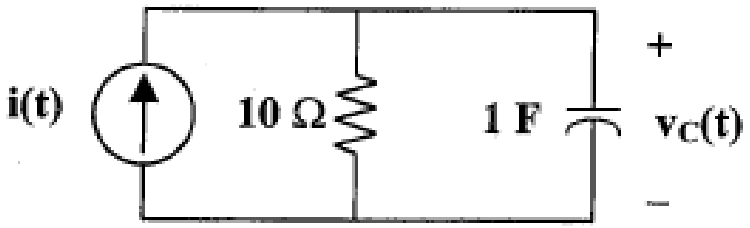
The first three nonzero harmonics of Vo(t). (30%)

(iii) Nilai *Vrms* bentuk gelombang.

The Vrms value of the waveshape. (10%)

5. Dengan menggunakan kaedah jelmaan Fourier, tentukan $V_c(t)$ seperti di Rajah 5, jika *i(t) = u(t)* A.

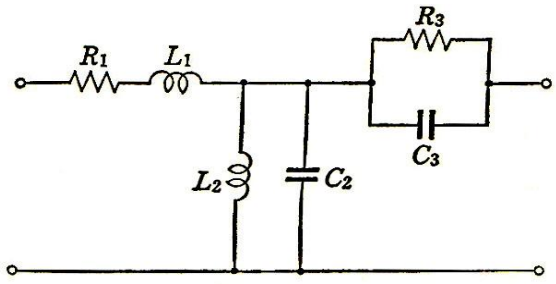
By using Fourier transform, determine $V_c(t)$ in Figure 5, if i(t) = u(t) A.



Rajah 5
Figure 5 (100%)

6. (a) Dapatkan parameter galangan untuk litar di dalam Rajah 6(a).
Obtain the impedance parameter for the circuit in Figure 6(a).

(30%)



Rajah 6(a)
Figure 6(a)

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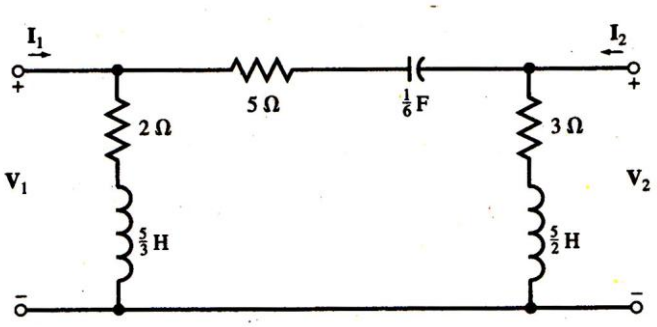
(b) Dapatkan parameter lepasan untuk litar di dalam Rajah 6(b).

Obtain the admittance parameter for the circuit in Figure 6(b).

(30%)

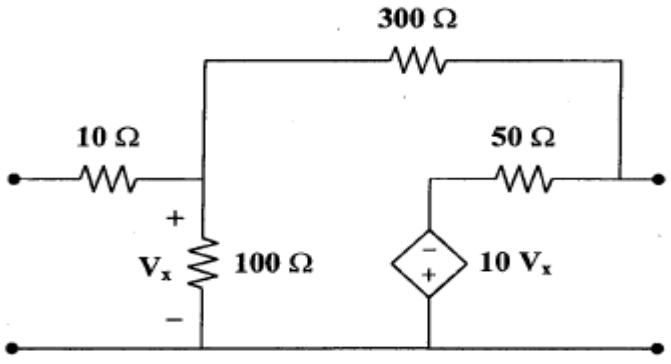


Rajah 6(b)
Figure 6(b)

(c) Dapatkan parameter g untuk litar di dalam Rajah 6(c).

Find the g parameter for the circuit in Figure 6(c).

(40%)



Rajah 6(c)
Rajah 6(c)

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Lampiran 1
Appendix 1

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

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

Lampiran 2
Appendix 2

JADUAL 2: SIFAT-SIFAT JELMAAN LAPLACE
TABLE 2: 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	$\frac{df(t)}{dt}$	$sF(s)-f(0^-)$
	$\frac{d^2 f(t)}{dt^2}$	$s^2F(s)-sf(0^-)-f'(0^-)$
	$\frac{d^3 f(t)}{dt^3}$	$s^3F(s)-s^2 f(0^-)-sf'(0^-)-f''(0^-)$
	$\frac{d^n f(t)}{dt^n}$	$s^nF(s)-s^{n-1}f(0^-)-s^{n-2}f'(0^-)-\ldots-f^{(n-1)}(0^-)$
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	$f_1(t)*f_2(t)$	$F_1(s)F_2(s)$

Lampiran 3
Appendix 3

JADUAL 3: PASANGAN-PASANGAN JELMAAN FOURIER
TABLE 3: FOURIER TRANSFORM PAIRS

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

Lampiran 4
Appendix 4

JADUAL 4: JADUAL PENGUBAHAN PARAMETER-PARAMETER RANGKAIAN DUA PANGKALAN
TABLE 4: 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

$\Delta_z = z_{11}z_{22} - z_{12}z_{21}$

$\Delta_y = y_{11}y_{22} - y_{12}y_{21}$

$\Delta_h = h_{11}h_{22} - h_{12}h_{21}$

$\Delta_g = g_{11}g_{22} - g_{12}g_{21}$

$\Delta_T = AD - BC$

$\Delta_t = ad - bc$