UNIVERSITI SAINS MALAYSIA

Peperiksaan Kursus Semasa Cuti Panjang
Sidang Akademik 2008/2009

Jun 2009

EEE 208 – TEORI LITAR II

Masa: 3 jam

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

Kertas soalan ini mengandungi ENAM soalan.

Jawab **LIMA** soalan.

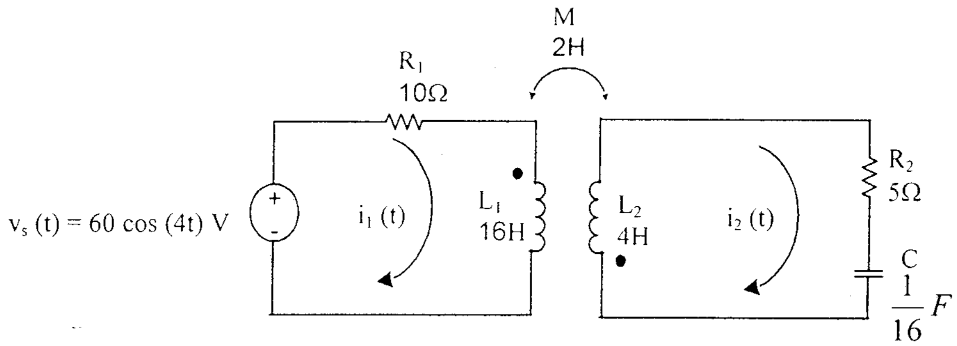
Mulakan jawapan anda untuk setiap soalan pada muka surat yang baru.

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.

1. Soalan 1 adalah berdasarkan Rajah 1.

Question 1 is based on Figure 1.



Rajah 1
Figure 1

(a) Tentukan nilai pekali gandingan.

Determine the coupling coefficient. (10%)

(b) Kirakan nilai regangan L_1, X_{L1}.

Calculate the reactance of L_1, X_{L1}. (5%)

(c) Kirakan nilai regangan L_2, X_{L2}.

Calculate the reactance of L_2, X_{L2}. (5%)

(d) Kirakan nilai regangan M, X_M.

Calculate the reactance of M, X_M. (5%)

(e) Kirakan nilai regangan C, X_C.

Calculate the reactance of C, X_C. (5%)

(f) Dapatkan $i_1(t)$.

Find $i_1(t)$. (20%)

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(g) Dapatkan $i_2(t)$.

Find $i_2(t)$. (10%)

(h) Dapatkan nilai $i_1(t)$ pada $t = 10s$.

Find the value of $i_1(t)$ at $t = 10s$. (10%)

(i) Dapatkan nilai $i_2(t)$ pada $t = 10s$.

Find the value of $i_2(t)$ at $t = 10s$. (10%)

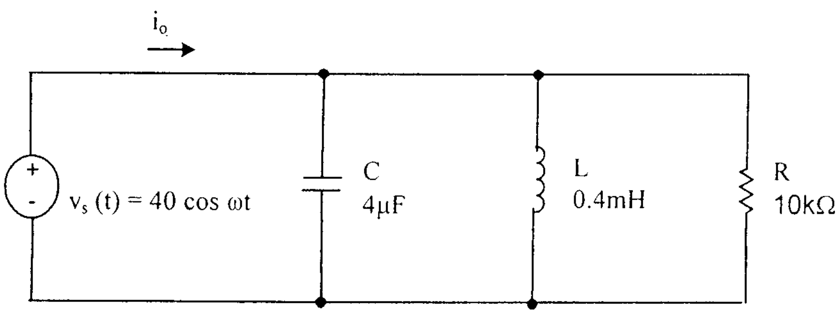
(j) Kirakan tenaga yang tersimpan dalam pengaruh gandingan pada $t = 10s$.

Calculate the energy stored in the coupled inductors at time $t = 10s$.

(20%)

2. Soalan 2 adalah berdasarkan Rajah 2.

Question 2 is based on Figure 2.



Rajah 2
Figure 2

(a) Kirakan frekuensi salunan, ω_0.

Calculate the resonant frequency, ω_0. (15%)

(b) Kirakan faktor kualiti, Q.

Calculate the quality factor, Q. (15%)

(c) Kirakan lebar jalur, B.

Calculate the bandwidth, B. (10%)

(d) Kirakan frekuensi-frekuensi kuasa separuh, ω_1, ω_2.

Calculate the half power frequencies, ω_1, ω_2. (20%)

(e) Dapatkan kuasa yang dilesapkan pada ω_0.

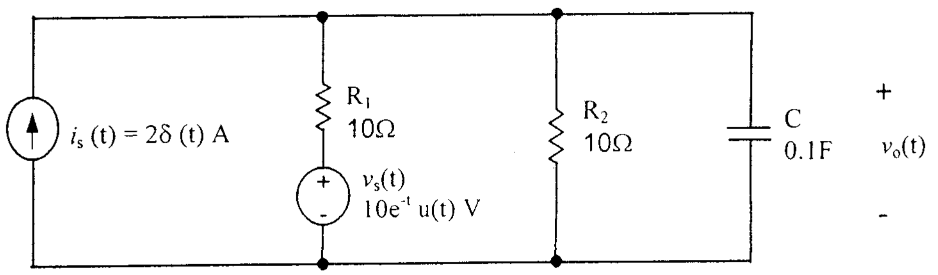
Determine the power dissipated at ω_0. (30%)

(f) Dapatkan kuasa yang dilesapkan pada ω_1.

Determine the power dissipated at ω_1. (10%)

3. Dapatkan $v_O(t)$ bagi litar dalam Rajah 3. Andaikan $v_O(0)$ = 5V.

Find $v_O(t)$ *for the circuit in Figure 3. Assume* $v_O(0) = 5V$.

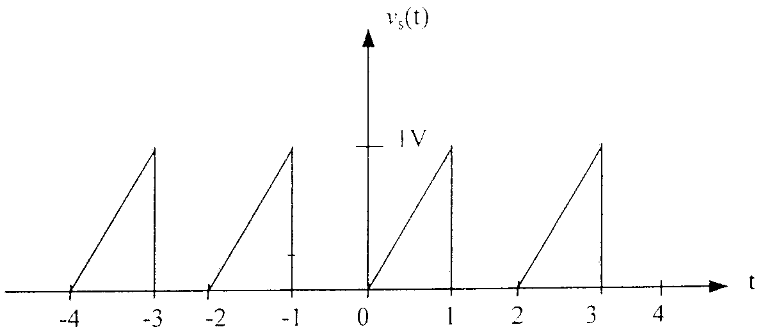


Rajah 3
Figure 3

(100%)

4. (a) Dapatkan siri Fourier bagi fungsi berkala $v_S(t)$ yang ditunjukkan dalam Rajah 4.

Obtain the Fourier series for the periodic function $v_S(t)$ shown in Figure 4.



(40%)

Rajah 4
Figure 4

(b) Plotkan spektra amplitude bagi fungsi dalam Rajah 4 (sehingga harmonik ke 6).

Plot the amplitude spectra for the function shown in Figure 4 (up to the 6^{th} harmonic).

(20%)

(c) Plotkan spektra fasa bagi fungsi dalam Rajah 4 (sehingga harmonik ke 6).

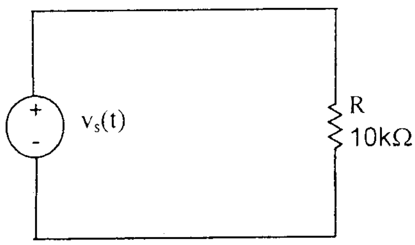
Plot the phase spectra for the function shown in Figure 4 (up to the 6^{th} harmonic).

(20%)

(d) Fungsi $v_S(t)$ dalam Rajah 4 dikenakan pada litar dalam Rajah 5. Kirakan kuasa yang dilesapkan oleh litar tersebut dengan menggunakan teori Parseval sehingga harmonik ke-3.

Function $v_S(t)$ in Figure 4 is applied to the circuit shown in Figure 5. Calculate the power dissipated by the circuit by using Parseval's theorem, up to the 3rd harmonic.

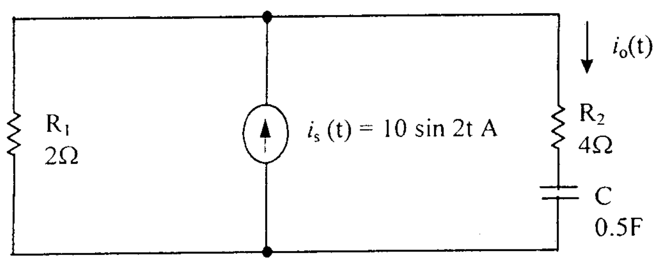
(20%)



Rajah 5
Figure 5

5. Menggunakan jelmaan Fourier, dapatkan $i_o(t)$ dalam Rajah 6.

Using the Fourier transform method, find $i_o(t)$ in Figure 6.

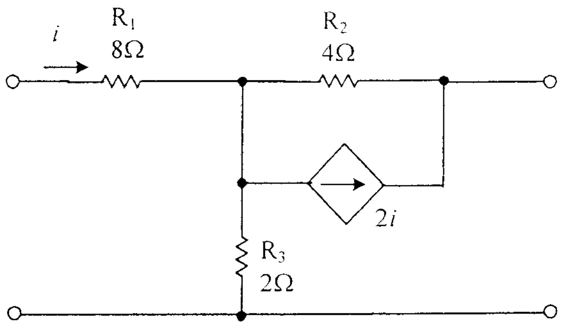


Rajah 6
Figure 6

(100%)

6. (a) Dapatkan parameter y bagi rangkaian 2 liang dalam Rajah 7.

Obtain the y parameters for the 2-port network shown in Figure 7.

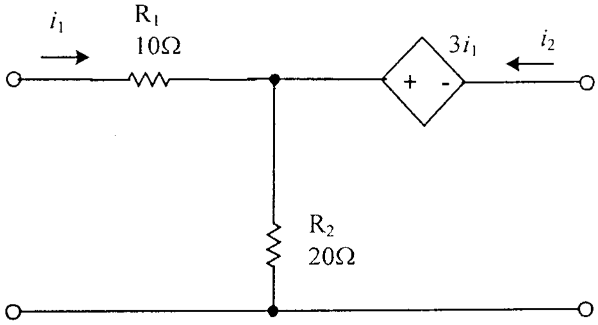


(50%)

Rajah 7
Figure 7

(b) Dapatkan parameter penghantaran untuk rangkaian 2 liang dalam Rajah 8.

Find the transmission parameters for the 2-port network in Figure 8.



(50%)

Rajah 8
Figure 8

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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	$\frac{df}{dt}$	$sF(s) - f(0^-)$
	$\frac{d^2 f}{dt^2}$	$s^2F(s) - sf(0^-) - f'(0^-)$
	$\frac{d^3 f}{dt^3}$	$s^3F(s) - s^2 f(0^-) - sf'(0^-) - f''(0^-)$
	$\frac{d^n f}{dt^n}$	$s^n F(s) - s^{n-1}f(0^-) - s^{n-2}f'(0^-) - \cdots - f^{(n-1)}(0^-)$
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}	$\frac{1}{(s+a)^2}$
$t^n e^{-at}$	$\frac{n!}{(s+a)^{n+1}}$
$\sin \omega t$	$\frac{\omega}{s^2+\omega^2}$
$\cos \omega t$	$\frac{s}{s^2+\omega^2}$
$\sin(\omega t+\theta)$	$\frac{s\sin\theta+\omega\cos\theta}{s^2+\omega^2}$
$\cos(\omega t+\theta)$	$\frac{s\cos\theta-\omega\sin\theta}{s^2+\omega^2}$
$e^{-at}\sin \omega t$	$\frac{\omega}{(s+a)^2+\omega^2}$
$e^{-at}\cos \omega t$	$\frac{s+a}{(s+a)^2+\omega^2}$

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

Fourier Transform Pairs

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