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UNIVERSITI SAINS MALAYSIA

Peperiksaan Semester Pertama  
Sidang Akademik 2008/2009

November 2008

**EEE208 – TEORI LITAR II**

Masa: 3 jam

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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.

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

*Find the magnitude of the transfer function  $H(\omega)$  in term of  $\omega$ .*

$H(\omega) = V_o(\omega) / V_i(\omega)$ .

(30%)

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

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

(15%)

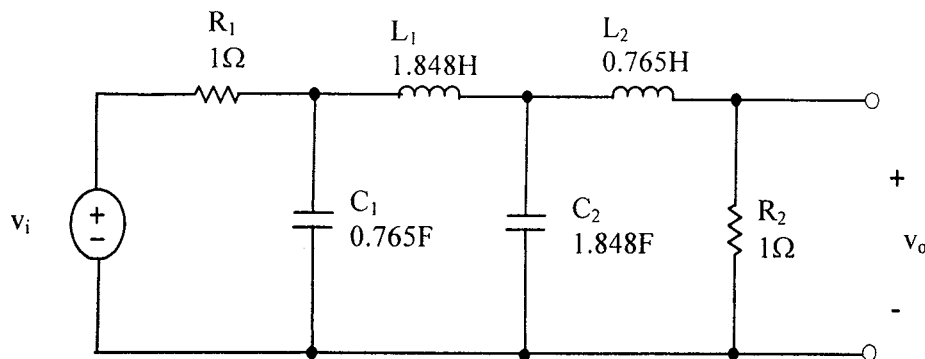
- (iii) Kirakan nilai frekuensi potong,  $\omega_c$ .

*Calculate the cutoff frequency,  $\omega_c$ .*

(25%)

- (b) Satu penapis dengan frekuensi potong  $\omega_c = 1$  rad/s ditunjukkan dalam Rajah 4. Skalikan litar tersebut kepada frekuensi potong 100 kHz dengan menggunakan perintang-perintang  $32k\Omega$ .

*A filter with the cutoff frequency  $\omega_c = 1$  rad/s is shown in Figure 4. Scale the circuit for a cutoff frequency of 100 kHz using  $32k\Omega$  resistors.*



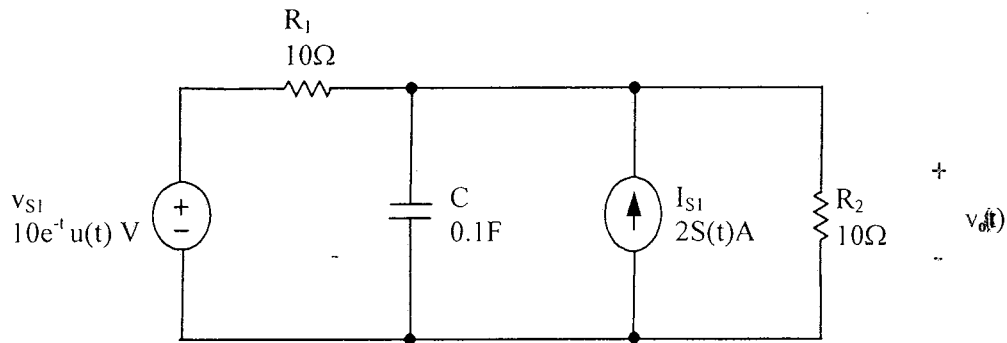
Rajah 4  
 Figure 4

(30%)

...5/-

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

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

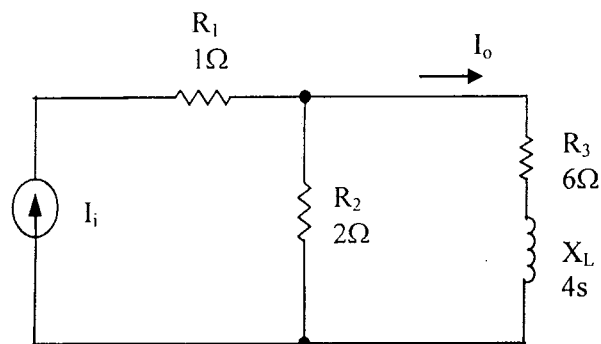


Rajah 5  
Figure 5

(60%)

- (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%)

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	$\frac{df}{dt}$	$sF(s) - f(0^-)$
	$\frac{d^2 f}{dt^2}$	$s^2 F(s) - sf(0^-) - f'(0^-)$
	$\frac{d^3 f}{dt^3}$	$s^3 F(s) - s^2 f(0^-) - sf'(0^-) - f''(0^-)$
	$\frac{d^n f}{dt^n}$	$s^n F(s) - s^{n-1} f(0^-) - s^{n-2} f'(0^-) - \dots - f^{(n-1)}(0^-)$
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	$f(0^+)$	$\lim_{s \rightarrow \infty} sF(s)$
Final value	$f(\infty)$	$\lim_{s \rightarrow 0} sF(s)$
Convolution	$f_1(t) * f_2(t)$	$F_1(s)F_2(s)$

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	$\frac{z_{22}}{z_{12}}$	$\frac{\Delta_z}{z_{12}}$	$\frac{y_{11}}{y_{12}}$	$-\frac{1}{y_{12}}$	$\frac{1}{h_{12}}$	$\frac{h_{11}}{h_{12}}$	$-\frac{\Delta_g}{g_{12}}$	$-\frac{g_{22}}{g_{12}}$	$\frac{D}{\Delta_T}$	$\frac{B}{\Delta_T}$	$a$	$b$
	$\frac{1}{z_{12}}$	$\frac{z_{11}}{z_{12}}$	$\frac{\Delta_y}{y_{12}}$	$-\frac{y_{22}}{y_{12}}$	$\frac{h_{22}}{h_{12}}$	$\frac{\Delta_h}{h_{12}}$	$\frac{g_{11}}{g_{12}}$	$\frac{1}{g_{12}}$	$\frac{C}{\Delta_T}$	$\frac{A}{\Delta_T}$	$c$	$d$

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

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

Fourier Transform Pairs

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