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UNIVERSITI SAINS MALAYSIA

Peperiksaan Semester Pertama  
Sidang Akademik 2005/2006

November 2005

**EEE 208 – TEORI LITAR II**

Masa : 3 Jam

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**ARAHAN KEPADA CALON:-**

Sila pastikan kertas peperiksaan ini mengandungi **TUJUH (7)** muka surat beserta **Lampiran (3 mukasurat)** bercetak dan **ENAM (6)** soalan sebelum anda memulakan peperiksaan ini.

Jawab **LIMA (5)** soalan.

Agihan markah diberikan di sudut sebelah kanan soalan berkenaan.

Pelajar dikehendaki menjawab **SATU (1)** soalan di dalam Bahasa Malaysia dan selebihnya di dalam Bahasa Inggeris.

...2/-

1. (a) Cari jelmaan Laplace bagi fungsi-fungsi berikut menggunakan kaedah pengamiran.

*Find Laplace transform of following functions by using method of integration.*

(i)  $3 \cdot e^{-4t} \cdot u(t)$

(ii)  $t \cdot \sin(t)$

(30%)

- (b) Cari jelmaan Laplace bagi fungsi-fungsi berikut menggunakan jadual dan teoram-teoram.

*Find the Laplace transform of following functions using tables and theorems.*

(i)  $f(t) = t \cdot e^{-(t-1)} \cdot u(t-1) - e^{-(t-1)} \cdot u(t-1)$

(ii)  $f(t) = \frac{1}{4} (5t - 4e^{-2t})$

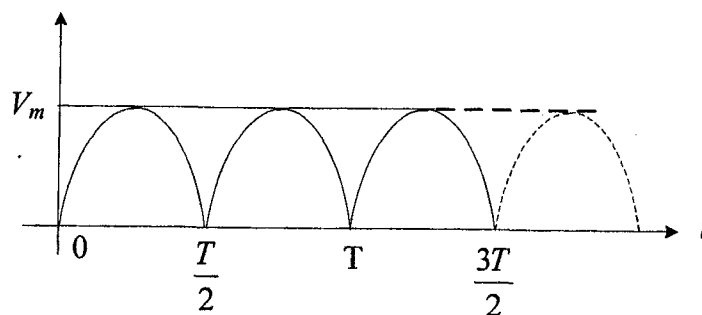
(iii)  $f(t) = \sin(2t-\tau) \cdot u(t-\tau)$       dimana  $\tau = 2$   
 where

(30%)

- (c) Cari jelmaan Laplace bagi gelombang yang ditunjukkan dalam Rajah 1.

*Find the Laplace Transform of waveform shown in Figure 1.*

(40%)



Rajah 1  
 Figure 1

...3/-

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

*Find the Laplace Inverse of following functions.*

(i) 
$$F(s) = \frac{S^2 + 2s + 6}{S(s+1)^3 (s+5)}$$

(ii) 
$$F(s) = \frac{5S^2 + 7s + 29}{S(s^2 + 4s + 29)}$$

(40%)

- (b) Gunakan jelmaan Laplace untuk menyelesaikan persamaan pembezaan berikut pada ketika keadaan awalan adalah sifar.

*Use the Laplace transform to solve the following differential equation when all initial conditions are zero.*

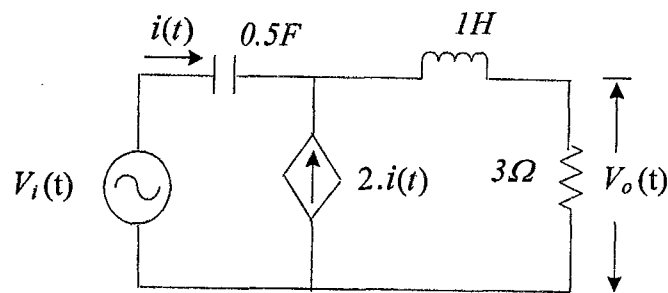
$$\frac{d^3 y(t)}{dt^3} + 6 \frac{d^2 y(t)}{dt^2} + 8 \frac{d y(t)}{dt} = e^{-t} \cdot \cos 2t$$

(30%)

- (c) Dapatkan fungsi pindah  $H(s) = \frac{V_o(s)}{V_i(s)}$  bagi litar yang ditunjukkan dalam Rajah 2.

*Obtain the transfer function  $H(s) = \frac{V_o(s)}{V_i(s)}$  for the following circuit shown in Figure 2.*

(30%)



Rajah 2  
Figure 2

...4/-

3. (a) Apakah kegunaan suatu penapis? Bagaimanakah ia dikelaskan? Rekabentuk satu penapis laluan rendah pada frekuensi potong 2 kHz. Tentukan nilai frekuensi di mana keluaran penapis menjadi separuh daripada bekalan voltan masukan.

*What is the purpose of a filter? How are they classified? Design a low pass filter with a cut-off frequency of 2 KHz. Find the frequency at which its output will be half of the input supply voltage.*

(40%)

- (b) Apakah kegunaan Lakaran Bode? Takrifkan frekuensi sudut. Lukis magnitud dan fasa Lakaran Bode bagi fungsi berikut. Terangkan berkaitan bentuk lakaran yang telah dibuat.

*What is the purpose of Bode plots? Define corner frequency. Draw the magnitude and phase Bode-plots for the following function. Comment on the shape of the plots drawn.*

$$H(\omega) = \frac{j\omega + 12}{j\omega(j\omega + 6)^2}$$

(60%)

4. (a) Apakah di antara jenis-jenis transformer? Apakah peranan pearuh saling dalam operasi Transformer Kuasa?

*What are the different types of transformers? What is the role of mutual inductance in the operation of Power Transformer?*

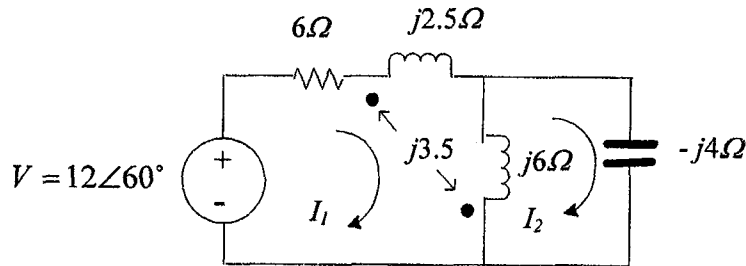
(15%)

...5/-

- (b) Tentukan arus-arus fasa  $I_1$  dan  $I_2$  dalam litar yang ditunjukkan dalam Rajah 4.

*Determine the phasor currents  $I_1$  and  $I_2$  in the circuit shown in Figure 4.*

(50%)



Rajah 4  
Figure 4

- (c) Tentukan tenaga yang disimpan dalam litar gandingan magnet pada keadaan mantap dalam litar yang ditunjukkan dalam Rajah 4.

*Determine the energy stored in the magnetically coupled circuit at steady state condition in the circuit shown in Figure 4.*

(35%)

5. (a) Terbitkan persamaan-persamaan bagi kuasa purata dan nilai-nilai pmkd sebuah isyarat taksinusoidal dan berkala.

*Develop the expressions for average power and RMS values of a nonsinusoidal and periodic signal.*

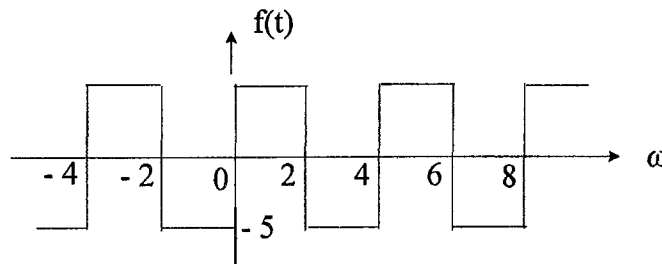
(25%)

...6/-

- (b) Cari Siri Fourier bagi isyarat segiempat seperti dalam Rajah 5(a). Lakarkan magnitud dan spektrum fasa.

*Find the Fourier Series of the square wave shown in Figure 5(a). Plot the phase magnitude and phase spectra.*

(35%)

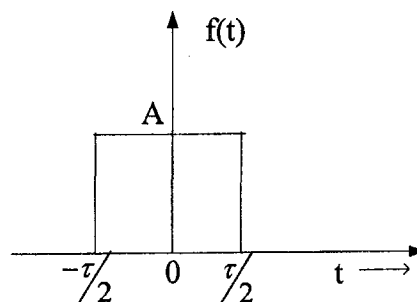


Rajah 5(a)  
Figure 5(a)

- (c) Terbitkan jelmaan Fourier bagi satu denyutan segiempat tunggal dengan lebarnya  $\tau$  dan ketinggian  $A$  seperti ditunjukkan dalam Rajah 5(b) serta lukis spektrum amplitudnya.

*Derive the Fourier transform of a single rectangular pulse of width  $\tau$  and height  $A$ , shown in Figure 5(b) and draw its amplitude spectrum.*

(40%)



Rajah 5(b)  
Figure 5(b)

...7/-

6. (a) Apakah kelebihan menentukan satu parameter daripada parameter yang lain? Tentukan parameter-parameter hibrid daripada parameter-parameter Z.

*What is the advantage of determining one parameter from another parameter? Determine hybrid parameters from Z-parameters.*

(15%)

- (b) Apakah kaedah-kaedah lain untuk menyambungkan dua Rangkaian, dua-Pengkalan. Tentukan rangkaian keseluruhan apabila dua Rangkaian, dua-Pengkalan disambungkan secara selari.

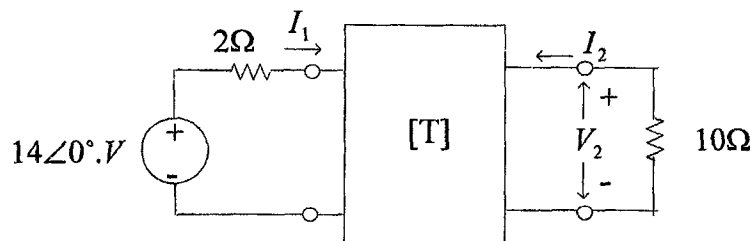
*What are the different methods to interconnect two, two-Port Networks. Determine the parameters of overall network when two, two-Port Networks are connected in parallel.*

(40%)

- (c) Tentukan  $I_1$  dan  $I_2$  jika parameter-parameter penghantaran bagi rangkaian dua-Pengkalan seperti dalam Rajah 6 adalah

*Find  $I_1$  and  $I_2$  if the transmission parameters for the two port network of Figure 6 are*

$$\begin{bmatrix} 5 & 10\Omega \\ 0.4s & 1 \end{bmatrix} \quad (45\%)$$



Rajah 6  
Figure 6

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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	$\frac{df}{dt}$	$sF(s) - f(0^-)$
	$\frac{d^2 f}{dt^2}$	$s^2 F(s) - sf(0^-) - f'(0^-)$
	$\frac{d^3 f}{dt^3}$	$s^3 F(s) - s^2 f(0^-) - sf'(0^-) - f''(0^-)$
	$\frac{d^n f}{dt^n}$	$s^n F(s) - s^{n-1} f(0^-) - s^{n-2} f'(0^-) - \dots - f^{(n-1)}(0^-)$
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	$z_{11}$	$z_{12}$	$\frac{y_{22}}{\Delta_y}$	$\frac{y_{12}}{\Delta_y}$	$\frac{\Delta_h}{h_{22}}$	$\frac{h_{12}}{h_{22}}$	$\frac{1}{g_{11}}$	$\frac{g_{12}}{g_{11}}$	$\frac{A}{C}$	$\frac{\Delta_T}{C}$	$\frac{d}{c}$	$\frac{1}{c}$
	$z_{21}$	$z_{22}$	$\frac{y_{21}}{\Delta_y}$	$\frac{y_{11}}{\Delta_y}$	$\frac{h_{21}}{h_{22}}$	$\frac{1}{h_{22}}$	$\frac{g_{21}}{g_{11}}$	$\frac{\Delta_g}{g_{11}}$	$\frac{1}{C}$	$\frac{D}{C}$	$\frac{\Delta_f}{c}$	$\frac{a}{c}$
y	$\frac{z_{22}}{\Delta_z}$	$\frac{z_{12}}{\Delta_z}$	$y_{11}$	$y_{12}$	$\frac{1}{h_{11}}$	$\frac{h_{12}}{h_{11}}$	$\frac{\Delta_g}{g_{22}}$	$\frac{g_{12}}{g_{22}}$	$\frac{D}{B}$	$\frac{\Delta_T}{B}$	$\frac{a}{b}$	$\frac{1}{b}$
	$\frac{z_{21}}{\Delta_z}$	$\frac{z_{11}}{\Delta_z}$	$y_{21}$	$y_{22}$	$\frac{h_{21}}{h_{11}}$	$\frac{\Delta_h}{h_{11}}$	$\frac{g_{21}}{g_{22}}$	$\frac{1}{g_{22}}$	$\frac{1}{B}$	$\frac{A}{B}$	$\frac{\Delta_f}{b}$	$\frac{d}{b}$
h	$\frac{\Delta_z}{z_{22}}$	$\frac{z_{12}}{z_{22}}$	$\frac{1}{y_{11}}$	$\frac{y_{12}}{y_{11}}$	$h_{11}$	$h_{12}$	$\frac{g_{22}}{\Delta_g}$	$\frac{g_{12}}{\Delta_g}$	$\frac{B}{D}$	$\frac{\Delta_T}{D}$	$\frac{b}{a}$	$\frac{1}{a}$
	$\frac{z_{21}}{z_{22}}$	$\frac{1}{z_{22}}$	$\frac{y_{21}}{y_{11}}$	$\frac{\Delta_y}{y_{11}}$	$h_{21}$	$h_{22}$	$\frac{g_{21}}{\Delta_g}$	$\frac{g_{11}}{\Delta_g}$	$\frac{1}{D}$	$\frac{C}{D}$	$\frac{\Delta_f}{a}$	$\frac{c}{a}$
g	$\frac{1}{z_{11}}$	$\frac{z_{12}}{z_{11}}$	$\frac{\Delta_y}{y_{22}}$	$\frac{y_{12}}{y_{22}}$	$\frac{h_{22}}{\Delta_h}$	$\frac{h_{12}}{\Delta_h}$	$g_{11}$	$g_{12}$	$\frac{C}{A}$	$\frac{\Delta_T}{A}$	$\frac{c}{d}$	$\frac{1}{d}$
	$\frac{z_{21}}{z_{11}}$	$\frac{\Delta_z}{z_{11}}$	$\frac{y_{21}}{y_{22}}$	$\frac{1}{y_{22}}$	$\frac{h_{21}}{\Delta_h}$	$\frac{h_{11}}{\Delta_h}$	$g_{21}$	$g_{22}$	$\frac{1}{A}$	$\frac{B}{A}$	$\frac{\Delta_f}{d}$	$\frac{b}{d}$
T	$\frac{z_{11}}{z_{21}}$	$\frac{\Delta_z}{z_{21}}$	$\frac{y_{22}}{y_{21}}$	$\frac{1}{y_{21}}$	$\frac{\Delta_h}{h_{21}}$	$\frac{h_{11}}{h_{21}}$	$\frac{1}{g_{21}}$	$\frac{g_{22}}{g_{21}}$	$A$	$B$	$\frac{d}{\Delta_f}$	$\frac{b}{\Delta_f}$
	$\frac{1}{z_{21}}$	$\frac{z_{22}}{z_{21}}$	$\frac{\Delta_y}{y_{21}}$	$\frac{y_{11}}{y_{21}}$	$\frac{h_{22}}{h_{21}}$	$\frac{1}{h_{21}}$	$\frac{g_{11}}{g_{21}}$	$\frac{\Delta_g}{g_{21}}$	$C$	$D$	$\frac{c}{\Delta_f}$	$\frac{a}{\Delta_f}$
t	$\frac{z_{22}}{z_{12}}$	$\frac{\Delta_z}{z_{12}}$	$\frac{y_{11}}{y_{12}}$	$\frac{1}{y_{12}}$	$\frac{1}{h_{12}}$	$\frac{h_{11}}{h_{12}}$	$\frac{\Delta_g}{g_{12}}$	$\frac{g_{22}}{g_{12}}$	$\frac{D}{\Delta_T}$	$\frac{B}{\Delta_T}$	$a$	$b$
	$\frac{1}{z_{12}}$	$\frac{z_{11}}{z_{12}}$	$\frac{\Delta_y}{y_{12}}$	$\frac{y_{22}}{y_{12}}$	$\frac{h_{22}}{h_{12}}$	$\frac{\Delta_h}{h_{12}}$	$\frac{g_{11}}{g_{12}}$	$\frac{1}{g_{12}}$	$\frac{C}{\Delta_T}$	$\frac{A}{\Delta_T}$	$c$	$d$

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

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