KOLEJ YAYASAN PELAJARAN JOHOR

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FINAL EXAMINATION

COURSE NAME	:	**CIRCUIT ANALYZE**
COURSE CODE	:	**DKE 2093**
SESSION	:	**DECEMBER 2022**
DURATION	:	**2 HOURS 30 MINUTES**

INSTRUCTION TO CANDIDATES/
ARAHAN KEPADA CALON

1. This examination paper consists of **SIX (6)** questions. /
   *Kertas soalan ini mengandungi **ENAM (6)** soalan.*

2. Candidates are not allowed to bring any material to examination room except with the permission from the invigilator. /
   Calon tidak dibenarkan untuk membawa sebarang bahan/nota ke bilik peperiksaan tanpa kebenaran daripada pengawas.

3. Please check to make sure that this examination pack consists of: /
   Pastikan kertas soalan peperiksaan ini mengandungi:
   i. Question Paper /
      Kertas Soalan.
   ii. Answering Booklet /
      Buku Jawapan.
   iii. Semilog Graph Paper/
      Kertas Semilog Graf.

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JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIBERITAHU

This examination paper consists of 10 printed pages including front page
Kertas soalan ini mengandungi 10 halaman bercetak termasuk kulit hadapan

This examination paper consists of **SIX (6)** questions. Answer **ALL** the questions in an Answering Booklet.

*Kertas soalan ini mengandungi **ENAM (6)** soalan. Jawab **SEMUA** soalan dalam Buku Jawapan.*

QUESTION 1/ *SOALAN 1*

Referring to **Figure 1**, find the equivalent inductance, L_{eq} view from terminal A-B and the energy stored in equivalent inductance, L_{eq} for the circuit under direct current condition.

(15* marks/ *markah)

*Berdasarkan **Rajah 1**, dapatkan kearuhan setara, L_{eq} dilihat dari terminal A-B dan tenaga yang disimpan dalam kearuhan setara, L_{eq} untuk litar di bawah keadaan arus terus.*

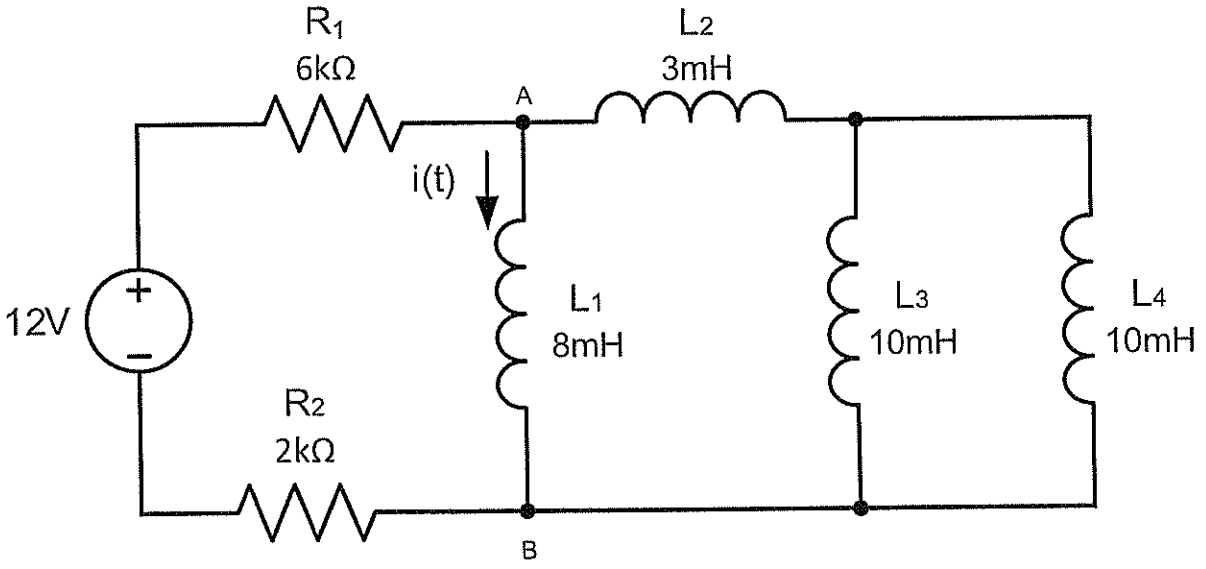

Figure 1/ *Rajah 1*

QUESTION 2/ *SOALAN 2*

Assume that the circuit in **Figure 2** is in its steady state condition at t<0. Find v(t) for t>0 using transient analysis method.

(20 marks/ *markah)*

Anggapkan bahawa litar dalam ***Rajah 2*** *telah berada dalam keadaan mantap pada* t<0. Dapatkan v(t) untuk t>0 dengan menggunakan kaedah analisis ubahtika.

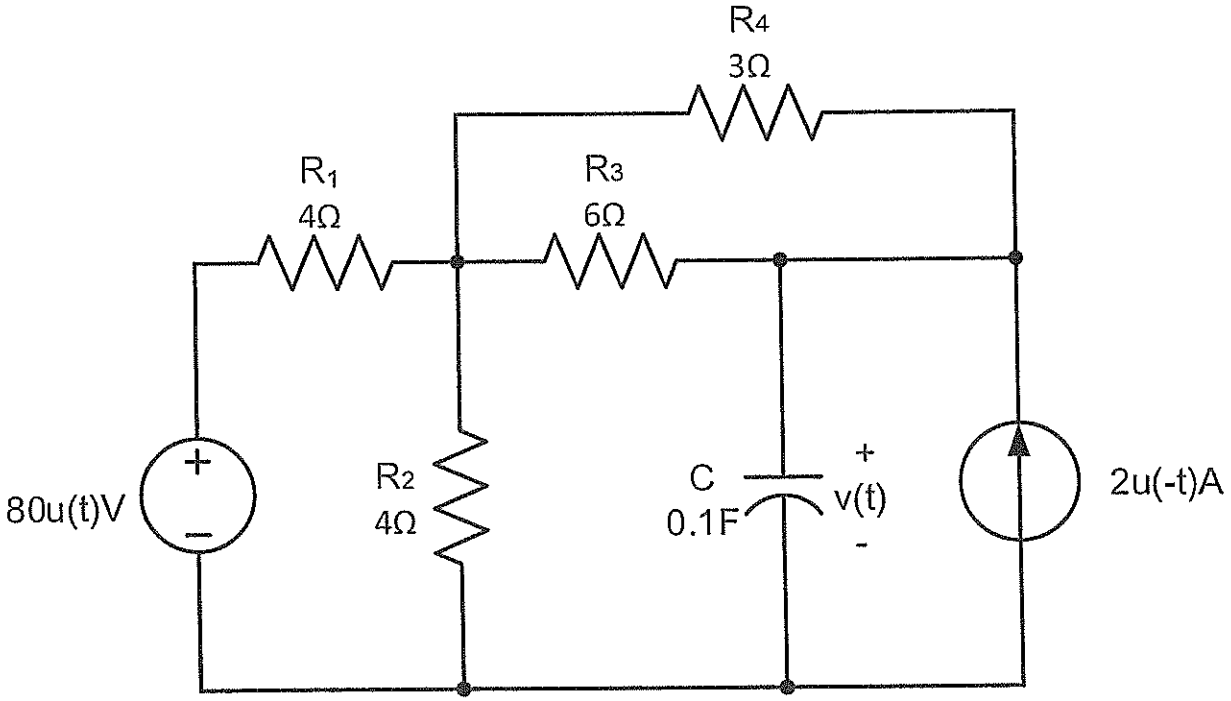

Figure 2/ *Rajah 2*

QUESTION 3/ *SOALAN 3*

The differential equation of the voltage across capacitor, v(t) in a second order circuit is given as:

$$\frac{d^2v(t)}{dt^2}+4\frac{dv(t)}{dt}+4v(t)=12V$$

Given that the initial voltage across capacitor, $v(0^-)=6V$ and $\frac{dv(0^+)}{dt}=1\frac{V}{s}$. Find the voltage, v(t) using transient analysis method.

(20 marks/ *markah)*

Persamaan kebezaan bagi voltan merintangi pemuat, v(t) dalam satu litar tertib kedua diberi sebagai:

$$\frac{d^2v(t)}{dt^2}+4\frac{dv(t)}{dt}+4v(t)=12V$$

Diberi voltan awalan merintangi pemuat, $v(0^-)=6V$ dan $\frac{dv(0^+)}{dt}=1\frac{V}{s}$. Dapatkan voltan, v(t) menggunakan kaedah analisis ubahtika.

QUESTION 4/ *SOALAN 4*

The switches S_1 and S_2 in the circuit of **Figure 4** have been opened for a long time at t<0. At t=0, both switches are closed. Find the Laplace function of the voltage across capacitor, V(s) for t≥0 using Laplace analysis method.

(15 marks/ *markah*)

*Suis S_1 dan S_2 dalam litar **Rajah 4** telah dibuka dalam jangka masa yang panjang pada t<0. Pada t=0, kedua-dua suis ditutup. Dapatkan fungsi Laplace bagi voltan melintangi pemuat, V(s) untuk t≥0 menggunakan kaedah analisis Laplace.*

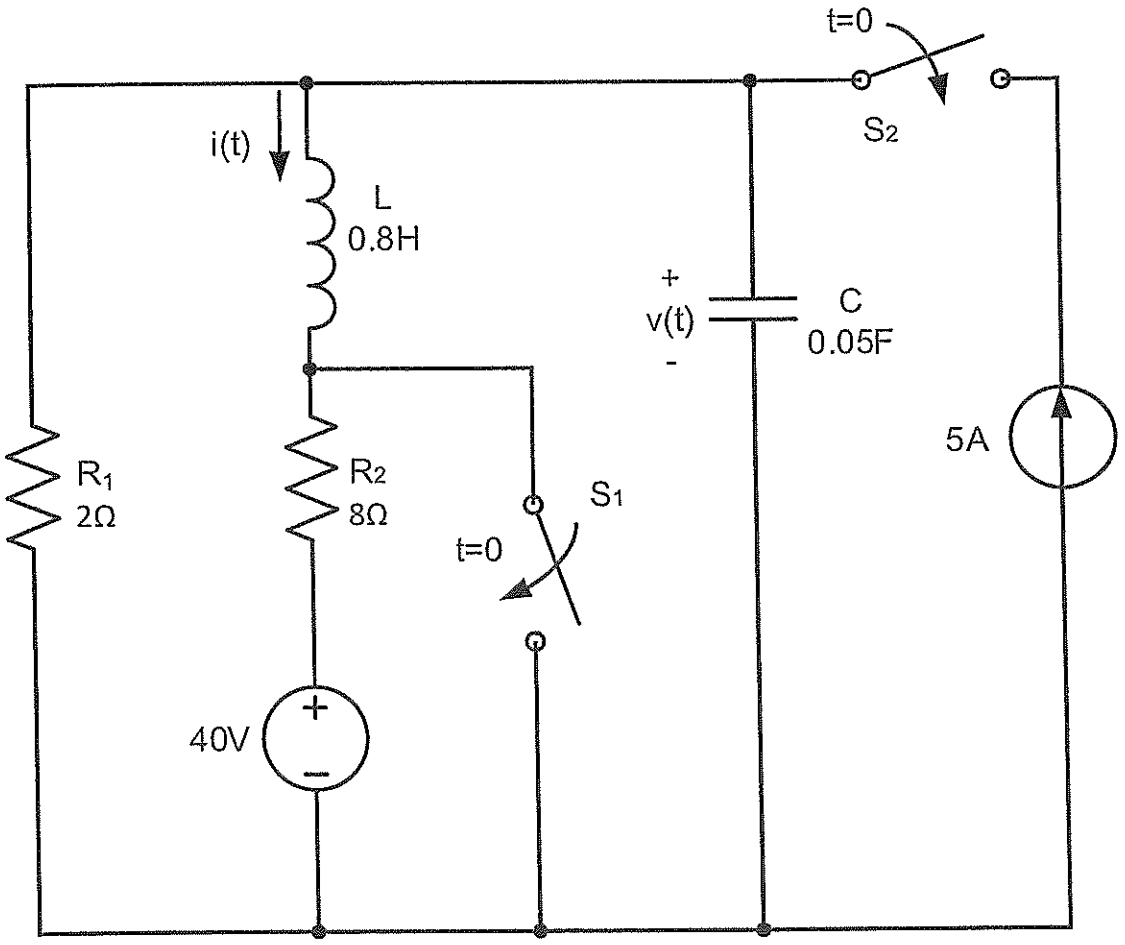

Figure 4/ *Rajah 4*

QUESTION 5/ *SOALAN 5*

Draw the magnitude Bode Plot for the following transfer function:

$$H(s) = \frac{(s+20)^2(s^2+48s+360000)}{563s^2(s+8000)}$$

Use minimum frequency, ω=1 rad/s and maximum frequency, ω=100,000 rad/s.

(15 marks/ *markah*)

Lukiskan magnitud Rajah Bode untuk rangkap pindah berikut:

$$H(s) = \frac{(s+20)^2(s^2+48s+360000)}{563s^2(s+8000)}$$

Guna frekuensi minima, ω=1 rad/s dan frekuensi maksima, ω=100,000 rad/s.

QUESTION 6/ *SOALAN 6*

The two-port network is terminated as shown in **Figure 6**. Find the output voltage, V_2 and the output current, I_2.

$$z = \begin{pmatrix} s+2 & \frac{1}{s} \\ -2 & 2+\frac{1}{s} \end{pmatrix}$$

(15 marks/ *markah*)

Rangkaian dua-liang ditamatkan seperti ditunjukkan dalam ***Rajah 6****. Dapatkan voltan keluaran, V_2 dan arus keluaran, I_2.*

$$z = \begin{pmatrix} s+2 & \frac{1}{s} \\ -2 & 2+\frac{1}{s} \end{pmatrix}$$

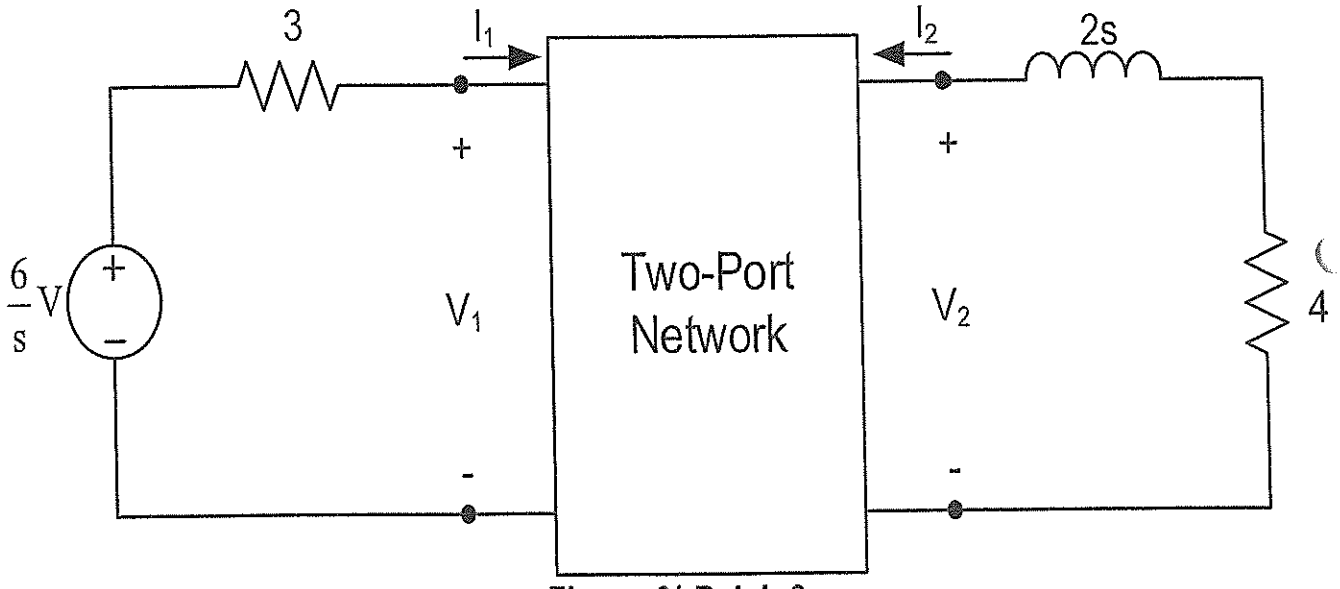

Figure 6/ *Rajah 6*

[100 MARKS/ 100 *MARKAH*]

END OF QUESTION PAPER/ *KERTAS SOALAN TAMAT*

Forcing Functions and Their Assumed Solutions
(Fungsi Berdaya dan Penyelesaian Anggapan)

Forcing functions (Fungsi Berdaya)			*Assumed Solutions (Penyelesaian Anggapan)*
Constan *(Malar)*		$f(t) = A$	$x_f(t) = K_2$
Exponential *(Eksponen)*		$f(t) = M\ e^{-st}$	$x_f(t) = K_2\ e^{-st}$
Variable *(Pembolehubah)*	Ramp *(Tanjak)*	$f(t) = mt$	$x_f(t) = K_2\ t + K_3$
	Parabolic *(Parabola)*	$f(t) = t^2$	$x_f(t) = K_2\ t^2 + K_3\ t + K_4$
Sinusoidal *(Sinus)*		$f(t) = M\ sin(\omega t + \theta)$	$x_f(t) = K_2\ sin\ \omega t + K_3\ cos\ \omega t$
		$f(t) = M\ cos(\omega t + \theta)$	
Exponential Sinusoidal *(Sinus Eksponen)*		$f(t) = M\ e^{-st}\ sin(\omega t + \theta)$	$x_f(t) = e^{-st}(K_2\ sin\ \omega t + K_3\ cos\ \omega t)$

Table of Laplace Transform Pairs
(Jadual Penukaran Pasangan Penjelmaan Laplace)

Functions *(Fungsi)*	f(t)	F(s)
Unit Impulse *(Dedenyut)*	$\delta(t)$	1
Unit Step *(Unit langkah)* Constant *(Malar)*	$u(t)$ 1	$\frac{1}{s}$
Unit Ramp *(Unit Tanjak)* t function *(Rangkap t)*	$t\,u(t)$	$\frac{1}{s^2}$
Unit Parabolic *(Unit Parabola)*	$\frac{1}{2}t^2\,u(t)$	$\frac{1}{s^3}$
n^{th} integral of impulse *(Kamiran ke–n dedenyut)*	$\delta^{-n}(t)$	$\frac{1}{s^n}$
n^{th} derivative of impulse *(Kerbezaan ke–n dedenyut)*	$\delta^{n}(t)$	s^n
Power of t *(Kuasa t)*	$\frac{t^{n-1}}{(n-1)!}$	$\frac{1}{s^n}$
Exponential *(Eksponen)*	e^{-at}	$\frac{1}{s+a}$
t–multiplication exponential *(Pendaraban t bagi eksponen)*	te^{-at}	$\frac{1}{(s+a)^2}$
Repeated t–multiplication exponential *(Pendaraban t berulang bagi eksponen)*	$\frac{1}{(n-1)!}t^{n-1}e^{-at}$	$\frac{1}{(s+a)^n}$
Sine *(Sinus)*	$\sin \omega t$	$\frac{\omega}{s^2+\omega^2}$
Cosine *(Kosinus)*	$\cos \omega t$	$\frac{s}{s^2+\omega^2}$
Damped sine *(Sinus teredam)*	$e^{-at}\sin \omega t$	$\frac{\omega}{(s+a)^2+\omega^2}$
Damped cosine *(Kosinus teredam)*	$e^{-at}\cos \omega t$	$\frac{s+a}{(s+a)^2+\omega^2}$
t–multiplicated sine *(Pendaraban t bagi sinus)*	$t \sin \omega t$	$\frac{2\omega s}{(s^2+\omega^2)^2}$
t–multiplicated cosine *(Pendaraban t bagi kosinus)*	$t \cos \omega t$	$\frac{s^2-\omega^2}{(s^2+\omega^2)^2}$

Two–Port Network Parameters
(Parameter Rangkaian Dua Liang)

Impedance parameters

$$V_1 = z_{11} I_1 + z_{12} I_2$$
$$V_2 = z_{21} I_1 + z_{22} I_2$$

Admittance parameters

$$I_1 = y_{11} V_1 + y_{12} V_2$$
$$I_2 = y_{21} V_1 + y_{22} V_2$$

Hybrid parameters

$$V_1 = h_{11} I_1 + h_{12} V_2$$
$$I_2 = h_{21} I_1 + h_{22} V_2$$

Transmission parameters

$$V_1 = AV_2 - BI_2$$
$$I_1 = CV_2 - DI_2$$

Jadual Penukaran Untuk Rangkaian Dua Liang
(Conversion Table for Two–Port Network Parameters)

	z	y	h	ABCD
z	z_{11} z_{12} z_{21} z_{22}	$\frac{y_{22}}{\Delta_y}$ $\frac{-y_{12}}{\Delta_y}$ $\frac{-y_{21}}{\Delta_y}$ $\frac{y_{11}}{\Delta_y}$	$\frac{\Delta_h}{h_{22}}$ $\frac{h_{12}}{h_{22}}$ $\frac{-h_{21}}{h_{22}}$ $\frac{1}{h_{22}}$	$\frac{A}{C}$ $\frac{\Delta_T}{C}$ $\frac{1}{C}$ $\frac{D}{C}$
y	$\frac{z_{22}}{\Delta_z}$ $\frac{-z_{12}}{\Delta_z}$ $\frac{-z_{21}}{\Delta_z}$ $\frac{z_{11}}{\Delta_z}$	y_{11} y_{12} y_{21} y_{22}	$\frac{1}{h_{11}}$ $\frac{-h_{12}}{h_{11}}$ $\frac{h_{21}}{h_{11}}$ $\frac{\Delta_h}{h_{11}}$	$\frac{D}{B}$ $\frac{-\Delta_T}{B}$ $\frac{-1}{B}$ $\frac{A}{B}$
h	$\frac{\Delta_z}{z_{22}}$ $\frac{z_{12}}{z_{22}}$ $\frac{-z_{21}}{z_{22}}$ $\frac{1}{z_{22}}$	$\frac{1}{y_{11}}$ $\frac{-y_{12}}{y_{11}}$ $\frac{y_{21}}{y_{11}}$ $\frac{\Delta_y}{y_{11}}$	h_{11} h_{12} h_{21} h_{22}	$\frac{B}{D}$ $\frac{\Delta_T}{D}$ $\frac{-1}{D}$ $\frac{C}{D}$
ABCD	$\frac{z_{11}}{z_{21}}$ $\frac{\Delta_z}{z_{21}}$ $\frac{1}{z_{21}}$ $\frac{z_{22}}{z_{21}}$	$\frac{-y_{22}}{y_{21}}$ $\frac{-1}{y_{21}}$ $\frac{-\Delta_y}{y_{21}}$ $\frac{-y_{11}}{y_{21}}$	$\frac{-\Delta_h}{h_{21}}$ $\frac{-h_{11}}{h_{21}}$ $\frac{-h_{22}}{h_{21}}$ $\frac{-1}{h_{21}}$	A B C D