KOLEJ YAYASAN PELAJARAN JOHOR

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FINAL EXAMINATION

COURSE NAME	:	**CIRCUIT ANALYZE**
COURSE CODE	:	**DKE 2093**
SESSION	:	**JUNE 2023**
DURATION	:	**2 HOURS 30 MINUTES**

INSTRUCTION TO CANDIDATES /
ARAHAN KEPADA CALON

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

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

3. Please check to make sure that this examination pack consist of: /
Pastikan kertas soalan peperiksaan ini mengandungi:

   i. The Question Paper /
   Kertas Soalan
   ii. An Answering Booklet /
   Buku Jawapan
   iii. Attachment 1 /
   Lampiran 1
   iv. Semilog Paper/
   Kertas Semilog

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JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIBERITAHU

This examination paper consists of **11** printed pages including front page
*Kertas soalan ini mengandungi **11** halaman bercetak termasuk muka hadapan*

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

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

QUESTION 1 / *SOALAN 1*

Figure 1 shows five (5) interconnected inductors. The initial currents for two (2) of the inductors are also shown in **Figure 1**. Looking from terminal A - B.

a) Find the equivalent inductance, L_{eq}.

b) Find the initial current, i in the inductive network.

c) Find the energy stored in equivalent inductance, L_{eq}.

(10 marks/ *markah*)

***Rajah 1** menunjukkan lima (5) pearuh yang saling dihubungkan. Arus awalan bagi dua (2) pearuh juga ditunjukkan dalam **Rajah 1**. Dilihat dari terminal A - B.*

a) Dapatkan kearuhan setara, L_{eq}.

b) Dapatkan arus awalan, i dalam rangkaian pearuh.

c) Dapatkan tenaga yang disimpan di dalam kearuhan setara, L_{eq}.

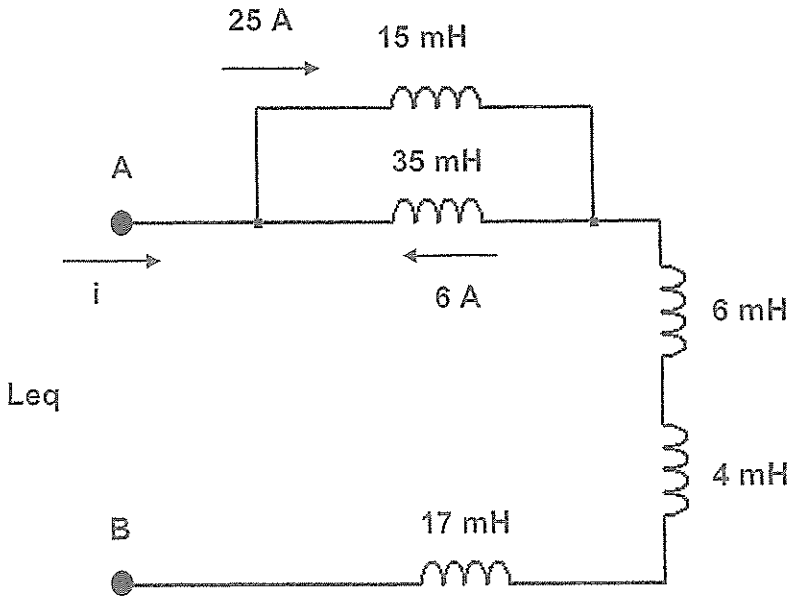

Figure 1 / *Rajah 1*

QUESTION 2 / *SOALAN 2*

The circuit in **Figure 2** is in steady state at t < 0. Find v(t) for t > 0 using transient analysis method.

(15 marks/ *markah*)

*Litar dalam **Rajah 2** berada dalam keadaan mantap pada t < 0. Cari v(t) untuk t > 0 menggunakan kaedah analisis ubahtika.*

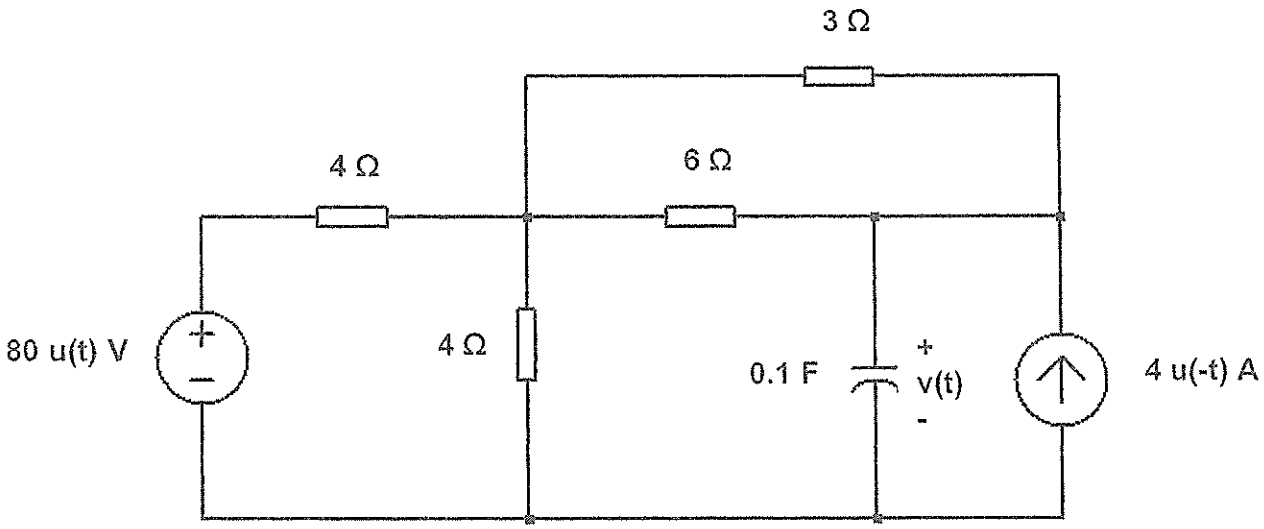

Figure 2 / *Rajah 2*

QUESTION 3 / *SOALAN 3*

Referring to **Figure 3,** the switch is closed at t = 0. Find i(t) and $i_R(t)$ for t ≥ 0.

(25 marks/ *markah*)

Merujuk kepada ***Rajah 3****, suis ditutup pada t = 0. Dapatkan i(t) dan* $i_R(t)$ *untuk* t ≥ 0.

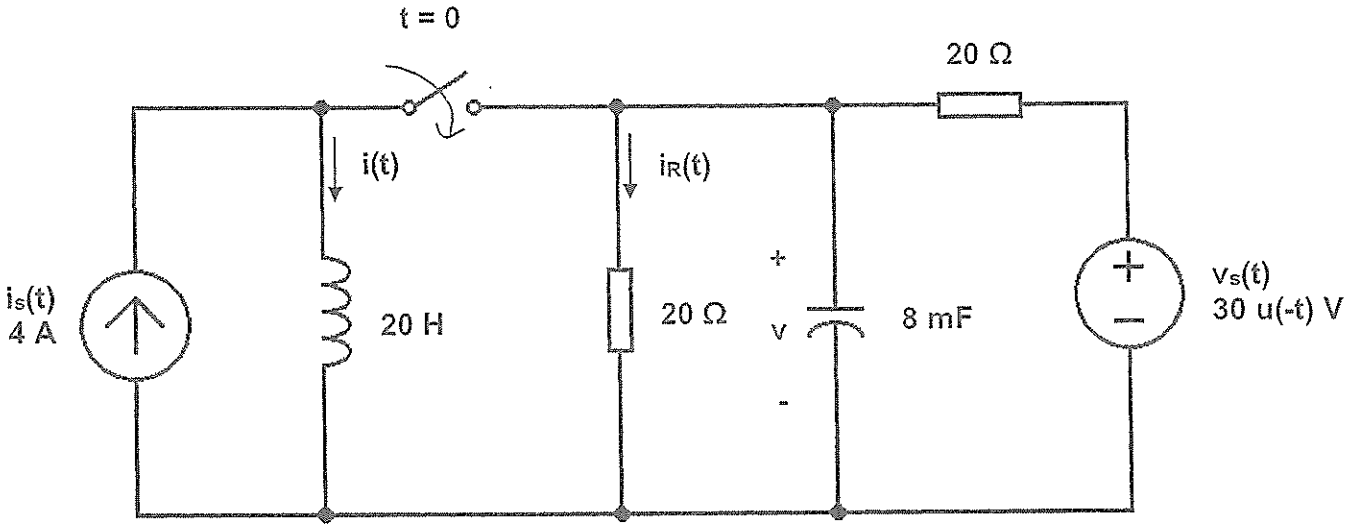

Figure 3 / *Rajah 3*

QUESTION 4 / *SOALAN 4*

Find $v_o(t)$ in the **Figure 4**, assuming zero initial conditions.

(15 marks/ *markah*)

*Cari $v_o(t)$ dalam **Rajah 4**, dengan mengandaikan keadaan awal adalah sifar.*

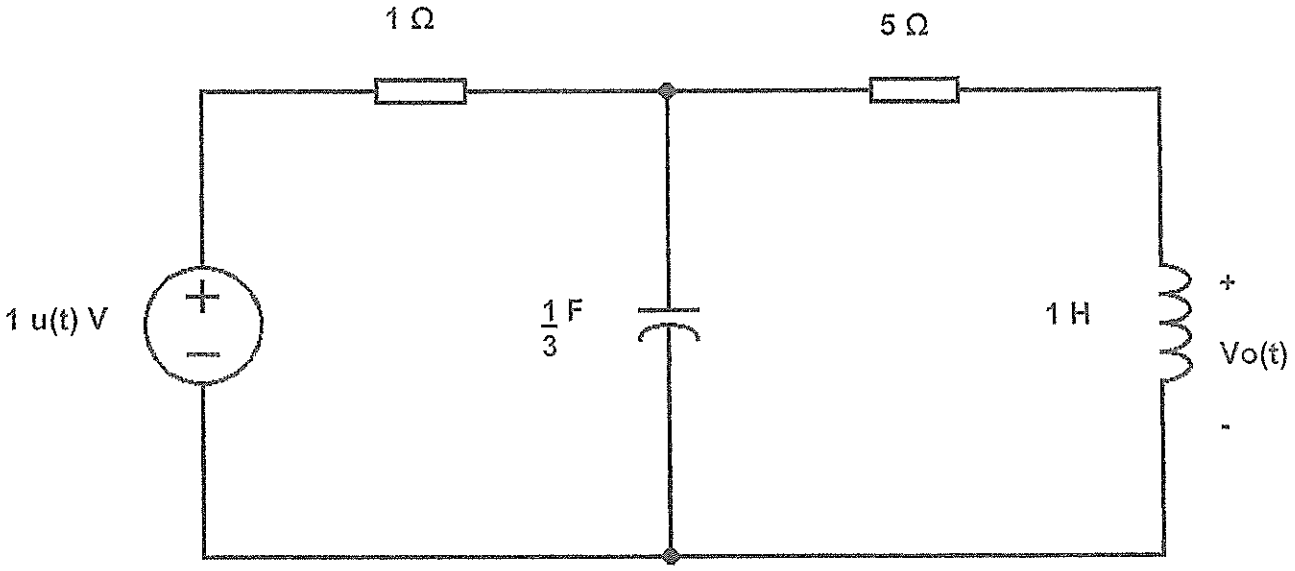

Figure 4 / *Rajah 4*

QUESTION 5 / *SOALAN 5*

Draw the magnitude Bode Plot for the following transfer function:

$$H(s) = \frac{10\ (s+5)}{(s+2)(s^2+2s+4)}$$

Use minimum frequency, ω=0.1 radian/second and maximum frequency, ω=10,000 radian/second.

(15 marks/ *markah*)

Lukis Plot Bode magnitud untuk rangkap pindah berikut:

$$H(s) = \frac{10\ (s+5)}{(s+2)(s^2+2s+4)}$$

Guna frekuensi minima, ω=0.1 radian/saat dan frekuensi maksima, ω=10,000 radian/saat.

QUESTION 6 / *SOALAN 6*

Obtain the z-parameters for the network in **Figure 5** as function of s.

(20 marks/ *markah*)

Dapatkan parameter-z untuk rangkaian dalam ***Rajah 5*** *sebagai fungsi s.*

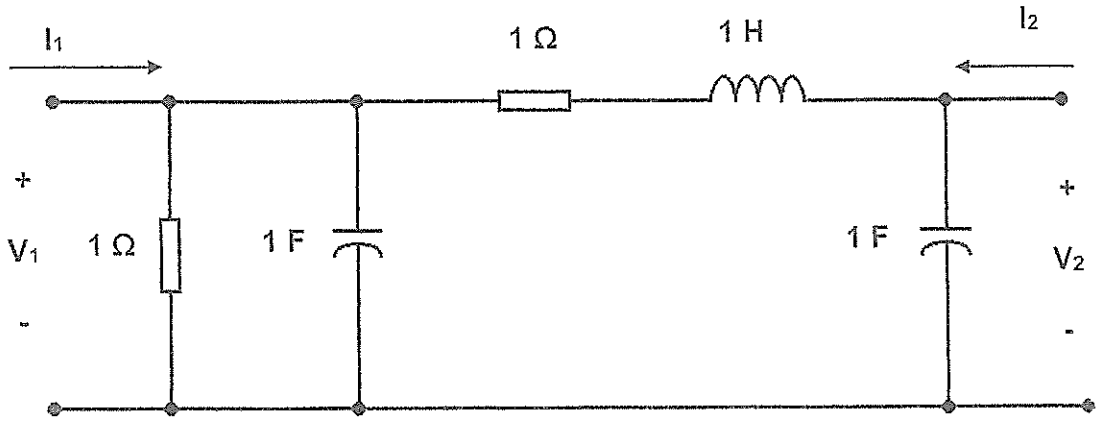

Figure 5 / *Rajah 5*

[100 MARKS/ *MARKAH*]

END OF QUESTION PAPER / KERTAS SOALAN TAMAT

Attachment 1 / *Lampiran 1*

Forcing Functions and Their Assumed Solutions
Fungsi Berdaya dan Penyelesaian Anggapan

Forcing function / *Fungsi Berdaya*			Assumed Solution / *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*		$f(t) = M\,\sin(\omega t+\theta)$ $f(t) = M\,\cos(\omega t+\theta)$	$x_f(t) = K_2\,\sin\omega t + K_3\,\cos\omega t$
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 Jelmaan Laplace

Function/ *Rangkap*	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

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

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

	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