KOLEJ YAYASAN PELAJARAN JOHOR

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FINAL EXAMINATION

COURSE NAME	:	**CIRCUIT ANALYZE**
COURSE CODE	:	**DKE 2093**
EXAMINATION	:	**OCTOBER 2019**
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. Answer **ALL** questions in the answer booklet and semilog graph paper provided. Sketch a diagram if neccessary to help illustrate your answer. /
*Jawab **SEMUA** soalan di dalam buku jawapan dan kertas semilog graf yang disediakan. Lakarkan gambarajah jika perlu bagi membantu menggambarkan jawapan anda.*

3. Candidates are not allowed to bring any material to examination room except with permission from the invigilator. /
Calon tidak dibenarkan membawa masuk sebarang peralatan ke dalam bilik peperiksaan kecuali dengan kebenaran pengawas peperiksaan.

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

   i. Question Paper /
   Kertas Soalan.

   ii. Kertas Semilog Graf /
   Semilog Graph Paper.

   iii. Answer Booklet /
   Buku Jawapan.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO /
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 muka hadapan*

This examination paper consists of **SIX (6)** questions. Answer **ALL** the questions in the answer booklet and semilog graph paper.
*Kertas soalan ini mengandungi **ENAM (6)** soalan. Jawab **SEMUA** soalan dalam buku jawapan dan kertas semilog graf.*

QUESTION 1/ *SOALAN 1*

Referring to **Figure Q1**. Determine:

a. the equivalent inductance, L_{eq}.

(5 marks)

b. the total voltage, v_T.

(3 marks)

c. the total energy stored in circuit, ω_T

(2 marks)

d. the voltage across each inductor.

(6 marks)

*Merujuk kepada **Rajah Q1**. Tentukan:*

a. *Kearuhan setara, L_{eq}.*

(5 markah)

b. *Jumlah voltan, v_T.*

(3 markah)

c. *Jumlah tenaga yang disimpan dalam litar, ω_T*

(2 markah)

d. *Voltan melintangi setiap pearuh.*

(6 markah)

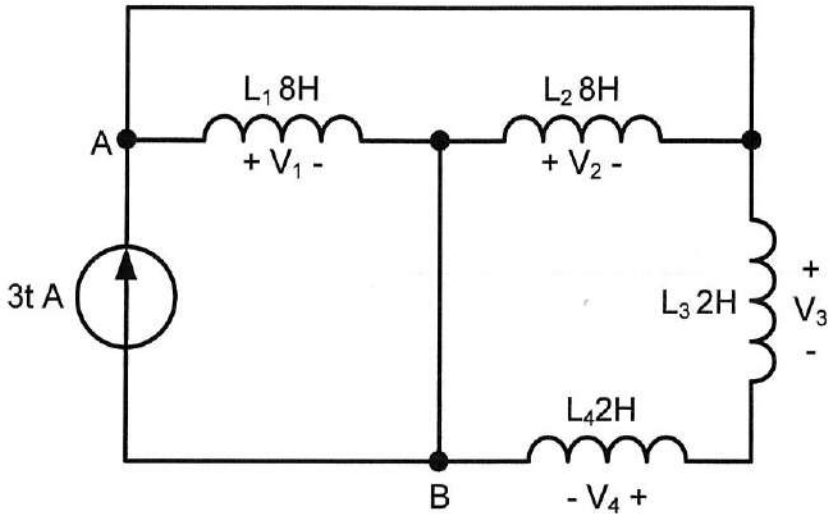

Figure Q1/ *Rajah Q1*

QUESTION 2/ *SOALAN 2*

Referring to **Figure Q2**, switch S1 has been opened for a long time until the circuit reaches steady-state. At t = 0, switch S1 is close. Find the voltage, v(t) using transient analysis method.

(20 marks)

*Merujuk kepada **Rajah Q2**, suis S1 telah dibuka buat sekian lama sehingga litar mencapai keadaan mantap. Pada t = 0, suis S1 ditutup. Dapatkan voltan, v(t) menggunakan kaedah analisis ubahtika.*

(20 markah)

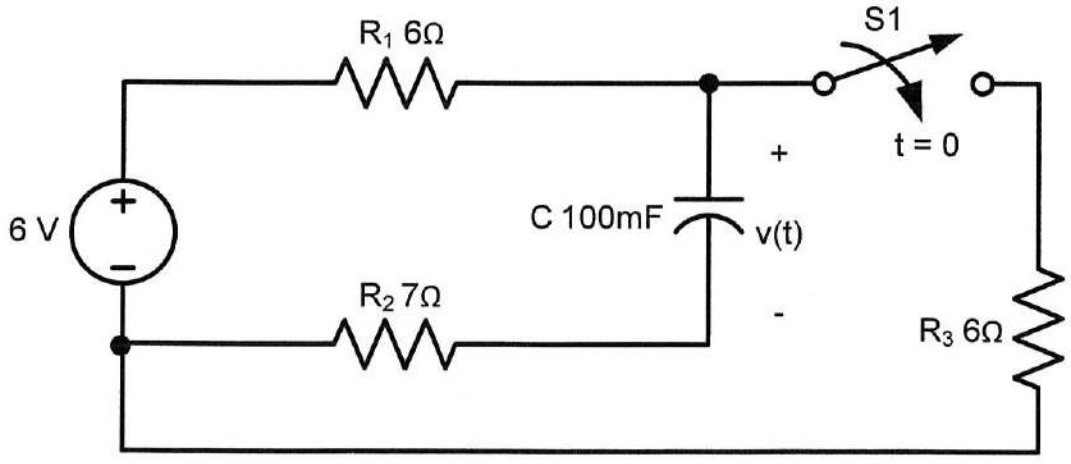

Figure Q2/ *Rajah Q2*

QUESTION 3/ *SOALAN 3*

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

$$\frac{d^2v(t)}{dt^2}+9\frac{dv(t)}{dt}+20v(t)=4e^{-2t}V$$

Given that the initial voltage across capacitor, $v(0^-)$ = 2V and $\frac{dv(0^+)}{dt}=-10\frac{V}{s}$.

Find the voltage, v(t) using transient analysis method.

(20 marks)

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

$$\frac{d^2v(t)}{dt^2}+9\frac{dv(t)}{dt}+20v(t)=4e^{-2t}V$$

Diberi voltan awal melintangi kapasitor, $v(0^-)$ = 2V dan $\frac{dv(0^+)}{dt}=-10\frac{V}{s}$. *Dapatkan voltan, v(t) menggunakan kaedah analisis ubahtika.*

(20 markah)

QUESTION 4/ *SOALAN 4*

Referring to **Figure Q4**, the switch is at position X and the circuit is in steady state for t < 0. At t = 0, the switch is moved to position Y. Find:

a. the initial value of the voltage across the capacitor, $V(0^-)$.

(4 marks)

b. Laplace functions of the voltage, V(s) for t > 0.

(10 marks)

*Merujuk kepada **Rajah Q4**, suis berada pada kedudukan X dan litar berada dalam keadaan mantap untuk t < 0. Pada t = 0, suis diubah ke kedudukan Y. Dapatkan:*

a. *nilai awalan voltan melintangi kapasitor, V(0⁻).*

(4 markah)

b. *fungsi Laplace bagi voltan, V(s) untuk t > 0.*

(10 markah)

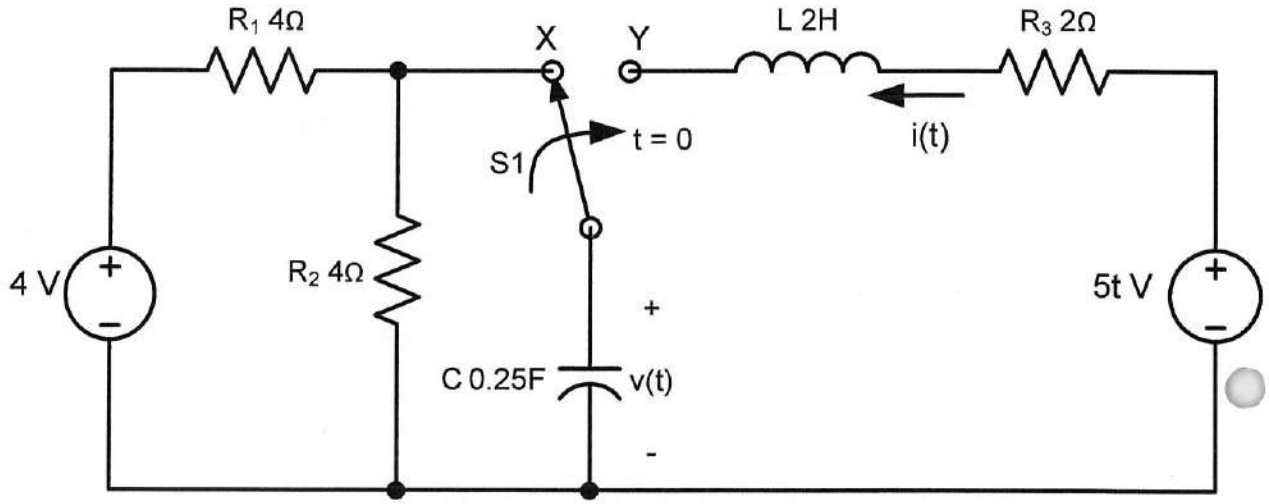

Figure Q4/ *Rajah Q4*

QUESTION 5/ *SOALAN 5*

Referring to **Figure Q5**, determine the transfer function, H(s) that relates the output voltage, $V_O(s)$ to input current $I_i(s)$ and draw the magnitude Bode plot. Use minimum frequency, ω = 1 rad/s and maximum frequency, ω = 100,000 rad/s.

(14 marks)

*Merujuk kepada **Rajah Q5**, tentukan rangkap pindah, H(s) yang menghubungkan voltan keluaran, $V_o(s)$ kepada arus masukan, $I_i(s)$ dan lukis magnitud rajah Bode. Guna frekuensi minima, ω = 1 rad/s dan frekuensi maksima, ω = 100,000 rad/s.*

(14 markah)

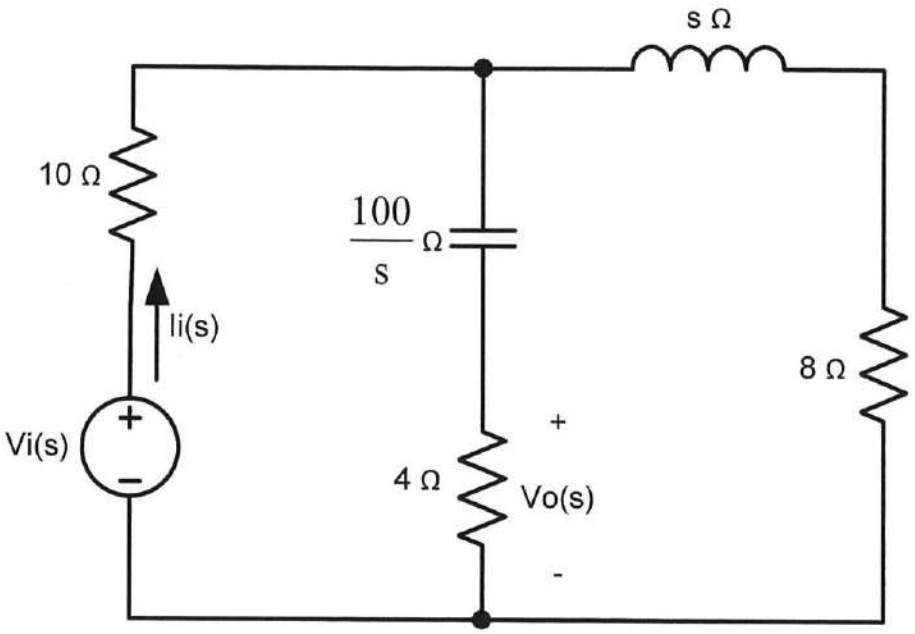

Figure Q5/ *Rajah Q5*

QUESTION 6/ *SOALAN 6*

A two-port network is terminated as shown in **Figure Q6**. The two-port network consists of two identical two-port networks interconnected in series where each network has Z-parameters. Determine voltage value, V_1 and current value, I_2.

(16 marks)

*Satu rangkaian dua-liang ditamatkan seperti ditunjukkan dalam **Rajah Q6**. Rangkaian dua-liang ini terdiri daripada dua rangkaian dua-liang yang serupa disaling hubung secara sesiri di mana setiap satu rangkaian mempunyai parameter-Z. Tentukan nilai voltan, V_1 dan nilai arus, I_2.*

(16 markah)

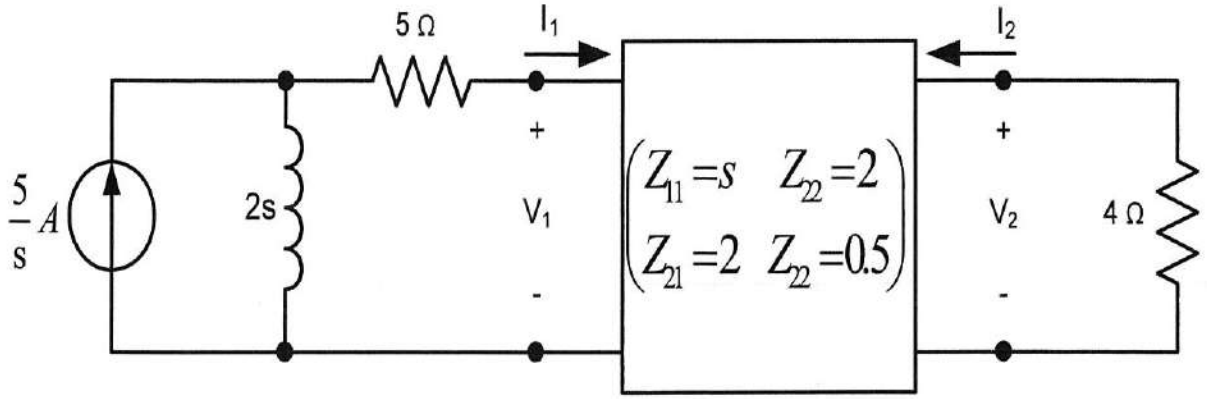

Figure Q6/ *Rajah Q6*

[100 MARKS/ *MARKAH*]

END OF QUESTION PAPER/ *KERTAS SOALAN TAMAT*

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)*		$f(t) = M\ sin\ (\omega t + \theta)$	$x_f(t) = K_2\ sin\ \omega t + K_3\ cos\ \omega t$
		$f(t) = M\ cos\ (\omega t + \theta)$	
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 Jelmaan Laplace)

Functions *(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

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

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