KOLEJ YAYASAN PELAJARAN JOHOR
ONLINE FINAL EXAMINATION

COURSE NAME	**:**	**CIRCUIT ANALYZE**
COURSE CODE	**:**	**DKE 2093**
SESSION	**:**	**NOVEMBER 2020**
DURATION	**:**	**6 HOURS**

INSTRUCTION TO CANDIDATES/
ARAHAN KEPADA CALON

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

2. Students are allowed to refer to resources such as lecture notes, books, internet or any other relevant resources. /
   Pelajar dibenarkan merujuk kepada sumber seperti nota kuliah, buku, internet atau mana-mana sumber yang berkaitan.

3. Answer **ALL** questions in the answer sheet which is **A4** size paper (or other paper with the consent of the relevant lecturer). /
   *Jawab **SEMUA** soalan di dalam kertas jawapan iaitu kertas bersaiz **A4** (atau lain-lain kertas dengan persetujuan pensyarah berkaitan).*

4. Write your details as follows in the upper left conner for each answer sheet: /
   Tulis butiran anda sepertimana berikut di penjuru atas kiri bagi setiap kertas jawapan:

   i. Student Full Name / *Nama Penuh Pelajar*
   ii. Identification Card (I/C) No. / *No. Kad Pengenalan*
   iii. Class Section / *Seksyen Kelas*
   iv. *Course Code* / *Kod Kursus*
   v. *Course Name* / *Nama Kursus*
   vi. *Lecturer Name* / *Nama Pensyarah*

5. Each answer sheet must have a page number written at the bottom right corner. /
   Setiap helai kertas jawapan mesti ditulis nombor muka surat di penjuru bawah kanan.

6. Answers should be handwritten, neat and clear. /
   Jawapan hendaklah ditulis tangan, kemas dan jelas.

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 an Answering Booklet.

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

QUESTION 1/ *SOALAN 1*

Referring to **Figure Q1**. Find:

a. The equivalent capacitance, C_{eq}.
b. The total charge, Q_T.
c. The voltage across capacitors C_1 and C_4.
d. The energy stored in capacitor C_4.

*Merujuk kepada **Rajah Q1**. Dapatkan:*

a. Kemuatan setara, C_{eq}.
b. Jumlah cas, Q_T.
c. Voltan merintangi pemuat C_1 dan C_4.
d. Tenaga yang disimpan dalam pemuat C_4

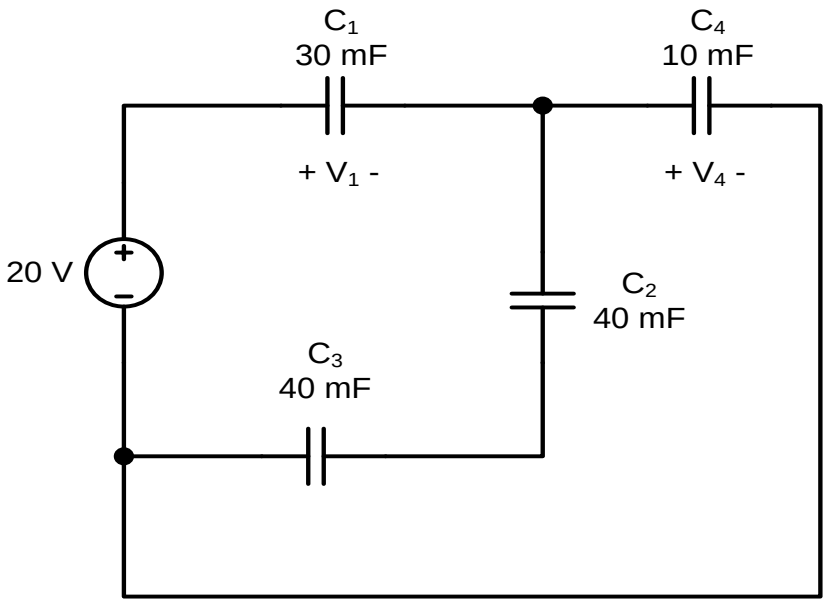

Figure Q1/ *Rajah Q1*

(*15 marks / *markah)

QUESTION 2/ *SOALAN 2*

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

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

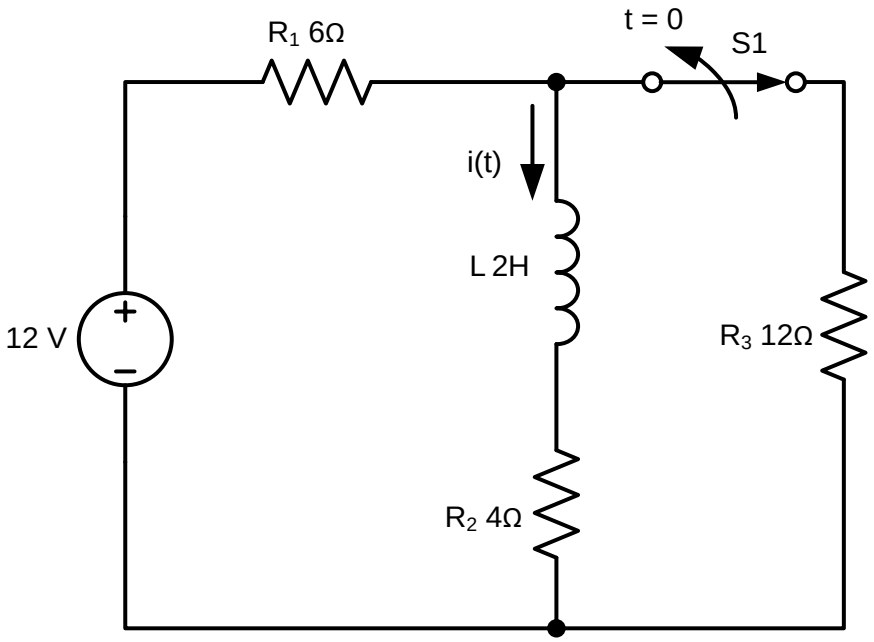

Figure Q2/ *Rajah Q2*

(*20 marks / *markah)

QUESTION 3/ *SOALAN 3*

The differential equation of the current flowing through an inductor, i(t) in a second order circuit is given as:

$$\frac{d^2i(t)}{dt^2}+5\frac{di(t)}{dt}+10i(t)=12A$$

Given that the initial current flowing through an inductor, $i(0^-)$ = 1A and $\frac{di(0^+)}{dt}=-4\frac{A}{s}$. Find the current i(t) using transient analysis method.

Persamaan kebezaan bagi arus mengalir melalui induktor, i(t) dalam satu litar tertib kedua diberi sebagai:

$$\frac{d^2i(t)}{dt^2}+5\frac{di(t)}{dt}+10i(t)=12A$$

Diberi arus awal melalui pearuh, $i(0^-)$ = 1A dan $\frac{di(0^+)}{dt}=-4\frac{A}{s}$ *. Dapatkan arus i(t) menggunakan kaedah analisis ubahtika.*

(*20 marks */ markah)

QUESTION 4/ *SOALAN 4*

The circuit in **Figure Q4** is in steady state at t < 0. Find the Laplace function of the voltage across capacitor, V(s) for t ≥ 0.

*Litar dalam **Rajah Q4** berada dalam keadaan mantap pada t < 0. Dapatkan fungsi Laplace bagi voltan merintangi pemuat, V(s) untuk t ≥ 0.*

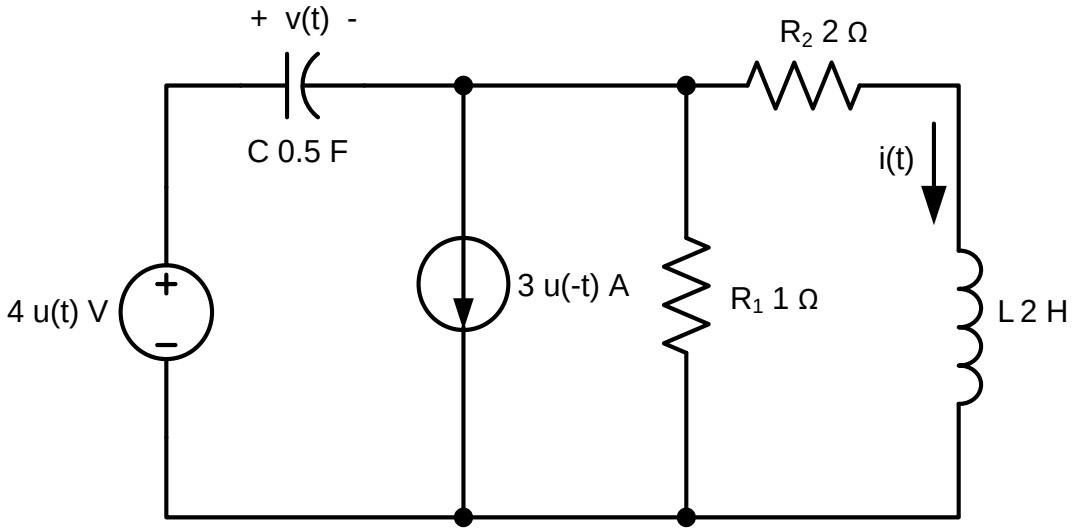

Figure Q4/ *Rajah Q4*

(*15 marks / *markah)

QUESTION 5/ *SOALAN 5*

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

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

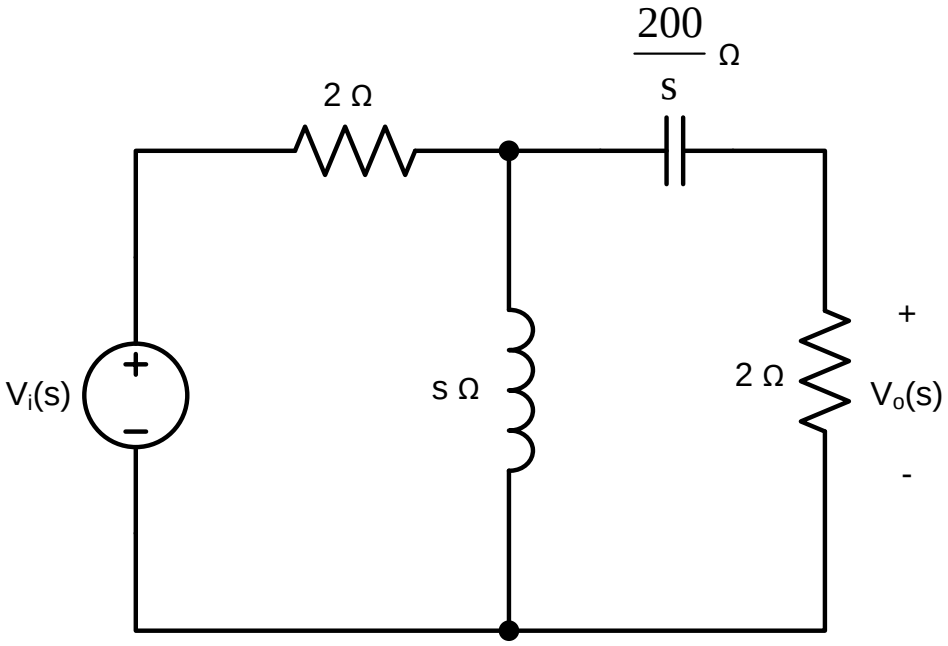

Figure Q5/ *Rajah Q5*

(*15 marks / *markah)

QUESTION 6/ *SOALAN 6*

Referring to **Figure Q6**, find the y-parameters for the two-port network given.

*Merujuk kepada **Rajah Q6**, dapatkan parameter-y untuk rangkaian dua-liang yang diberi.*

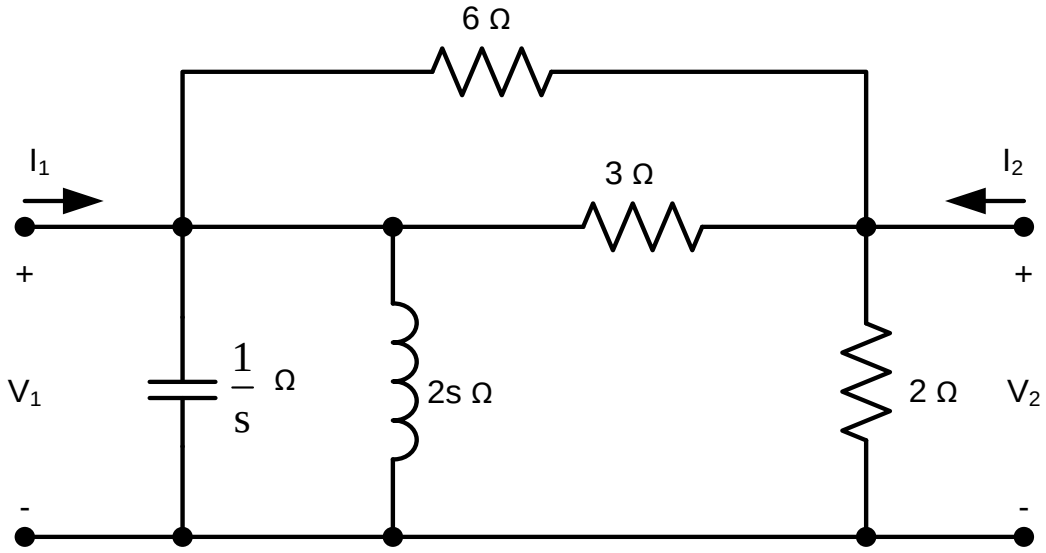

Figure Q6/ *Rajah Q6*

(*15 marks / *markah)

[100 MARKS/ 100 *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 Penjelmaan 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

$$V_1 = AV_2 - B I_2$$
$$I_1 = CV_2 - D I_2$$

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