

SULIT



BAHAGIAN PEPERIKSAAN DAN PENILAIAN  
JABATAN PENDIDIKAN POLITEKNIK  
KEMENTERIAN PENDIDIKAN MALAYSIA

JABATAN KEJURUTERAAN ELEKTRIK

PEPERIKSAAN AKHIR  
SESI DISEMBER 2014

**EE602: CIRCUIT ANALYSIS**

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**TARIKH : 20 APRIL 2015**  
**MASA : 2.30 PTG – 4.30 PTG (2 JAM)**

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Kertas ini mengandungi **LAPAN (8)** halaman bercetak.

Bahagian A: Struktur (10 soalan)

Bahagian B: Esei (3 soalan)

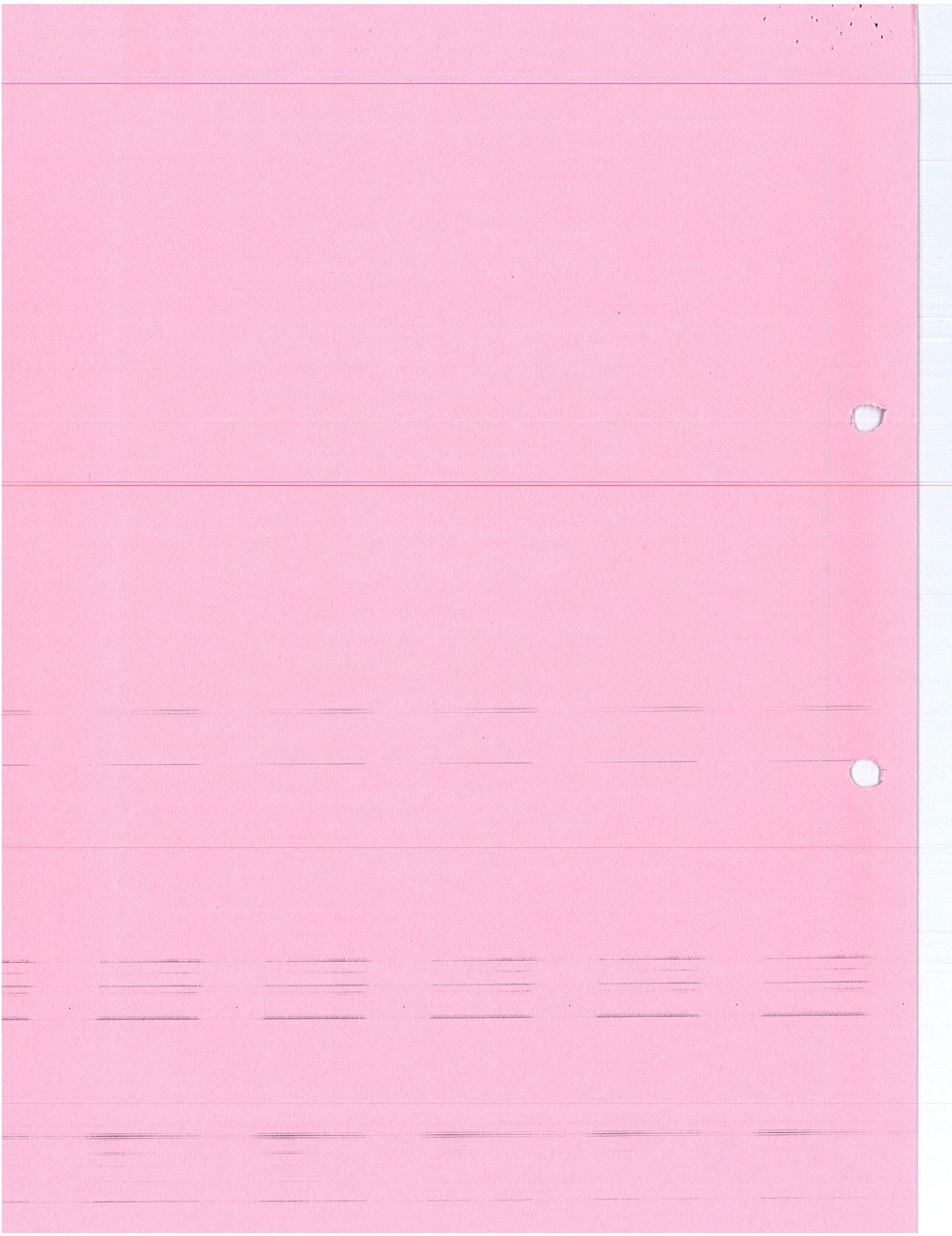
Dokumen sokongan yang disertakan : Jadual Laplace

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**JANGAN BUKA KERTAS SOALANINI SEHINGGA DIARAHKAN**

(CLO yang tertera hanya sebagai rujukan)

SULIT



**SECTION A: 40 MARKS****BAHAGIANA: 40 MARKAH****INSTRUCTION:**

This section consists of **TEN (10)** structured questions. Answer **ALL** questions.

**ARAHAN:**

Bahagian ini mengandungi **SEPULUH (10)** soalan berstruktur. Jawab **SEMUA** soalan.

CLO1

C3

**QUESTION 1**

By referring to Figure A1, calculate the current  $I_1$  using Mesh Analysis if  $I_2 = 0.9\angle -5.2^\circ$

**SOALAN 1**

Merujuk kepada Rajah A1, kirakan arus  $I_1$  menggunakan Analisa "Mesh" jika  $I_2 = 0.9\angle -5.2^\circ$ .

[4 marks]

[4 markah]

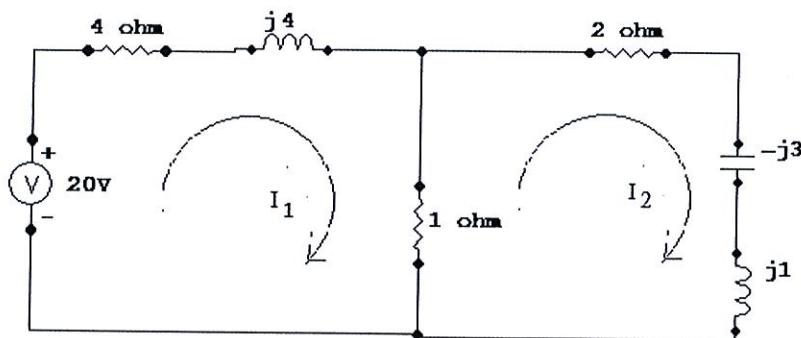


Figure A1 / Rajah A1

CLO1

C3

**QUESTION 2**

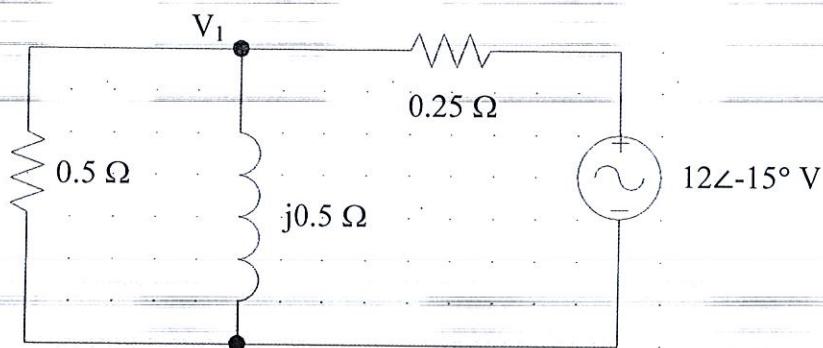
By using Nodal Analysis, calculate the value of  $V_1$  in Figure A2.

**SOALAN 2**

Dengan menggunakan Analisa Nodal, kirakan nilai  $V_1$  dalam Rajah A2.

[4 marks]

[4 markah]

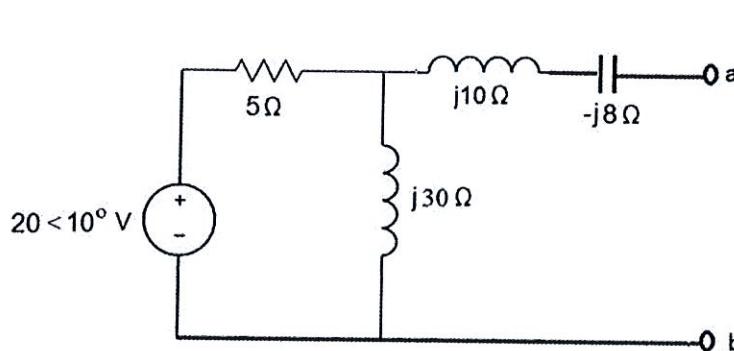


CLO1  
C3**QUESTION 3**

By referring to Figure A3, calculate the equivalent Thevenin Impedance ( $Z_{TH}$ ) at terminal a-b.

**SOALAN 3**

Dengan merujuk Rajah A3, kirakan nilai Galangan Thevenin ( $Z_{TH}$ ) pada terminal a-b.



[4 marks]  
[4 markah]

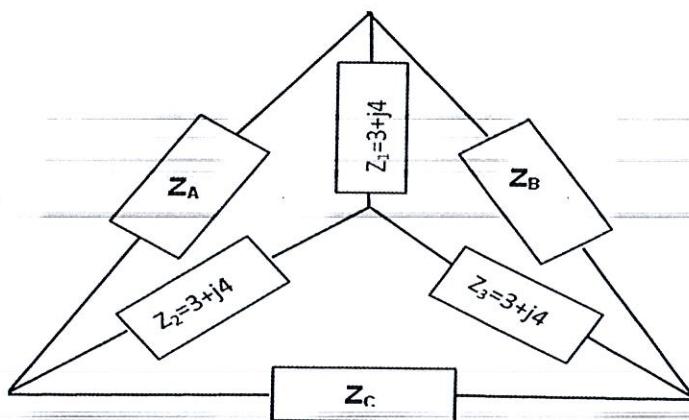
Figure A3 / Rajah A3

CLO1  
C3**QUESTION 4**

By referring to the Figure A4 , Calculate the value of  $Z_A$ ,  $Z_B$ ,  $Z_C$  by using the  $\dot{Y}$ - $\Delta$  Transformation.

**SOALAN 4**

Rujuk pada Rajah A4 di bawah, kirakan nilai bagi  $Z_A$ ,  $Z_B$ ,  $Z_C$  dengan menggunakan transformasi  $\dot{Y}$ - $\Delta$ .



[4 marks]  
[4 markah]

Figure A4 /Rajah A4

CLO1  
C3**QUESTION 5**

By using Direct Integration Method , transfer the function  $f(t) = 15$  into Laplace Transform.

**SOALAN 5**

Dengan menggunakan Kaedah Kamiran terus, ubahkan fungsi  $f(t) = 15$  ke Jelmaan Laplace

[4 marks]

[4 markah]

CLO1  
C2**QUESTION 6**

Determine the Laplace equation for the function below:

$$\mathcal{L}\{3t^4e^{-2t}\}$$

**SOALAN 6**

Tentukan persamaan laplace untuk fungsi di bawah:

$$\mathcal{L}\{3t^4e^{-2t}\}$$

[4 marks]

[4 markah]

CLO 1  
C2**QUESTION 7**

Compute the inverse Laplace transform of

$$F(s) = \frac{5}{s+1} + \frac{6}{s^2+4}$$

**SOALAN 7**

Kirakan Jelmaan Laplace Songsang bagi

$$F(s) = \frac{5}{s+1} + \frac{6}{s^2+4}$$

[4 marks]

[4 markah]

CLO2  
C2**QUESTION 8**

Determine the analytical equation for the periodic function in Figure A8.

**SOALAN 8**

Dapatkan persamaan analitikal untuk fungsi berkala dalam Rajah A8.

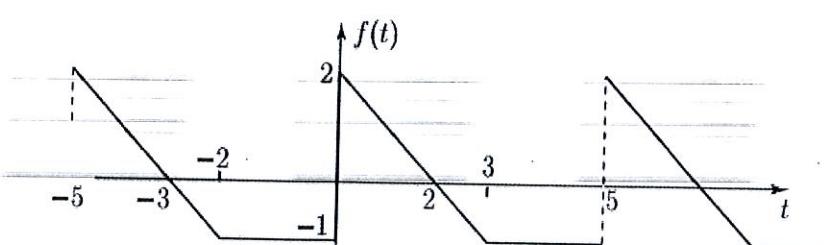


Figure A8 / Rajah A8

[4 marks]

[4 markah]

CLO2  
C3**QUESTION 9**

Sketch the graph for the analytical function below. Determine whether the function is even or odd.

$$f(t) = \begin{cases} 1 & 0 < t < \pi \\ -1 & \pi < t < 2\pi \end{cases}$$

$$f(t) = (t + 2\pi)$$

**SOALAN 9**

Lakarkan graf untuk fungsi analitikal di bawah. Tentukan samada fungsi tersebut adalah genap atau ganjil.

$$f(t) = \begin{cases} 1 & 0 < t < \pi \\ -1 & \pi < t < 2\pi \end{cases}$$

$$f(t) = (t + 2\pi)$$

[4 marks]

[4 markah]

CLO2  
C3**QUESTION 10**

Sketch the line spectrum from the Fourier series equation below.

$$f(t) = 1.27 \sin \omega t + 0.41 \cos \omega t + 0.42 \sin 3\omega t + 0.32 \cos 3\omega t + \dots$$

**SOALAN 10**

Lakarkan spektrum garisan daripada persamaan Siri Fourier dibawah.

$$f(t) = 1.27 \sin \omega t + 0.41 \cos \omega t + 0.42 \sin 3\omega t + 0.32 \cos 3\omega t + \dots$$

[4 marks]

[4 markah]

**SECTION B : 60 MARKS****BAHAGIAN B : 60 MARKAH****INSTRUCTION:**

This section consists of **THREE (3)** essay questions. Answer **ALL** questions.

**ARAHAN :**

*Bahagian ini mengandungi **TIGA (3)** soalan esei. Jawab semua soalan.*

**QUESTION 1****SOALAN 1**

CLO2  
C3

- (a) By using Mesh Analysis method, calculate for the currents  $I_A$ ,  $I_B$  and  $I_M$  in Figure B1(a).

*Dengan menggunakan kaedah analisa "Mesh", kirakan  $I_A$ ,  $I_B$  dan  $I_M$  dalam Rajah B1(a).*

[10 marks]

[10 markah]

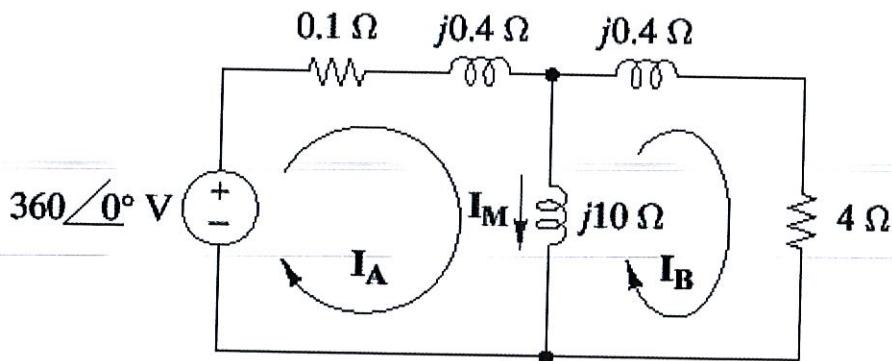


Figure B1(a) / Rajah B1(a)

CLO2  
C3

- (b) By referring to the circuit in Figure B1(b), calculate the current I by using Superposition Theorem method.

*Merujuk kepada litar dalam Rajah B1(b), kirakan arus I menggunakan kaedah Teorem Tindihan.*

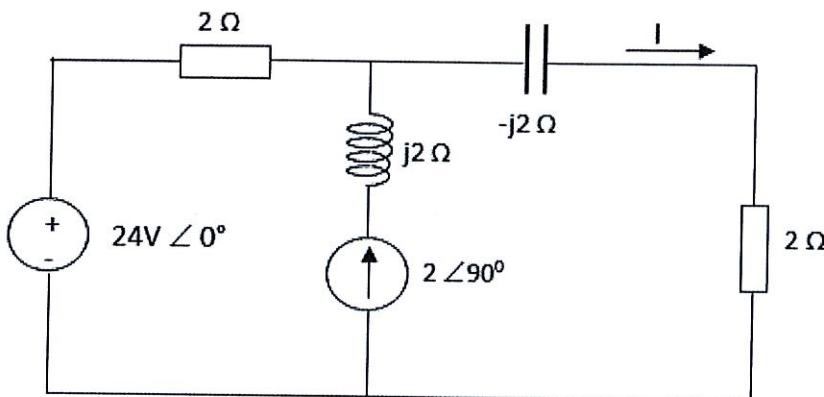


Figure B1(b) / Rajah B1(b)

[10 marks]

[10 markah]

## QUESTION 2

CLO3  
C3

- (a) By using Laplace Transform, calculate the time domain  $y(t)$  for the given function.

*Dengan menggunakan kaedah Jelmaan Laplace, kirakan domain masa  $y(t)$  bagi rangkap berikut.*

$$y'' + 4y' + 3y = 0; \text{ given } y(0) = 3, y'(0) = 1$$

[10 marks]

[10 markah]

- CLO3  
C3 (b) Based on Figure B2(b), calculate the value of  $i(t)$  at  $t = 2s$  by using Laplace Transform.  
Given  $L = 20H$ ,  $C = 1F$ ,  $V_s(t) = 4V$ . (Assuming zero initial condition).

Berdasarkan Rajah B2(b), kirakan nilai  $i(t)$  pada masa  $t = 2s$  dengan menggunakan Jelmaan Laplace. Diberi  $L = 20H$ ,  $C = 1F$ ,  $V_s(t) = 4V$ . (Anggap nilai permulaan adalah sifar).

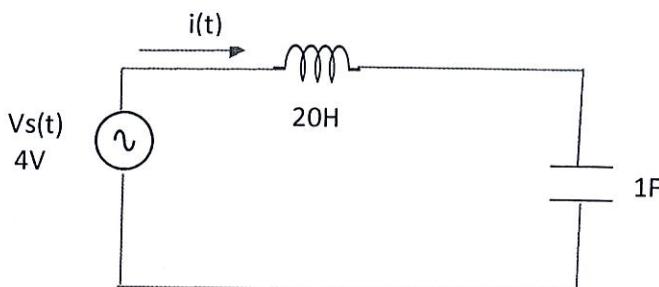


Figure B2(b)/ Rajah B2(b)

[10 marks]

[10 markah]

### QUESTION 3

#### SOALAN 3

The form of voltage from a square wave generator is given as:

*Bentuk voltan dari sebuah penjana segiempat sama diberi sebagai:*

$$v(t) = \begin{cases} 0 & -10 < t < 0 \\ 5 & 0 < t < 10 \end{cases}$$

$$v(t) = v(t + 20)$$

CLO3  
C3

- a. Sketch the function of  $v(t)$   
*Lakarkan fungsi  $v(t)$  tersebut*

[2 marks]  
[2 markah]

CLO3  
C3

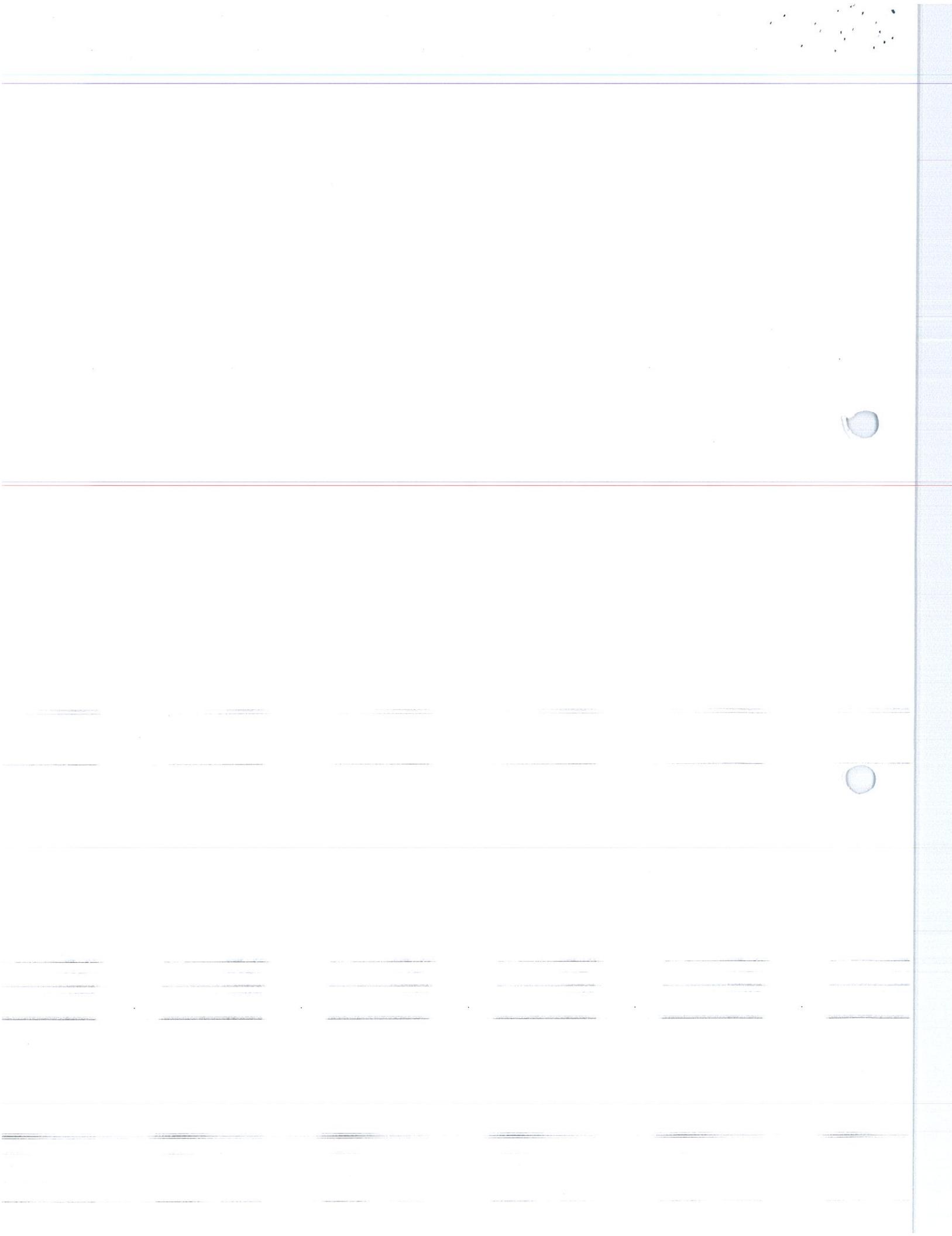
- b. Demonstrate that the Fourier Series for the function of  $v(t)$  is given by:

*Tunjukkan bahawa Siri Fourier untuk fungsi  $v(t)$  tersebut adalah diberi sebagai*

$$v(t) = \frac{5}{2} + \frac{10}{\pi} \left[ \sin\left(\frac{\pi t}{10}\right) + \frac{1}{3} \sin\left(\frac{3\pi t}{10}\right) + \frac{1}{5} \sin\left(\frac{5\pi t}{10}\right) + \dots \right]$$

[18 marks]  
[18 markah]

**SOALAN TAMAT**



Hyperbolic & Circular Functions

$$e^{j\omega t} = \cos \omega t + j \sin \omega t$$

$$e^{-j\omega t} = \cos \omega t - j \sin \omega t$$

$$\cosh j\omega t = \cosh \omega t$$

$$\sinh j\omega t = j \sin \omega t$$

$$\cos j\omega t = \cosh \omega t$$

$$\sin j\omega t = j \sin \omega t$$

$$\cos \omega t = \frac{e^{j\omega t} + e^{-j\omega t}}{2}$$

$$\sin \omega t = \frac{e^{j\omega t} - e^{-j\omega t}}{2j}$$

$$\cosh \omega t = \frac{e^{\omega t} + e^{-\omega t}}{2}$$

$$\sinh \omega t = \frac{e^{\omega t} - e^{-\omega t}}{2}$$

Addition Formulae

$$\sin(A+B) = \sin A \cos B + \cos A \sin B$$

$$\sin(A-B) = \sin A \cos B - \cos A \sin B$$

$$\cos(A+B) = \cos A \cos B - \sin A \sin B$$

$$\cos(A-B) = \cos A \cos B + \sin A \sin B$$

$$\tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$$

$$\tan(A-B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}$$

Multiple Angle Formulae

$$\sin 2\theta = 2 \sin \theta \cos \theta = \frac{2 \tan \theta}{1 + \tan^2 \theta}$$

$$\begin{aligned}\cos 2\theta &= \cos^2 \theta - \sin^2 \theta \\ &= 2 \cos^2 \theta - 1 \\ &= 1 - 2 \sin^2 \theta \\ &= \frac{1 - \tan^2 \theta}{1 + \tan^2 \theta}\end{aligned}$$

$$\cos^2 \theta = \frac{1 + \cos 2\theta}{2}$$

$$\sin^2 \theta = \frac{1 - \cos 2\theta}{2}$$

Sum & Difference Formulae

$$\sin A + \sin B = 2 \sin \frac{(A+B)}{2} \cos \frac{(A-B)}{2}$$

$$\sin A - \sin B = 2 \cos \frac{(A+B)}{2} \sin \frac{(A-B)}{2}$$

$$\cos A + \cos B = 2 \cos \frac{(A+B)}{2} \cos \frac{(A-B)}{2}$$

$$\cos A - \cos B = -2 \sin \frac{(A+B)}{2} \sin \frac{(A-B)}{2}$$

Product Formulae

$$\sin A \cos B = \frac{1}{2} \{ \sin(A+B) + \sin(A-B) \}$$

$$\cos A \sin B = \frac{1}{2} \{ \sin(A+B) - \sin(A-B) \}$$

$$\cos A \cos B = \frac{1}{2} \{ \cos(A+B) + \cos(A-B) \}$$

$$\sin A \sin B = \frac{1}{2} \{ \cos(A-B) - \cos(A+B) \}$$

Time Function $f(t)$ $f(t) = \mathcal{L}^{-1}\{F(s)\}$	Laplace Transform of $f(t)$ $F(s) = \mathcal{L}\{f(t)\}$
1	$\frac{1}{s} \quad s > 0$
$t$ (unit-ramp function)	$\frac{1}{s^2} \quad s > 0$
$t^n$ ( $n$ , a positive integer)	$\frac{n!}{s^{n+1}} \quad s > 0$
$e^{at}$	$\frac{1}{s - a} \quad s > a$
$\sin \omega t$	$\frac{\omega}{s^2 + \omega^2} \quad s > 0$
$\cos \omega t$	$\frac{s}{s^2 + \omega^2} \quad s > 0$
$t^n g(t)$ , for $n = 1, 2, \dots$	$(-1)^n \frac{d^n G(s)}{ds^n}$
$t \sin \omega t$	$\frac{2\omega s}{(s^2 + \omega^2)^2} \quad s >  \omega $
$t \cos \omega t$	$\frac{s^2 - \omega^2}{(s^2 + \omega^2)^2} \quad s >  \omega $
$g(at)$	$\frac{1}{a} G\left(\frac{s}{a}\right)$ Scale property
$e^{at} g(t)$	$G(s - a)$ Shift property
$e^{at} t^n$ , for $n = 1, 2, \dots$	$\frac{n!}{(s - a)^{n+1}} \quad s > a$
$te^{-t}$	$\frac{1}{(s + 1)^2} \quad s > -1$
$1 - e^{-t/T}$	$\frac{1}{s(1 + Ts)} \quad s > -\frac{1}{T}$
$e^{at} \sin \omega t$	$\frac{\omega}{(s - a)^2 + \omega^2} \quad s > a$
$e^{at} \cos \omega t$	$\frac{s - a}{(s - a)^2 + \omega^2} \quad s > a$
$u(t)$	$\frac{1}{s} \quad s > 0$
$u(t - a)$	$\frac{e^{-as}}{s} \quad s > 0$
$u(t - a) \cdot g(t - a)$	$e^{-as} G(s)$ Time-displacement theorem
$g'(t)$	$sG(s) - g(0)$
$g''(t)$	$s^2 \cdot G(s) - s \cdot g(0) - g'(0)$
$g^{(n)}(t)$	$s^n \cdot G(s) - s^{n-1} \cdot g(0) - s^{n-2} \cdot g'(0) - \dots - g^{n-1}(0)$
$\int_0^t g(t) dt$	$\frac{G(s)}{s}$
$\int g(t) dt$	$\frac{G(s)}{s} + \frac{1}{s} \left\{ \int g(t) dt \right\}_{t=0}$