

SULIT



BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN KEJURUTERAAN ELEKTRIK

PEPERIKSAAN AKHIR

SESI JUN 2015

EE602 CIRCUIT ANALYSIS

TARIKH : 29 OKTOBER 2015
TEMPOH : 2.30 PM - 4.30 PM (2 JAM)

Kertas ini mengandungi LAPAN (8) halaman bercetak.

Bahagian A: Struktur (10 soalan)

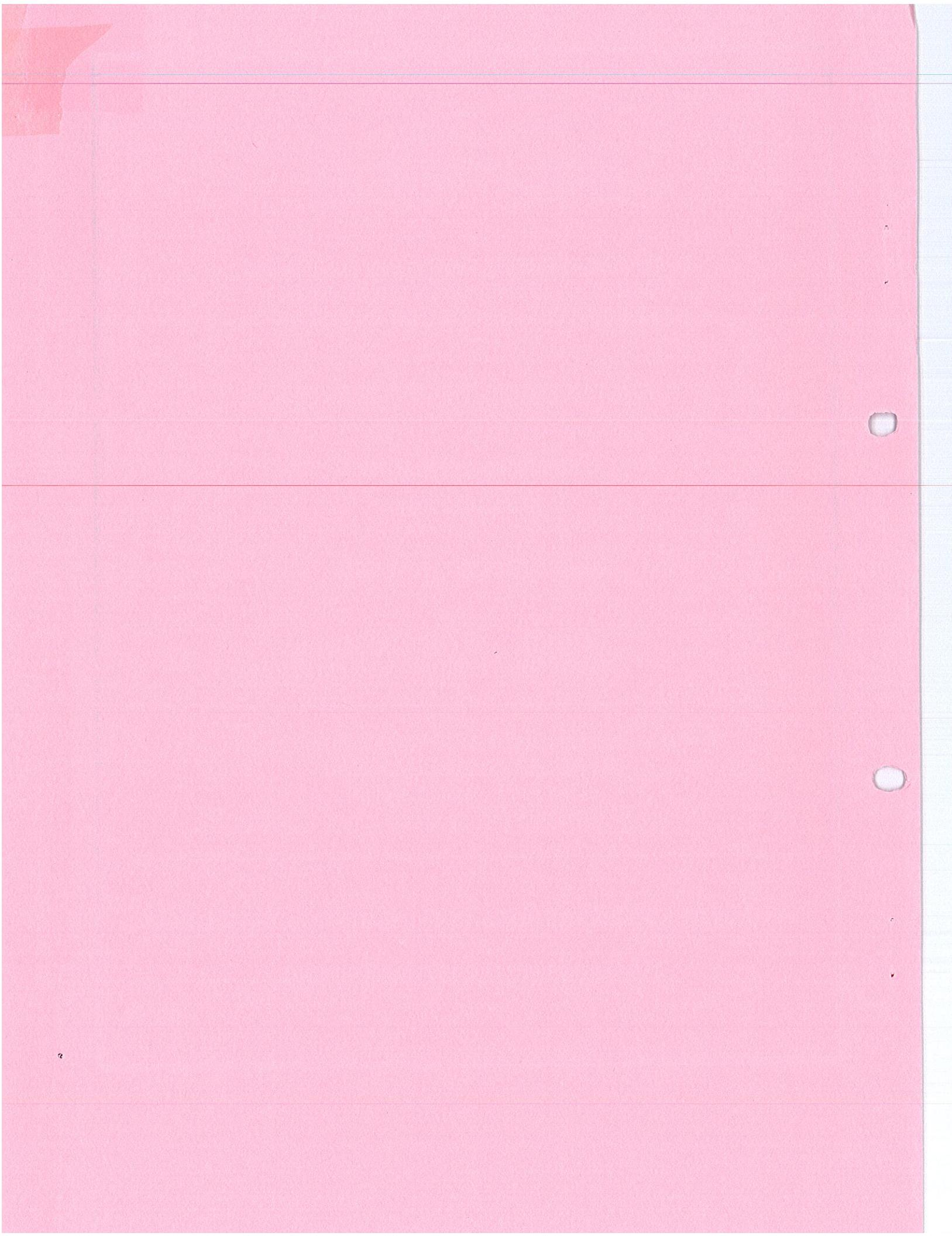
Bahagian B: Esei (3 soalan)

Dokumen sokongan yang disertakan : Jadual Laplace

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHHKAN

(CLO yang tertera hanya sebagai rujukan)

SULIT



SECTION A: 40 MARKS
BAHAGIAN A: 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, derive the simultaneous equation for I_1 and I_2 using Mesh Analysis.

SOALAN 1

Merujuk Rajah A1, dapatkan persamaan serentak bagi I_1 dan I_2 menggunakan Analisa "Mesh".

[4 marks]

[4 markah]

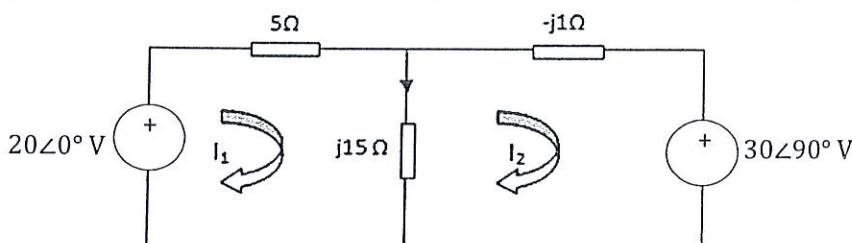


Figure A1/Rajah A1

CLO1
C3

QUESTION 2

By using Nodal analysis, calculate the value of voltage at node Va as in Figure A2.

SOALAN 2

Dengan menggunakan analisa 'Nodal', kirakan nilai voltan pada titik Va seperti didalam Rajah A2.

[4 marks]

[4 markah]

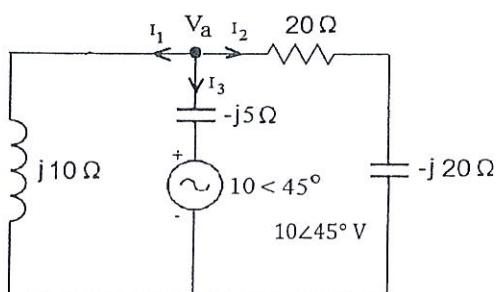


Figure A2/Rajah A2

CLO1

C3

QUESTION 3

By referring Figure A3, when the current source, $2\angle 0^\circ \text{A}$ is OFF, the value of $V' = 25\angle 53.13^\circ \text{ V}$. Calculate the value of V by using Superposition Theorem.

SOALAN 3

Dengan merujuk Rajah A3, ketika sumber arus, $2\angle 0^\circ \text{A}$ ‘OFF’.

nilai $V' = 25\angle 53.13^\circ \text{ V}$. Tunjukkan langkah seterusnya dan kirakan nilai V menggunakan Teorem Tindihan.

[4 marks]

[4 markah]

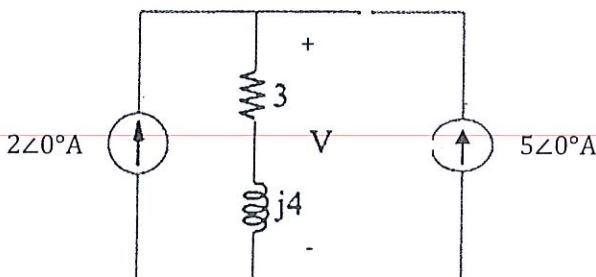


Figure A3/Rajah A3

CLO1
C3**QUESTION 4**

By referring to Figure A4, calculate the Thevenin Voltage (V_{TH}) across the terminal A-B.

SOALAN 4

Merujuk kepada Rajah A4, kirakan Voltan Thevenin (V_{TH}) pada terminal A-B.

[4 marks]

[4 markah]

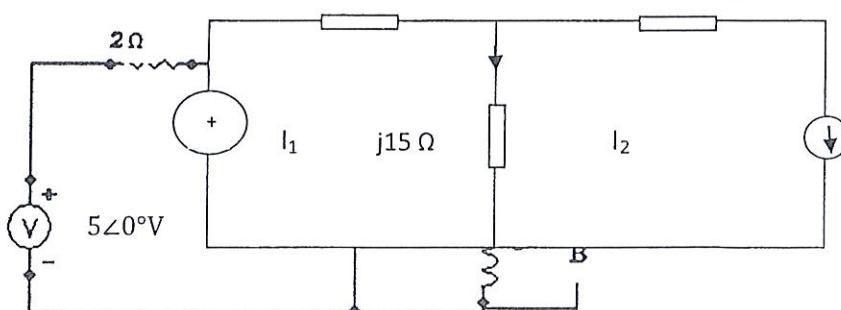


Figure A4/Rajah A4

CLO1
C3**QUESTION 5**

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

SOALAN 5

Dengan menggunakan Kaedah Kamiran Terus, ubahkan fungsi $f(t) = u(t)$ kepada Jelmaan Laplace.

[4 marks]

[4 markah]

CLO 1
C2**QUESTION 6**

Determine the Laplace Transform of $f(t) = 4t^2 - 3\sin 5t$.

SOALAN 6

Tentukan Jelmaan Laplace bagi $f(t) = 4t^2 - 3\sin 5t$.

[4 marks]

[4 markah]

CLO 1
C3**QUESTION 7**

Calculate the Inverse Laplace Transform of the following function $F(s)$:

$$F(s) = \frac{3}{s} + \frac{1}{s-2} + \frac{4}{s-3}$$

SOALAN 7

Kirakan Jelmaan Songsangan Laplace bagi fungsi $F(s)$ berikut:

$$F(s) = \frac{3}{s} + \frac{1}{s-2} + \frac{4}{s-3}$$

[4 marks]

[4 markah]

CLO2
C2**QUESTION 8**

Determine the analytical equation for the waveform in Figure A8.

SOALAN 8

Tentukan persamaan analitikal bagi gelombang di Rajah A8.

[4 marks]

[4 markah]

QUESTION 9

CLO2 Sketch the waveform and determine the angular velocity, ω for an analytical function below:

C3

$$f(t) = \begin{cases} 3 & -\frac{\pi}{4} < t < \frac{\pi}{4} \\ 0 & \frac{\pi}{4} < t < 3\frac{\pi}{4} \end{cases}$$

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

SOALAN 9

Lakarkan gelombang dan tentukan nilai halaju sudut, ω untuk fungsi analitikal dibawah:

$$f(t) = \begin{cases} 3 & -\frac{\pi}{4} < t < \frac{\pi}{4} \\ 0 & \frac{\pi}{4} < t < 3\frac{\pi}{4} \end{cases}$$

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

[4 marks]
[4 markah]

QUESTION 10

CLO2 By referring to analytical function below, calculate the Fourier coefficient a_0 .

C3

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

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

SOALAN 10

Merujuk kepada fungsi analitikal di bawah, kirakan pekali Fourier, a_0 .

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

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

[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 eseai. Jawab semua soalan.

QUESTION 1**SOALAN 1**

CLO2
C3

- (a) By using Superposition Theorem, calculate the current I_x in Figure B1(a).

Dengan menggunakan Teorem Tindihan, kirakan nilai arus I_x pada Rajah B1(a).

[10 marks]
[10 markah]

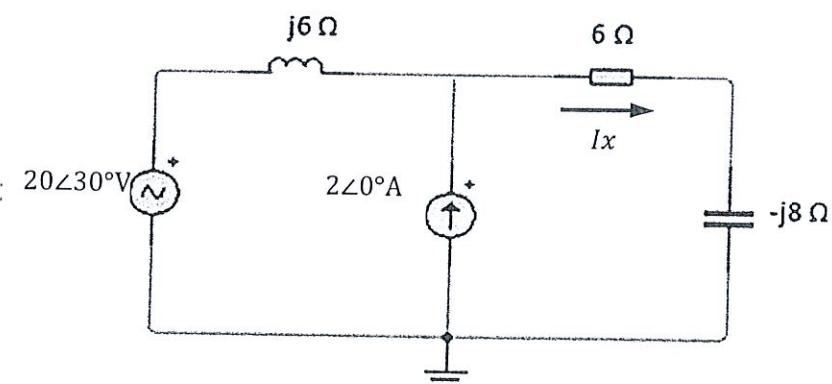


Figure B1(a)/Rajah B1(a)

CLO2

C3

- b) By using Thevenin's Theorem, calculate the value of I_L in Figure B1(b).

Dengan menggunakan Teorem Thevenin, kirakan nilai I_L dalam Rajah B1(b).

[10 marks]
[10 markah]

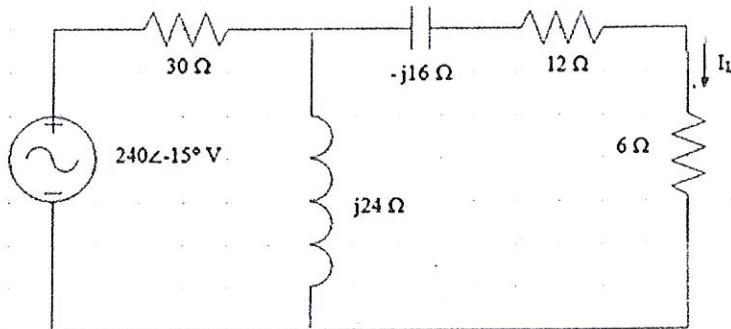


Figure B1 (b)/Rajah B1(b)

QUESTION 2

SOALAN 2

CLO3

C3

- (a) Calculate $x(t)$ for the given equation by using Laplace Transform method.

$$x'' - 4x' + 3x = 0 \quad \text{given,} \quad x(0) = 2, \quad x'(0) = 10$$

Kirakan $x(t)$ bagi persamaan yang diberi dengan menggunakan kaedah Jelmaan Laplace.

$$x'' - 4x' + 3x = 0 \quad \text{diberi,} \quad x(0) = 2, \quad x'(0) = 10$$

[10 marks]
[10 markah]

CLO3

C3

- (b) Calculate $V_x(t)$ in the circuit of Figure B2(b), by using Laplace Transform method.

Kirakan $V_x(t)$ pada Rajah B2(b) dengan menggunakan kaedah Jelmaan Laplace.

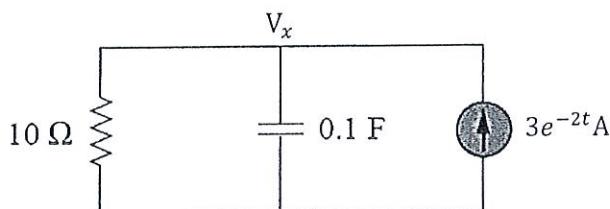


Figure B2 (b)/Rajah B2(b)

[10 marks]
[10 markah]

QUESTION 3**SOALAN 3**CLO3
C3

By referring to Figure B3, the function given is an odd function where, $a_n = 0$. Calculate the other coefficient a_0 and b_n , then derive the Trigonometric Fourier Series equation and draw line spectrum until 3rd harmonic.

Merujuk kepada Rajah B3, fungsi yang diberi adalah fungsi ganjil; $a_n = 0$. Kirakan pekali selainnya a_0 and b_n , kemudian dapatkan persamaan dan lukiskan garis spektrum bagi Siri Fourier Trigonometri sehingga harmonic ke-3.

[20 marks]

[20 markah]

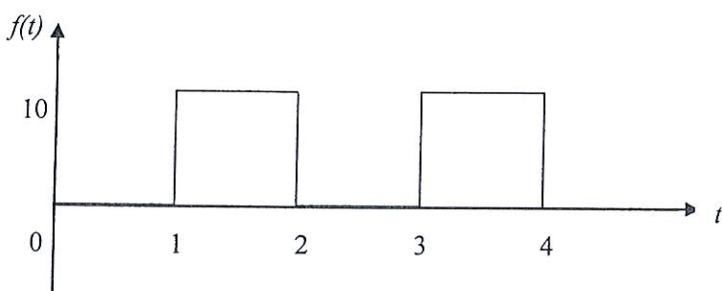
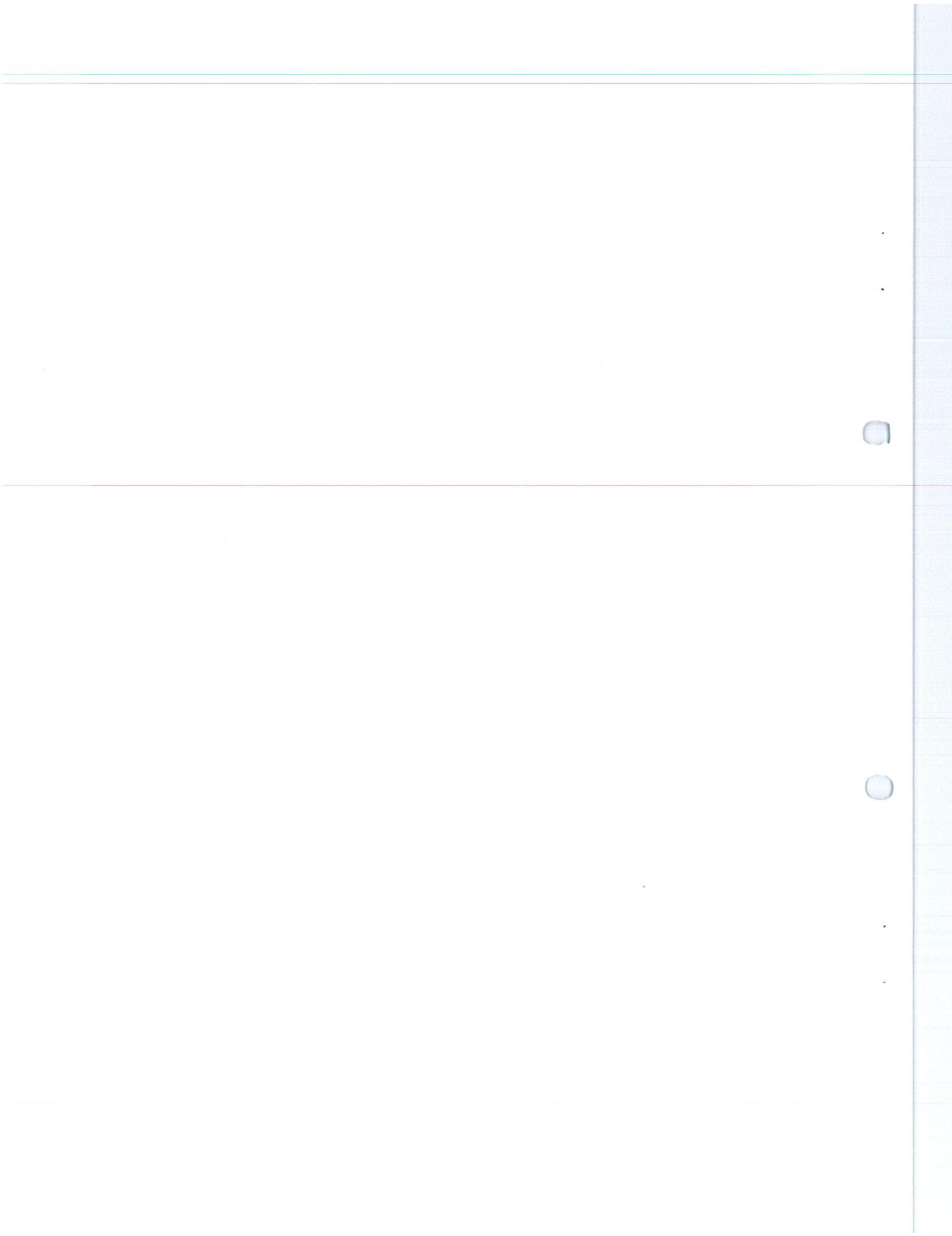


Figure B3 / Rajah B3

SOALAN TAMAT



	$\mathcal{L}^{-1}\{F(s)\} = f(t)$	$F(s) = \mathcal{L}\{f(t)\}$
i.	1	$\frac{1}{s}$
ii.	k	$\frac{k}{s}$
iii.	e^{at}	$\frac{1}{s-a}$
iv.	$\sin at$	$\frac{a}{s^2 + a^2}$
v.	$\cos at$	$\frac{s}{s^2 + a^2}$
vi.	t	$\frac{1}{s^2}$
vii.	t^2	$\frac{2!}{s^3}$
viii.	t^n	$\frac{n!}{s^{n+1}}$
ix.	$\sinh at$	$\frac{a}{s^2 - a^2}$
x.	$\cosh at$	$\frac{s}{s^2 - a^2}$
xi.	$e^{at} t^n$	$\frac{n!}{(s-a)^{n+1}}$
xii.	$e^{at} \sin \omega t$	$\frac{\omega}{(s-a)^2 + \omega^2}$
xiii.	$e^{at} \cos \omega t$	$\frac{s-a}{(s-a)^2 + \omega^2}$
xiv.	$e^{at} \sinh \omega t$	$\frac{\omega}{(s-a)^2 - \omega^2}$
xv.	$e^{at} \cosh \omega t$	$\frac{s-a}{(s-a)^2 - \omega^2}$

connection	Phase voltages/currents	Line voltages/currents
Y - Δ	$V_{an} = V_p \angle 0^\circ$ $V_{bn} = V_p \angle -120^\circ$ $V_{cn} = V_p \angle +120^\circ$ $I_{AB} = V_{AB} / Z_\Delta$ $I_{BC} = V_{BC} / Z_\Delta$ $I_{CA} = V_{CA} / Z_\Delta$	$V_{ab} = V_{AB} = \sqrt{3}V_p \angle 30^\circ$ $V_{bc} = V_{BC} = V_{ab} \angle -120^\circ$ $V_{ca} = V_{CA} = V_{ab} \angle +120^\circ$ $I_a = I_{AB} \sqrt{3} \angle -30^\circ$ $I_b = I_a \angle -120^\circ$ $I_c = I_a \angle +120^\circ$
Δ - Y	$V_{ab} = V_p \angle 0^\circ$ $V_{bc} = V_p \angle -120^\circ$ $V_{ca} = V_p \angle +120^\circ$ same as line currents	Same as phase voltages $I_a = \frac{V_p \angle -30^\circ}{\sqrt{3}Z_Y}$ $I_b = I_a \angle -120^\circ$ $I_c = I_a \angle +120^\circ$

First derivative :	Overview of Fourier analysis :
$\mathcal{L}[f'(t)] = s \mathcal{L}[f(t)] - f(0)$	$f(t) = a_0 + \sum_{n=1}^{\infty} (a_n \cos(2\pi n f_0 t) + b_n \sin(2\pi n f_0 t))$
Second derivative :	Alternative form of the Fourier series : $A_n = \sqrt{a_n^2 + b_n^2}$ and $\phi_n = \tan^{-1} \frac{-b_n}{a_n}$

Waveform	Fourier coefficients	waveform	Fourier coefficients
Constant (dc)	$\alpha_0 = A$ $\alpha_n = 0 \text{ all } n$ $b_n = 0 \text{ all } n$	Sawtooth wave	$\alpha_0 = \frac{A}{2}$ $\alpha_0 = 0 \text{ all } n$ $b_n = -\frac{A}{n\pi} \text{ all } n$
Cosine wave	$\alpha_0 = 0$ $\alpha_1 = A$ $\alpha_n = 0 \text{ } n \neq 1$ $b_n = 0 \text{ all } n$	Triangular wave	$\alpha_0 = 0$ $\alpha_n = \frac{8A}{(n\pi)^2} \text{ } n \text{ odd}$ $\alpha_n = 0 \text{ } n \text{ even}$ $b_n = 0 \text{ all } n$
Sine wave	$\alpha_0 = 0$ $\alpha_n = 0 \text{ all } n$ $b_1 = A$ $b_n = 0 \text{ } n \neq 1$	Half-wave rectified sine wave	$\alpha_0 = \frac{A}{\pi}$ $\alpha_n = \frac{2A/\pi}{1-n^2} \text{ } n \text{ even}$ $\alpha_n = 0 \text{ } n \text{ odd}$ $b_1 = \frac{A}{2} \text{ } n = 1$ $b_n = 0 \text{ } n \neq 1$
Square wave	$\alpha_0 = 0$ $\alpha_n = 0 \text{ all } n$ $b_n = \frac{4A}{n\pi} \text{ } n \text{ odd}$ $b_n = 0 \text{ } n \text{ even}$	Full-wave rectified sine wave	$\alpha_0 = \frac{2A}{\pi}$ $\alpha_n = \frac{4A/\pi}{1-n^2} \text{ } n \text{ even}$ $\alpha_n = 0 \text{ } n \text{ odd}$ $b_n = 0 \text{ all } n$
Rectangular pulse	$\alpha_0 = \frac{AT}{T_0}$ $\alpha_n = \frac{2A}{n\pi} \sin\left(\frac{n\pi T}{T_0}\right)$ $b_n = 0 \text{ all } n$	Parabolic wave	$\alpha_0 = 0$ $\alpha_n = 0 \text{ all } n$ $b_n = \frac{32A}{(n\pi)^3} \text{ } n \text{ odd}$ $b_n = 0 \text{ } n \text{ even}$

