SULIT

POLITEKNIK MALAYSIA

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 DIARAHKAN

(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*]

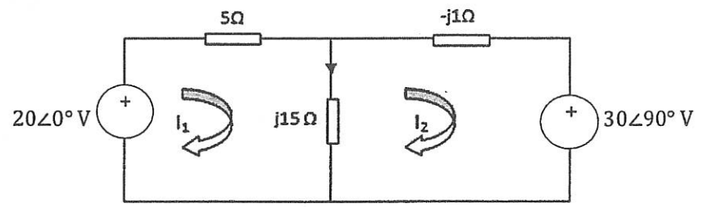

Figure A1/*Rajah A1*

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*]

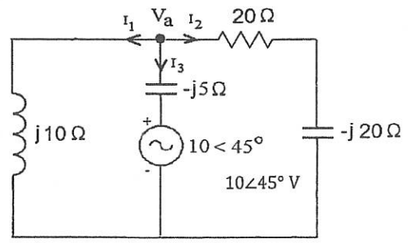

Figure A2/*Rajah A2*

CLO1
C3

QUESTION 3

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

SOALAN 3

Dengan merujuk Rajah A3, ketika sumber arus, $2\angle 0°$A **'OFF'**.

nilai $V' = 25\angle 53.13°$ V. *Tunjukkan langkah seterusnya dan kirakan nilai V menggunakan Teorem Tindihan.*

[4 marks]

[*4 markah*]

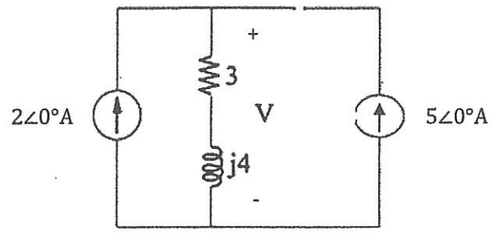

Figure A3/*Rajah A3*

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*]

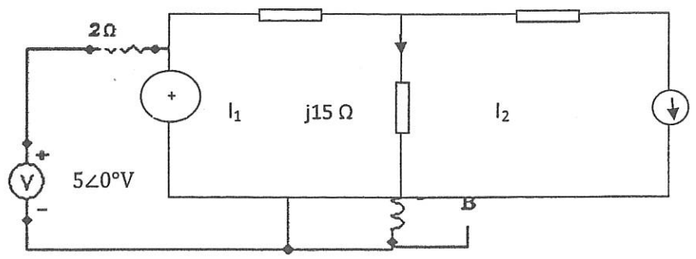

Figure A4/*Rajah A4*

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 $f(t) = 4t^2 - 3sin\ 5t$.

SOALAN 6

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

[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 C3 Sketch the waveform and determine the angular velocity, ω for an analytical function below:

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

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

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 C3 By referring to analytical function below, calculate the Fourier coefficient a_0.

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

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

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 esei. Jawab **semua soalan.***

QUESTION 1

SOALAN 1

CLO2 C3 (a) By using Superposition Theorem, calculate the current *Ix* in Figure B1(a).

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

[10 marks]
[*10 markah*]

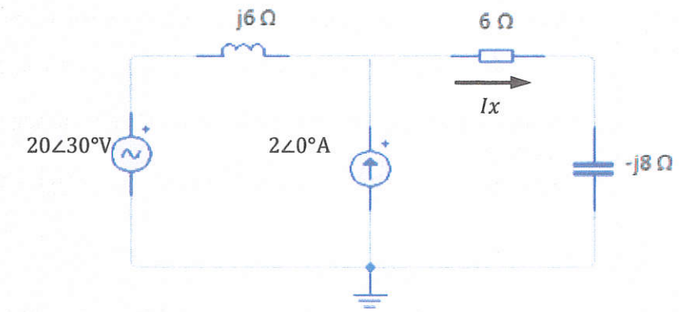

Figure B1(a)/*Rajah B1(a)*

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*]

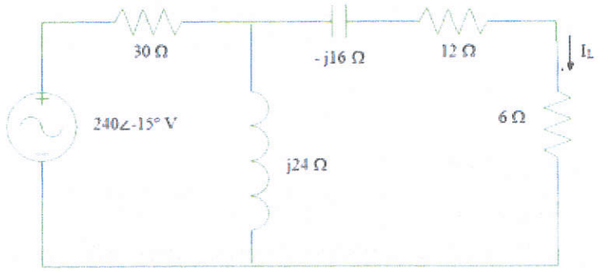

Figure B1 (b)/*Rajah B1(b)*

QUESTION 2

SOALAN 2

CLO3 C3

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

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

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

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

[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.*

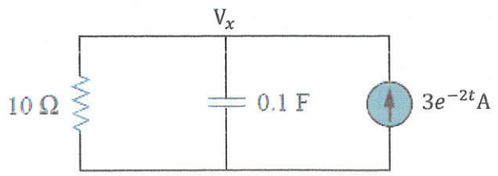

Figure B2 (b)/*Rajah B2(b)*

[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*]

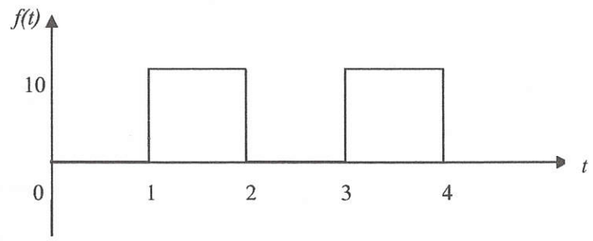

Figure B3 / *Rajah B3*

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

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 :
$\mathcal{L}[f''(t)] = s^2\mathcal{L}[f(t)] - sf(0) - f'(0)$	$A_n = \sqrt{a_n^2 + b_n^2}$ and $\phi_n = \tan^{-1}\frac{-b_n}{a_n}$

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