

SULIT



**BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK
KEMENTERIAN PENDIDIKAN TINGGI**

JABATAN KEJURUTERAAN ELEKTRIK

PEPERIKSAAN AKHIR

SESI JUN 2016

DEE6142/EE602: CIRCUIT ANALYSIS

TARIKH : 03 NOVEMBER 2016

MASA : 2.30 PM - 4.30 PM (2 JAM)

Kertas ini mengandungi **TUJUH (7)** halaman bercetak.

Bahagian A: Struktur (4 soalan)

Bahagian B: Esei (2 soalan)

Dokumen sokongan yang disertakan : Jadual Laplace

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SULIT

SECTION A: 60 MARKS
BAHAGIAN A: 60 MARKAH

INSTRUCTION:

This section consists of **FOUR (4)** structured questions. Answer **ALL** questions.

ARAHAN:

Bahagian ini mengandungi **EMPAT (4)** soalan berstruktur. Jawab **SEMUA** soalan.

QUESTION 1**SOALAN 1**

CLO1
C1

- a) List the steps in analyzing AC circuit by using Mesh Analysis

Senaraikan langkah-langkah untuk menganalisis litar ulang-alik dengan menggunakan Analisa "Mesh"

[3 marks]

[3 markah]

CLO1
C3

- b) Referring to Figure A1(b), calculate the value of the current I_1 .

Merujuk kepada Rajah A1(b), kirakan nilai arus I_1

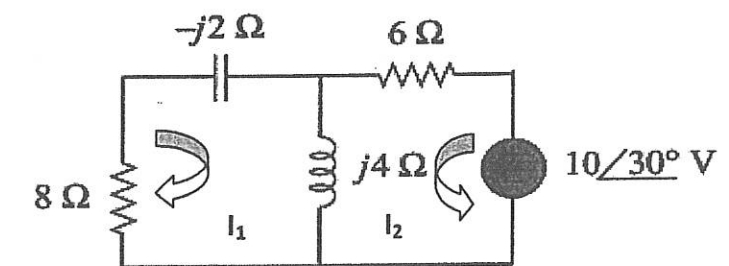


Figure A1(b)/Rajah A1(b)

[6 marks]

[6 markah]

CLO1
C3

- c) List **THREE (3)** differences between **THEVENIN** and **NORTON** Analysis.

*Senaraikan **TIGA (3)** perbezaan di antara analisa Thevenin dan Norton*

[6 marks]

[6 markah]

QUESTION 2
SOALAN 2

CLO1
C3

- a) Referring to Figure A2(a), draw the delta transformation of the circuit in Figure A2(a).

Merujuk kepada Rajah A2(a), lukis litar Delta daripada Rajah A2(a)

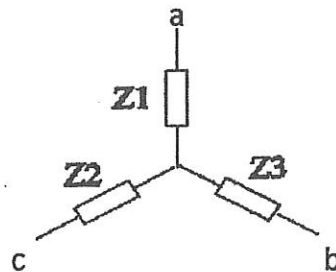


Figure A2(a)/Rajah A2(a)

[4 marks]
[4 markah]

CLO1
C3

- b) By referring to Figure A2(b), determine Z_{in} for the circuit.

Merujuk kepada Rajah A2(b), dapatkan nilai Z_{in} di dalam litar.

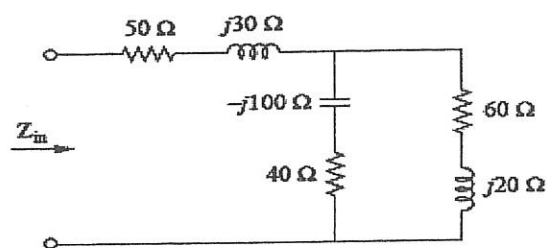


Figure A2(b)/Rajah A2(b)

[5 marks]
[5 markah]

CLO1
C3

- c) By referring to Figure A2(c), find the equation at node v_1 and v_2 using Nodal Analysis.

Merujuk kepada Rajah A2(c), cari persamaan pada nod v_1 dan v_2 dengan menggunakan Analisis Nod.

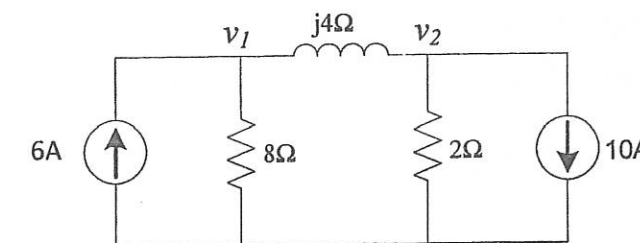


Figure A2(c)/Rajah A2(c)

[6 marks]
[6 markah]

QUESTION 3
SOALAN 3

CLO2
C1

- a) Write the basic equation for Laplace Transform $F(s)$

Tuliskan persamaan asas untuk Jelmaan Laplace $F(s)$

[3 marks]
[3 markah]

CLO2
C2

- b) Solve the Laplace Transform of the following function $f(t)$ by using Laplace Transform Table.

Selesaikan Jelmaan Laplace $f(t)$ bagi fungsi berikut dengan menggunakan jadual Laplace transform

$$f(t) = 6e^{-3t} + 2\sin 4t + 5t^3 - 9$$

[6marks]
[6 markah]

CLO2
C2

- c) Determine the Inverse Laplace for the function $f(s)$ below:

Dapatkan laplace songsang untuk fungsi $f(S)$ dibawah:

$$f(s) = \frac{3s-7}{s^2+16}$$

[6marks]
[6 markah]

QUESTION 4
SOALAN 4

CLO3
C2

- a) Sketch the graph for the analytical function below. State whether the function is even or odd.

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

$$f(t) = \begin{cases} -3, & -\pi < t < 0 \\ 3 & 0 < t < \pi \end{cases} \quad f(t) = f(t + 2\pi)$$

[3 marks]
[3 markah]

CLO3
C3

- b) Determine the analytical equation for the periodic function in Figure A4(b)

Dapatkan persamaan analitikal untuk fungsi berkala dalam Rajah A4(b)

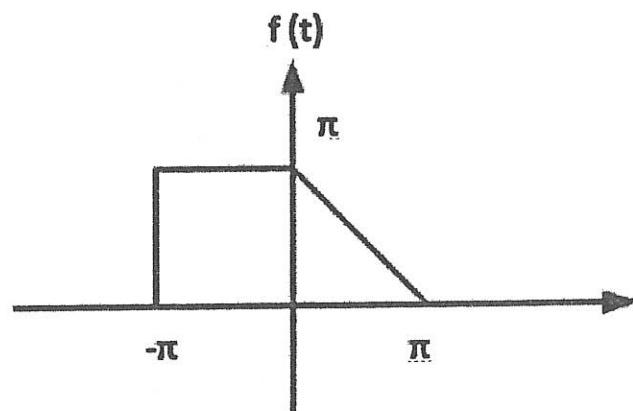


Figure A4(b) / Rajah A4(b)

[5marks]
[5markah]

CLO3
C4

- c) By referring to the waveform in figure A4(c), calculate the Fourier coefficient b_n

Merujuk kepada gelombang pada Rajah A4(c) kirakan pekali Fourier, b_n

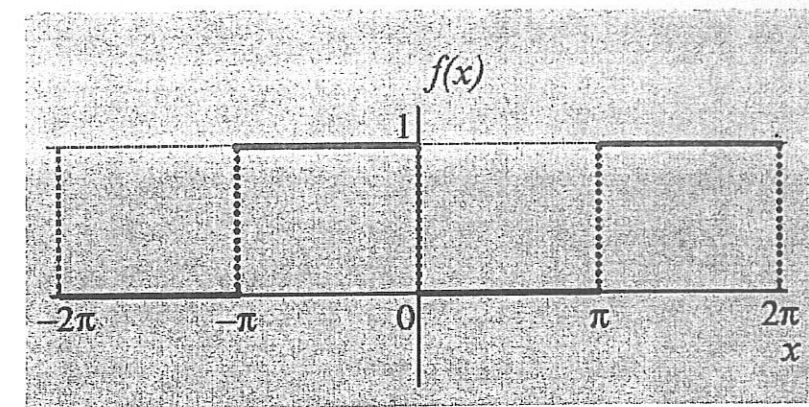


Figure A4(c) / Rajah A4(c)

[7 marks]
[7 markah]

SECTION B : 40 MARKS
BAHAGIAN B : 40 MARKAH

INSTRUCTION:

This section consists of TWO (2) essay questions. Answer ALL questions.

ARAHAN:

Bahagian ini mengandungi DUA (2) soalan esei. Jawab SEMUA soalan sahaja.

QUESTION 1

SOALAN 1

CLO2
C3

By using Laplace Transform, produce the $y(t)$ for the differential equation..

Dengan menggunakan Jelmaan Laplace , keluarkan $y(t)$ bagi persamaan pembezaan.

[20 marks]

[20 markah]

$$y''(t) + y'(t) - 2y(t) = 5e^{3t}, \quad \text{given } y'(0) = -4; \quad y(0) = 1$$

QUESTION 2

SOALAN 2

CLO3
C4

A series RL circuit with 60Ω and $10H$ are connected in series with 120 DC source. At $t = 0$, the switch is closed. Assume initial current is zero. Construct the circuit in t-domain and reconstruct the circuit into s-domain, then analyze RL circuit by using Laplace Transform to get the steady state total current flowing through the circuit, $i(t)$.

Satu litar siri RL dengan 60Ω dan $10H$ disambung secara siri dengan 120 DC sumber bekalan. Pada ketika $t = 0$, suis adalah ditutup. Andaikan arus permulaan adalah sifar. Bina litar dalam t- domain dan bina semula litar ke dalam s-domain, kemudian analisis litar RL dengan menggunakan Jelmaan Laplace untuk mendapatkan keadaan mantap jumlah arus yang mengalir melalui litar, $i(t)$.

[20 marks]

[20 markah]

SOALAN TAMAT

JADUAL LAPLACE

NO	$L^{-1}\{F(s)\} = f(t)$	$F(s) = L\{f(t)\}$
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 $V_n \angle -30^\circ$ $I_a = \frac{V_n}{\sqrt{3} Z_Y}$ $I_b = I_a \angle -120^\circ$ $I_c = I_a \angle +120^\circ$

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

Waveform	Fourier Coefficients	Waveform	Fourier Coefficients
Constant (dc)	$\alpha_0 = A$ $\alpha_n = 0$ all n $b_n = 0$ all n	Sawtooth wave	$\alpha_0 = \frac{A}{2}$ $\alpha_n = 0$ all n $b_n = -\frac{A}{n\pi}$ all n
Cosine wave	$\alpha_0 = 0$ $\alpha_1 = A$ $\alpha_n = 0$ n ≠ 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

Waveform	Fourier Coefficients	Waveform	Fourier Coefficients
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