



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

**JABATAN KEJURUTERAAN ELEKTRIK**

**PEPERIKSAAN AKHIR  
SESI DISEMBER 2016**

**DEE6142: CIRCUIT ANALYSIS**

**TARIKH : 11 APRIL 2017  
MASA : 2.30 PM – 4.30 PM (2 JAM)**

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Kertas ini mengandungi **SEMBILAN (9)** halaman bercetak.  
Bahagian A: Struktur (4 soalan)  
Bahagian B: Esei (2 soalan)  
Dokumen sokongan yang disertakan : Formula

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**JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN**

(CLO yang tertera hanya sebagai rujukan)

## 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) State **THREE (3)** main steps to solve a circuit using nodal analysis method.

Nyatakan **TIGA (3)** langkah utama untuk menyelesaikan litar elektrik menggunakan kaedah Analisis Nodal.

[3 marks]  
[3 markah]

CLO1  
C3

- b) Based on figure A1(b), calculate the value of  $I_1$  using Mesh analysis.

Berdasarkan Rajah A1(b), dapatkan nilai  $I_1$  menggunakan Analisis Mesh.

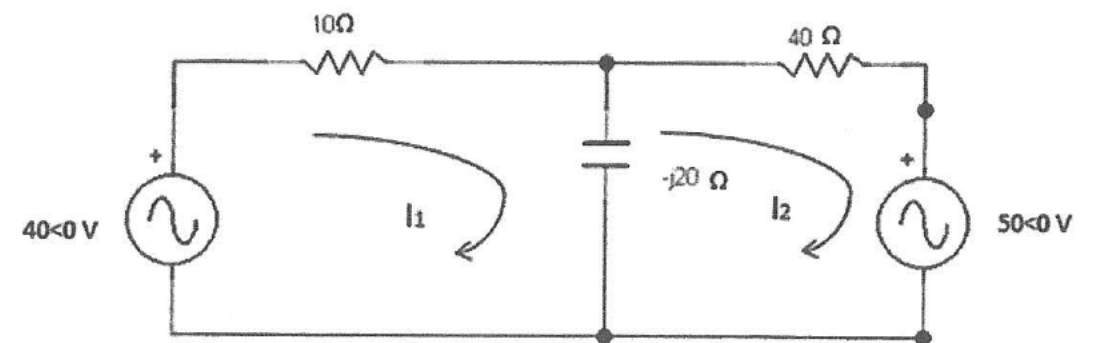


Figure A1(b) / Rajah A1(b)

[6 marks]  
[6 markah]

- CLO1 C3 c) Refer to Figure A1(c), derive the equations for node voltages  $V_1$  and  $V_2$  using nodal analysis.

Berdasarkan Rajah A1(c), dapatkan persamaan bagi voltan nod bagi  $V_1$  dan  $V_2$  menggunakan Analisis Nodal.

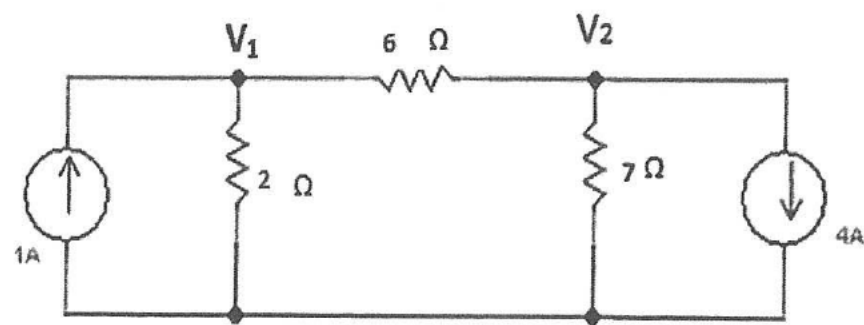


Figure A1(c) / Rajah A1(c)

[6 marks]  
[6 markah]

**QUESTION 2**  
**SOALAN 2**

- CLO1 C1 a) Referring to Figure A2(a), write the equations for the transformation from  $\Delta$  to Y.

Berdasarkan Rajah A2(a), tuliskan persamaan bagi penukaran daripada  $\Delta$  kepada Y.

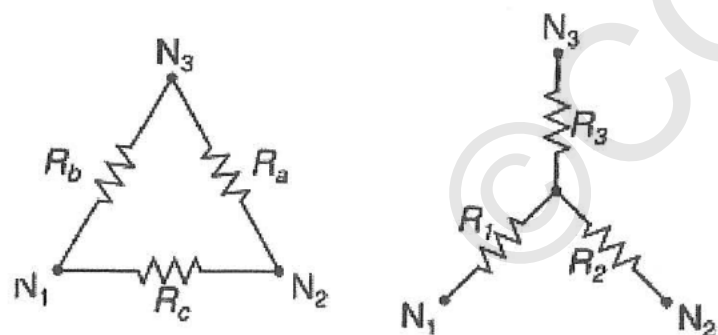


Figure A2(a) / Rajah A2(a)

[4 marks]  
[4 markah]

- CLO1 C2 b) Determine the Thevenin voltage,  $V_{th}$ , at terminal a-b of the circuit in Figure A2(b).

Dapatkan nilai voltan Thevenin,  $V_{th}$  pada terminal a-b bagi litar di Rajah A2(b).

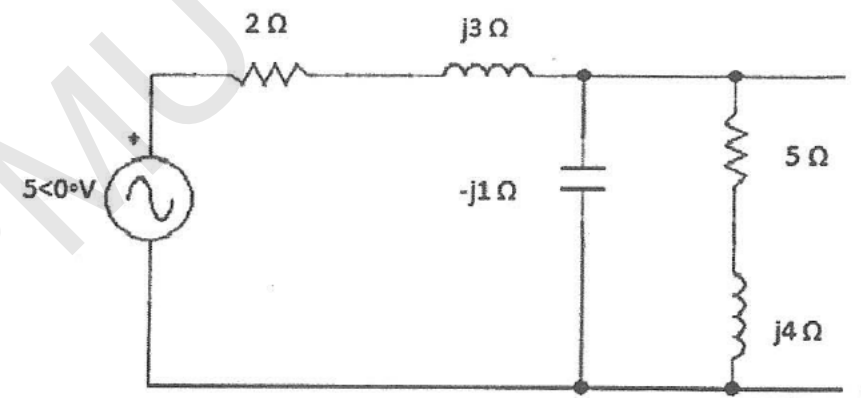


Figure A2(b) / Rajah A2(b)

[5marks]  
[5 markah]

- CLO1 C2 c) Using the Norton Theorem, calculate  $Z_N$  and  $I_N$  at terminal a-b in Figure A2(c).

Dengan menggunakan Teorem Norton, kirakan nilai  $Z_N$  dan  $I_N$  pada terminal a-b dalam Rajah A2(c).

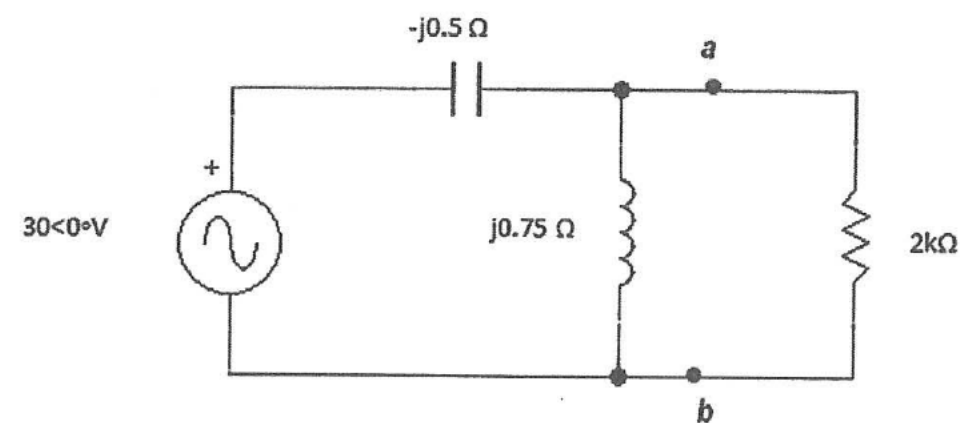


Figure A2(c) / Rajah A2(c)

[6 marks]  
[6 markah]

QUESTION 3

SOALAN 3

- CLO2 C2 a) Determine the analytical equation for the function  $f(t)$  in Figure A3(a).

Kenalpasti persamaan analitik bagi fungsi  $f(t)$  pada Rajah A3(a)

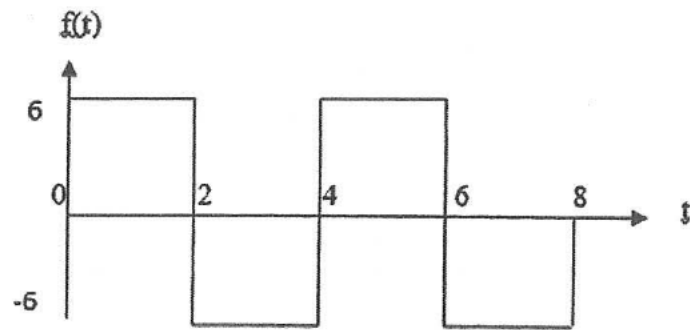


Figure A3(a) / Rajah A3(a)

[3 marks]  
[3 markah]

- CLO2 C3 b) Sketch the function of  $f(t)$  and calculate the Fourier Series of Co-efficient :  $a_0$

Lakarkan fungsi  $f(t)$  dan kirakan pekali Siri Fourier :  $a_0$

$$f(t) = \begin{cases} 4 & -5 < t < 5 \\ 0 & 5 < t < 10 \end{cases}$$

$$f(t+15)$$

[5 marks]  
[5 markah]

- CLO2 C4 c) Analyze the Fourier Series equation  $f(t)$  up to 3<sup>th</sup> harmonic.

Analisa persamaan Siri Fourier  $f(t)$  sehingga harmonik ke 3.

$$f(t) = \sum_{n=1}^{\infty} \left( \frac{10}{n\pi} [1 - \cos n\pi] \sin n\omega t \right)$$

[7 marks]  
[7 markah]

QUESTION 4

SOALAN 4

- CLO3 C1 a) Based on the RLC circuit in Figure A4(a), write the expression for the voltage in t-Domain.

Berdasarkan litar RLC pada Rajah A4(a), tuliskan persamaan voltan dalam Domain-t.

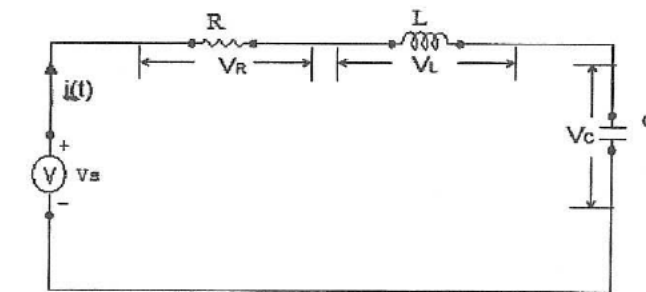


Figure A4(a) / Rajah A4(a)

[3 marks]  
[3 markah]

- CLO3 C2 b) Using Laplace Transform, determine  $I(s)$  for the circuit in Figure A4(b) when  $S_1$  is closed. Assume that the initial condition is zero.

Dengan menggunakan Jelmaan Laplace, dapatkan persamaan  $I(s)$  bagi litar pada Rajah A4(b) bila  $S_1$  ditutup. Anggapkan keadaan awal adalah sifar.

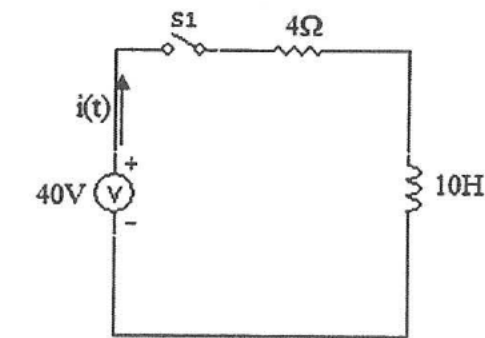


Figure A4(b) / Rajah A4(b)

[6 marks]  
[6 markah]

CLO3  
C2

- c) By referring to Figure A4(c), calculate the value of current  $i(t)$  at  $t=4s$  by using Laplace Transformation when S1 switch is closed.  
(Assuming that the initial condition is zero).

Dengan merujuk kepada Rajah A4(c), kirakan nilai arus  $i(t)$  pada  $t=4s$  dengan menggunakan Jelmaan Laplace bila S1 ditutup.  
(Anggap nilai permulaan adalah kosong).

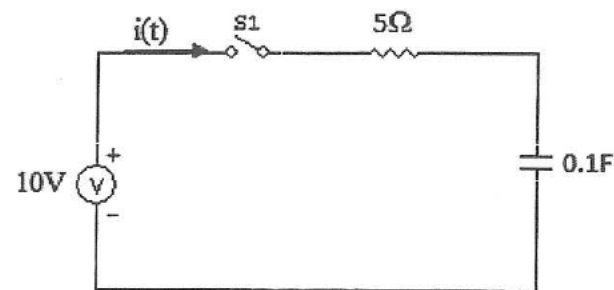


Figure A4(c) / Rajah A4(c)

[6 marks]  
[6 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.

## QUESTION 1

## SOALAN 1

CLO2  
C3

Write the analytical equation for the function  $V(t)$  in Figure B1, and then calculate the Trigonometric Fourier Series for the waveform.

Tuliskan persamaan analitik bagi fungsi  $V(t)$  dalam Rajah B1, dan seterusnya kirakan siri Fourier trigonomteri bagi fungsi itu.

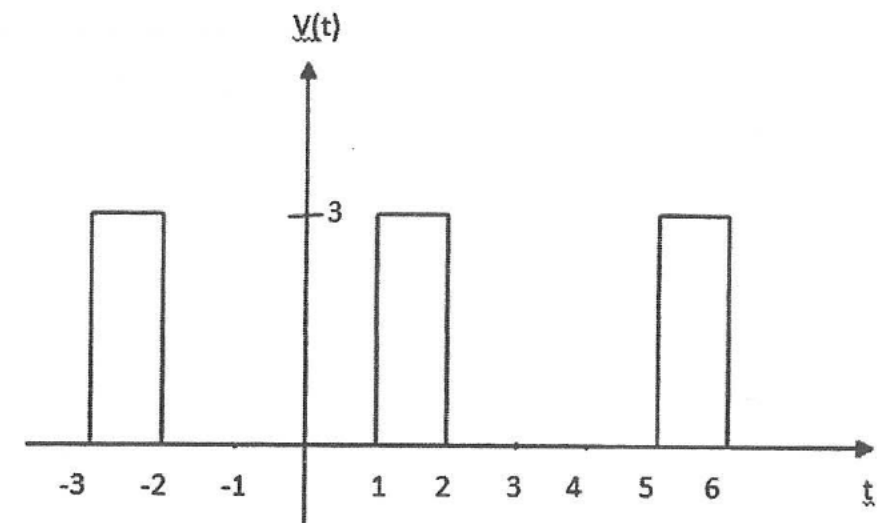


Figure B1 / Rajah B1

[20 marks]  
[20 markah]

## QUESTION 2

## SOALAN 2

CLO3  
C4

Based on the circuit in Figure B2, determine the current  $i(t)$  for  $t > 0$ , if  $C=1/3$  F,  $v_g(t)=6V$ ,  $i(0)=1A$ , and  $v_c(0)=1V$ .

Merujuk kepada litar dalam Rajah B2, tentukan arus  $i(t)$  bagi  $t > 0$ , jika  $C=1/3$  F,  $v_g(t)=6V$ ,  $i(0)=1A$  dan  $v_c(0)=1V$ .

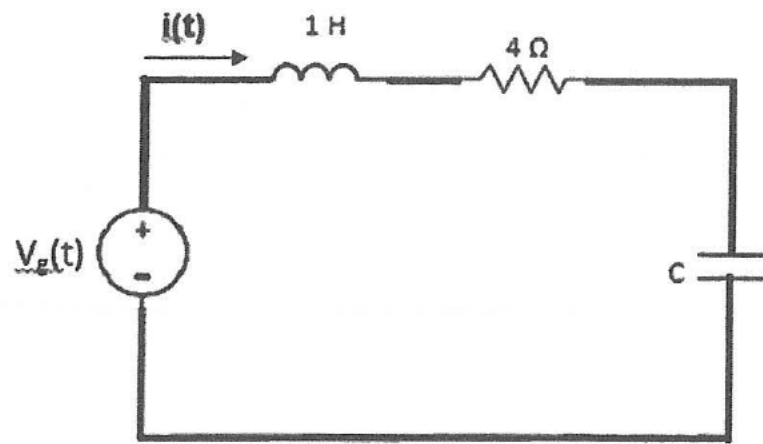


Figure B2 / Rajah B2.

[20 marks]  
[20 markah]

SOALAN TAMAT

## FORMULA

## Laplace transforms and the inverses

$f(t) = L^{-1}\{F(s)\}$	$F(s) = L\{f(t)\}$
$a$	$\frac{a}{s}$
$t^n, n=1,2,3,\dots$	$\frac{n!}{s^{n+1}}$
$e^{at}$	$\frac{1}{s-a}$
$\sin at$	$\frac{a}{s^2 + a^2}$
$\cos at$	$\frac{s}{s^2 + a^2}$
$\sinh at$	$\frac{a}{s^2 - a^2}$
$\cosh at$	$\frac{s}{s^2 - a^2}$
$e^{at} \sin bt$	$\frac{b}{(s-a)^2 + b^2}$
$e^{at} \cos at$	$\frac{s-a}{(s-a)^2 + b^2}$
$t^n e^{at}$	$\frac{n!}{(s-a)^{n+1}}$
$t^n f(t)$	$(-1)^n \frac{d^n}{ds^n} [F(s)]$
$e^{at} f(t)$	$F(s-a)$
$y'(t)$	$sY(s) - y(0)$
$y''(t)$	$s^2 Y(s) - sy(0) - y'(0)$
$\int_0^t f(t) dt$	$\frac{F(s)}{s}$

## Other Related Formula

Integration by Parts $\int_a^b u dv$	$uv - \int_a^b v du$
$V_R$	$Ri(t)$
$V_L$	$L \frac{di(t)}{dt}$
$V_C$	$\frac{1}{C} \int_0^t i(t) dt + V_C(0)$
$I_R$	$\frac{v(t)}{R}$
$I_C$	$C \frac{dv(t)}{dt}$
$I_L$	$\frac{1}{L} \int_0^t v(t) dt$