



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

**JABATAN KEJURUTERAAN ELEKTRIK**

**PEPERIKSAAN AKHIR  
SESI DISEMBER 2017**

**DEE6142 : CIRCUIT ANALYSIS**

**TARIKH : 08 APRIL 2018  
MASA : 8.30 PAGI - 10.30 PAGI (2 JAM)**

---

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

Bahagian A: Struktur ( 4 soalan)  
Bahagian B: Esei (2 soalan)

Dokumen sokongan yang disertakan : Formula

---

**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 struktur. Jawab **SEMUA** soalan

## QUESTION 1

## SOALAN 1

CLO1  
C1

- a) Define Kirchoff Current Law with an appropriate circuit.

*Takrifkan Hukum Arus Kirchoff dengan litar yang bersesuaian.*

[3 marks]

[3 markah]

CLO1  
C3

- b) Derive nodal voltage equations at node B and node C in **Figure A1(b)**.

*Terbitkan persamaan voltan nodal pada nod B dan nod C di dalam **Rajah A1(b)**.*

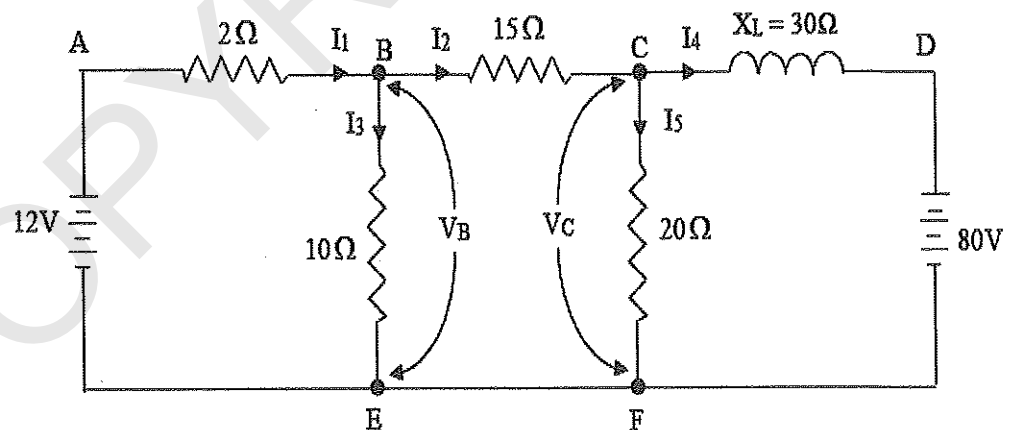


Figure A1(b)/ *Rajah A1(b)*.

[6 marks]

[6 markah]

CLO1  
C3

- c) Calculate current  $I_1$  using Mesh Analysis for the circuit in Figure A1(c) if the current of  $I_2$  is  $0.9 \angle -5.20$  A.

*Kira arus  $I_1$  menggunakan Analisis Mesh bagi litar di dalam Rajah A1(c) jika arus  $I_2$  ialah  $0.9 \angle -5.20$  A.*

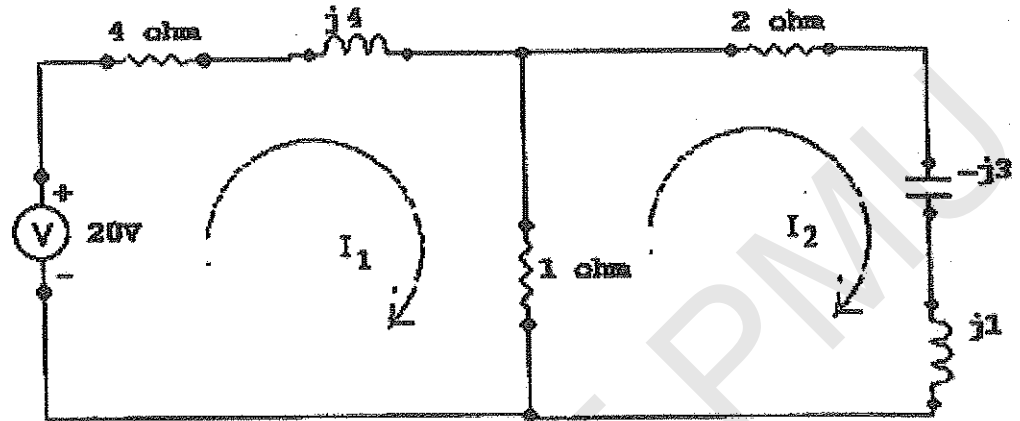


Figure A1 (c) / Rajah A1(c)

[6 marks]

[6 markah]

## QUESTION 2

## SOALAN 2

CLO1  
C1

- a) Draw the basic Thevenin Equivalent circuit with  $E_{TH} = (60 - j120)$  V and  $Z_{TH} = (0.8 - j1.6)\Omega$ .

*Lukis litar setara Thevenin asas dengan  $E_{TH} = (60 - j120)V$  dan  $Z_{TH} = (0.8 - j1.6)\Omega$ .*

[4 marks]

[4 markah]

CLO1  
C2

- b) By referring to QUESTION 2 (a), identify a Norton equivalent circuit with calculated Norton current  $I_N$ .

*Berdasarkan SOALAN 2 (a), kenalpasti litar setara Norton dengan kiraan arus Norton  $I_N$ .*

[5 marks]

[5 markah]

CLO1  
C3

- (c) Referring to Figure A2(c), when the current source  $15\angle 0^\circ$  A is OFF, the value of  $I_x' = (2.35 - j1.66)$  A. Calculate the value of  $I_x$  by using Superposition Theorem.

*Merujuk kepada Rajah A2(c), bila Bekalan Voltan  $15\angle 0^\circ$  A dimatikan, nilai*

*$I_x' = (2.35 - j1.66)$  A. Kira nilai  $I_x$  dengan menggunakan Teorem Superposition.*

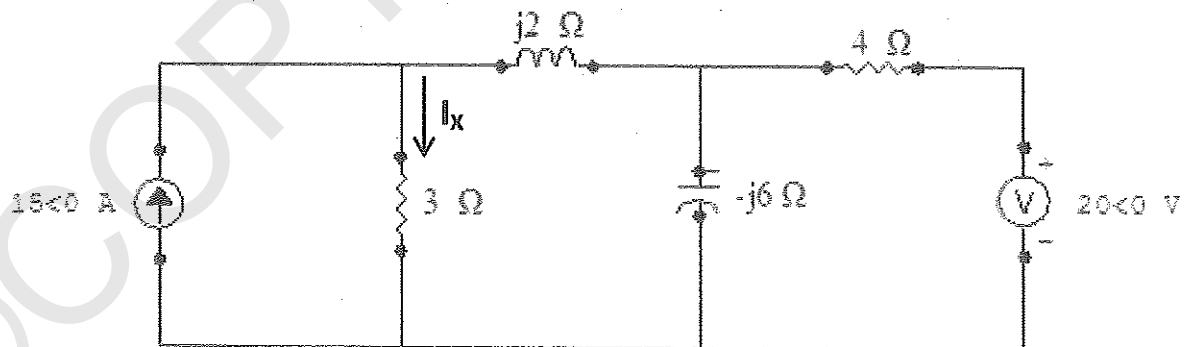


Figure A2(c) / Rajah A2(c)

[6 marks]

[6 markah]

## QUESTION 3

## SOALAN 3

CLO2  
C2

- a) Express the Fourier coefficient expressions of  $a_n$  by using the given analytical function.  
*Ungkapkan pekali Fourier bagi  $a_n$  menggunakan fungsi analitik yang diberi.*

$$f(t) = \begin{cases} \frac{6t}{T} & \text{for } 0 < t < \frac{T}{3} \\ 2 & \text{for } \frac{T}{3} < t < \frac{2T}{3} \\ \frac{-6t}{T} + 6 & \text{for } \frac{2T}{3} < t < T \end{cases}$$

[3 marks]  
[3 markah]CLO2  
C3

- b) Interpret the analytical function and the period for the waveform in Figure A3(b).  
*Tafsirkan fungsi analitik dan tempoh masa bagi gambarajah gelombang di Rajah A3(b)*

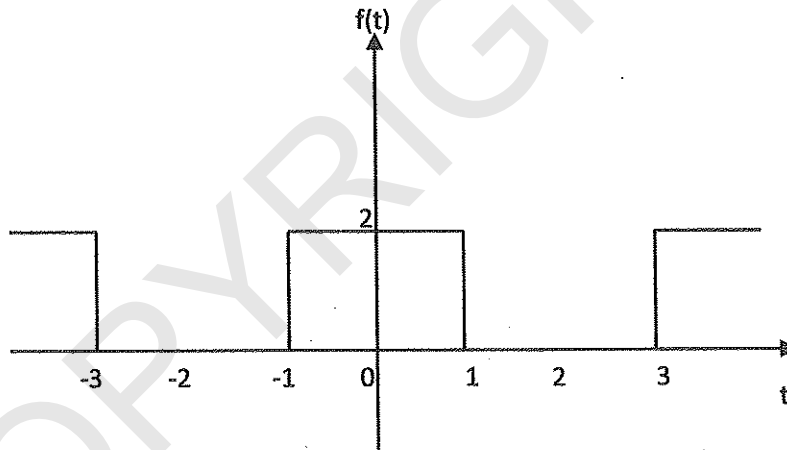


Figure A3(b) / Rajah A3(b)

[5 marks]  
[5 markah]

CLO2  
C4

- c) Transform the given analytical function into a graph of  $f(t)$  in the interval of  $\frac{-3T}{4} < t < \frac{3T}{4}$  and identify the coefficient expression of  $a_0$ .

*Tukarkan fungsi analitik yang diberi ke dalam bentuk graf  $f(t)$  di dalam julat*

*$\frac{-3T}{4} < t < \frac{3T}{4}$  dan kenalpasti ungkapan pekali  $a_0$ .*

$$f(t) = \begin{cases} 2, & \frac{-T}{4} < t < \frac{T}{4} \\ 1, & \frac{T}{4} < t < \frac{3T}{4} \end{cases}$$

[7 marks]

[7 markah]

## QUESTION 4

## SOALAN 4

CLO3  
C1

- a) Show a Laplace Transform for the given function.  
*Tunjukkan Jelmaan Laplace bagi fungsi yang diberi.*

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

[3 marks]

[3 markah]

CLO3  
C2

- b) Determine the Laplace Transform of  $f(t)$  by using Direct Integration Method.  
*Tentukan Jelmaan Laplace bagi  $f(t)$  dengan menggunakan Kaedah Kamilan Terus.*

$$f(t) = 2e^{-2t}$$

[6 marks]

[6 markah]

CLO3  
C2

- c) Determine the Inverse Laplace Transform of function  $F(s)$  by using partial fraction.  
*Tentukan Jelmaan Laplace Songsang bagi fungsi  $F(s)$  dengan menggunakan pecahan separa.*

$$F(s) = \frac{11-3s}{s^2+2s-3}$$

[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

Carry out the Trigonometric Fourier Series for the given waveform in Figure B1 and interpret the types of the function for the waveform.

Laksanakan Trigonometri Siri Fourier bagi gambarajah gelombang di Rajah B1 yang diberi dan kenalpasti jenis fungsi bagi gelombang tersebut.

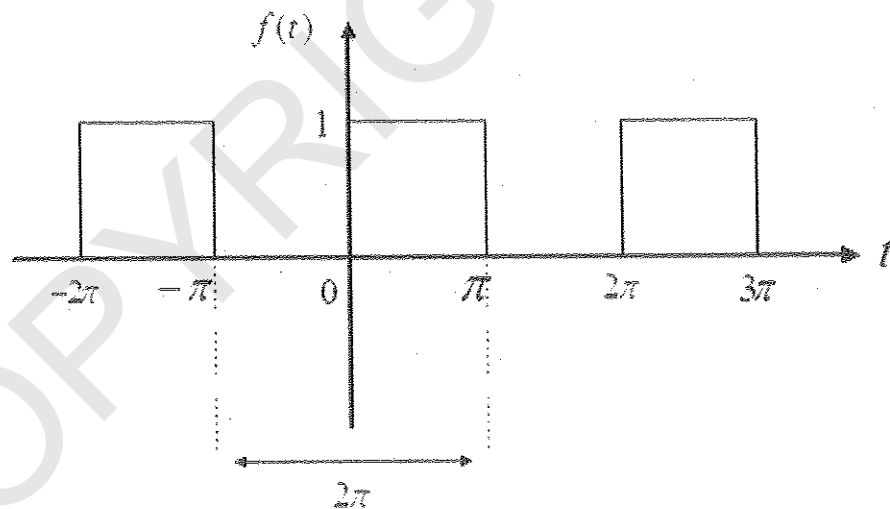


Figure B1/ Rajah B1

[20 marks]

[20 markah]

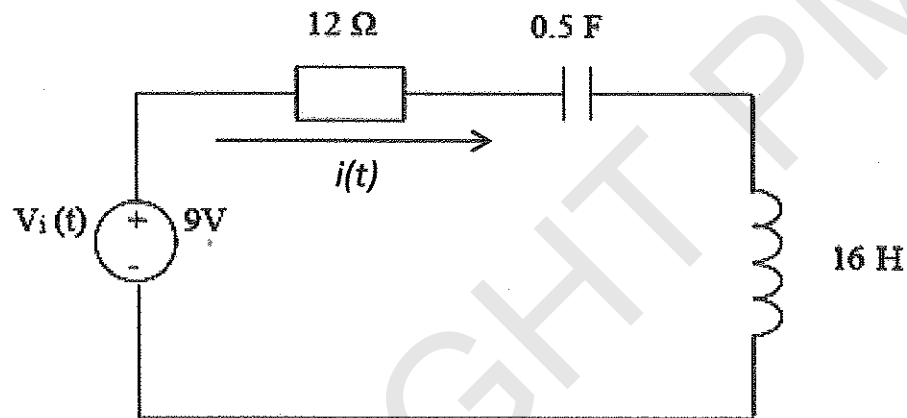
## QUESTION 2

## SOALAN 2

CLO3  
C4

Transform the circuit in **Figure B2** in s- domain, then calculate the current  $i(t)$  using Laplace transform method.

*Tukarkan litar dalam **Rajah B2** ke domain-s dan kemudian kirakan arus  $i(t)$  dengan menggunakan kaedah Jelmaan Laplace.*

Figure B2/ *Rajah B2*

[20 marks]

[20 markah]

SOALAN TAMAT

## FORMULA FOR DEE6142 CIRCUIT ANALYSIS

## Laplace transforms and the inverses

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

## FORMULA FOR DEE6142 CIRCUIT ANALYSIS

## Other Related Formula

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