4

DDPB

UTM UNIVERSITI TEKNOLOGI MALAYSIA

Sekolah Pendidikan Profesional dan Pendidikan Berterusan (UTMSPACE)

FINAL EXAMINATION / *PEPERIKSAAN AKHIR*
SEMESTER 1 – SESSION 2016 / 2017
PROGRAM KERJASAMA

COURSE CODE / *KOD KURSUS* : DDPE 2103

COURSE NAME / *NAMA KURSUS* : NETWORK AND SYSTEM / *SISTEM DAN RANGKAIAN*

YEAR / PROGRAMME / *TAHUN / PROGRAM* : 2 / DDPE / P / B

DURATION / *TEMPOH* : 2 HOURS 30 MINUTES / 2 *JAM 30 MIMIT*

DATE / *TARIKH* : OCTOBER 2016

INSTRUCTION/*ARAHAN* :

1. Answer **ALL** questions in the answer booklet provided.
   *Jawab **SEMUA** soalan di dalam buku jawapan yang disediakan.*

(You are required to write your name and your lecturer's name on your answer script)
(Pelajar dikehendaki tuliskan nama dan nama pensyarah pada skrip jawapan)

NAME / *NAMA*	:	.....
I.C NO. / *NO. K/PENGENALAN*	:	.....
YEAR / COURSE *TAHUN / KURSUS*	:	.....
COLLEGE NAME *NAMA KOLEJ*	:	.....
LECTURER'S NAME *NAMA PENSYARAH*	:	.....

This examination paper consists of ...9... pages including the cover
Kertas soalan ini mengandungi .....9..... muka surat termasuk kulit hadapan

Q1. The differential equation of the voltage across the capacitor v(t) in a second order circuit is given as

$$\frac{d^2v}{dt^2} + 12\frac{dv}{dt} + 36v = 200\sin t$$

Given that the initial voltage across the capacitor $v(0^-) = 2$ V and $\frac{dv}{dt}(0^+) = -12$ V/s. Find the voltage v(t) using transient analysis method.

Persamaan kebezaan bagi voltan melintangi kapasitor, v(t) dalam satu litar tertib kedua diberi sebagai

$$\frac{d^2v}{dt^2} + 12\frac{dv}{dt} + 36v = 200\sin t$$

Diberi voltan awal melintangi kapasitor $v(0^-) = 2$ *V dan* $\frac{dv}{dt}(0^+) = -12$ *V/s. Dapatkan voltan v(t) menggunakan kaedah analisis ubahtika.*

(15 marks / *markah*)

Q2. Referring to Figure Q2, the switch is at position X and the circuit is in steady state for $t < 0$. At $t = 0$, the switch is moved to position Y. Find the Laplace function of the current flowing through the inductor, I(s) for $t \geq 0$.

Merujuk kepada Rajah Q2, suis berada pada kedudukan X dan litar berada dalam keadaan mantap untuk $t < 0$. Pada $t = 0$, suis diubah ke kedudukan Y. Dapatkan fungsi Laplace bagi arus melalui induktor, I(s) untuk $t \geq 0$.

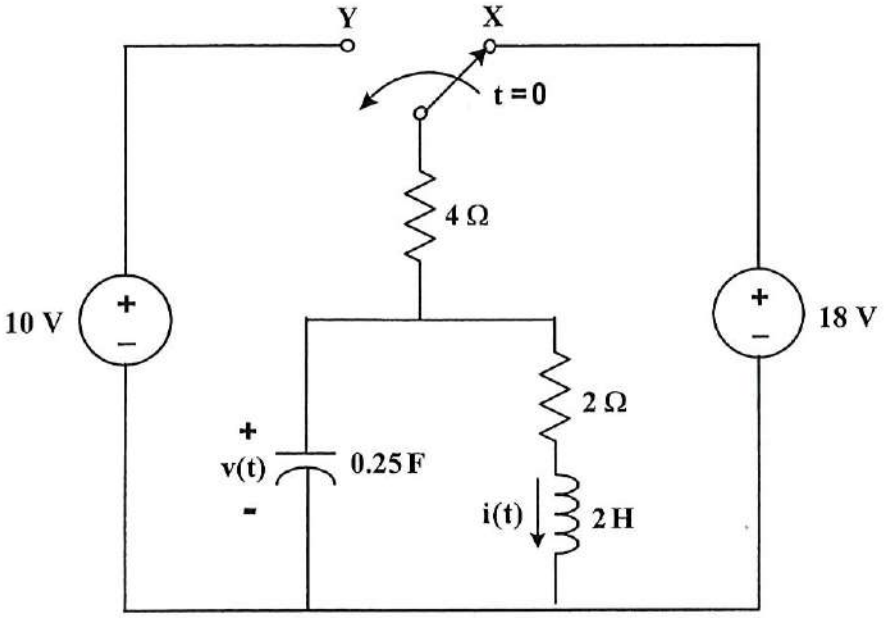

Figure Q2 / *Rajah Q2*

(15 marks / *markah*)

Q3. The transfer function that relates the output voltage across the capacitor, $V_o(s)$ to the input voltage, $V_i(s)$ is given as:

$$\frac{V_o(s)}{V_i(s)} = \frac{2(s^2+4s+10)}{s(s^2+9s+20)}$$

If $v_i(t) = 5e^{-5t}\ u(t)$ V, determine the output voltage across the capacitor, $v_o(t)$.

Rangkap pindah yang menghubungkan voltan keluaran melintangi kapasitor, $V_o(s)$ terhadap voltan masukan, $V_i(s)$ diberi sebagai:

$$\frac{V_o(s)}{V_i(s)} = \frac{2(s^2+4s+10)}{s(s^2+9s+20)}$$

Sekiranya $v_i(t) = 5e^{-5t}\ u(t)$ V, tentukan voltan keluaran melintangi kapasitor, $v_o(t)$.

(15 marks / *markah)*

Q4. Draw the magnitude Bode Plot for the following transfer function:

$$H(s) = \frac{(s+30)^2(s^2+128s+640000)}{3000s^2(s+10000)}$$

Use minimum frequency, ω = 1 rad/s and maximum frequency, ω = 100 krad/s.

Lukiskan Plot Bode magnitud untuk rangkap pindah berikut:

$$H(s) = \frac{(s+30)^2(s^2+128s+640000)}{3000s^2(s+10000)}$$

Guna frekuensi minima, ω = 1 rad/s dan frekuensi maksima, ω = 100 krad/s.

(12 marks / *markah*)

Q5. (a) Referring to Figure Q5(a), network 1 is connected to network 2. Determine the ABCD parameters

i) for network 1.

ii) for the whole circuit.

Merujuk pada Rajah Q5(a), rangkaian 1 disambungkan kepada rangkaian 2. Tentukan parameter ABCD

i) untuk rangkaian 1.

ii) untuk keseluruhan litar.

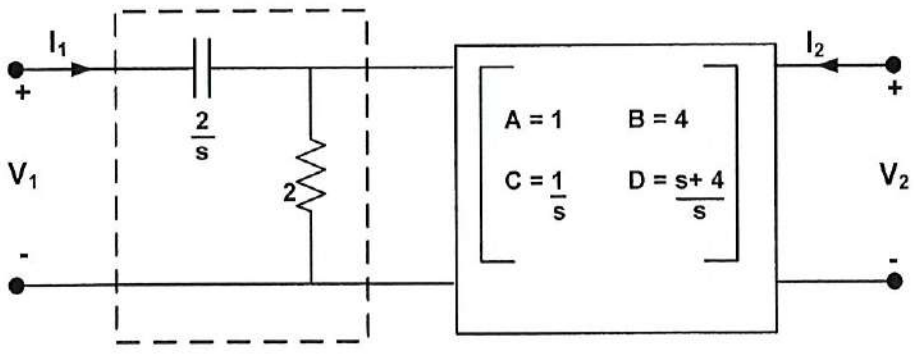

Figure Q5(a) / *Rajah Q5(a)*

(12 marks)

(b) A 2-port network is terminated as shown in Figure Q5(b). Determine the output voltage, V_2 and the output current, I_2.

Satu rangkaian 2 liang ditamatkan seperti ditunjukkan dalam Rajah Q5(b). Tentukan voltan keluaran V_2 dan arus keluaran I_2.

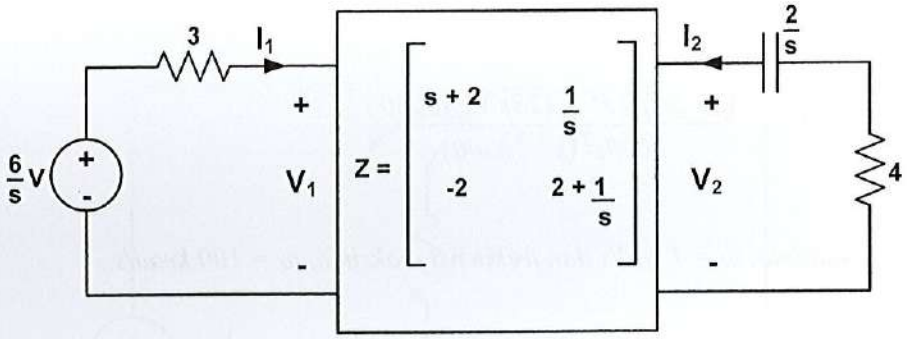

Figure Q5(b) / *Rajah Q5(b)*

(13 marks)

Q6. (a) Determine the trigonometric Fourier series for the waveform in Figure Q6(a) up to the 5th harmonics.

Tentukan siri Fourier trigonometrik untuk gelombang pada Rajah Q6(a) sehingga harmonik ke-5

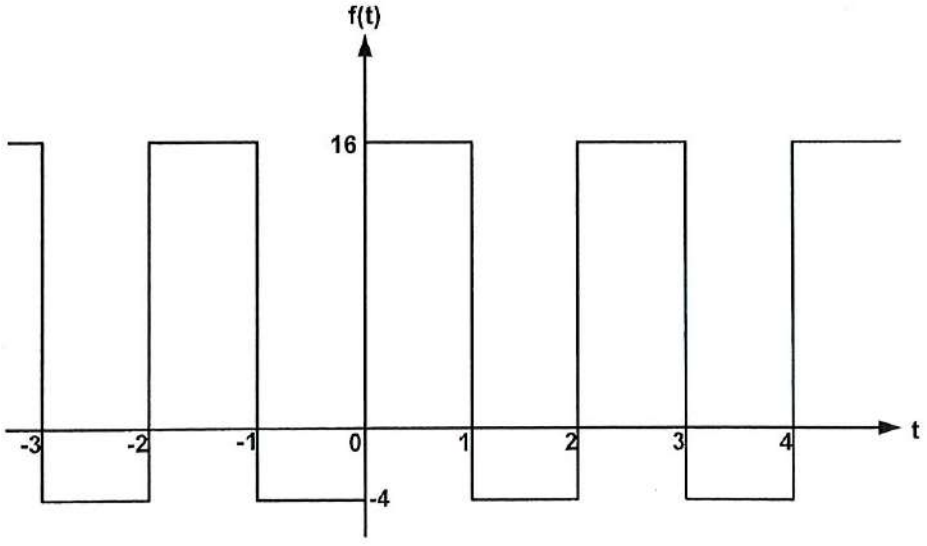

Figure Q6(a) / *Rajah Q6(a)*

(10 marks)

(b) The Fourier series of a current is given as follows :

$$i(t) = \frac{5}{7} + \sum_{n=odd}^{\infty}\left(\frac{8}{n\pi^2}\right)\cos n\omega t + \sum_{n=1}^{\infty}\left(\frac{(-1)^n}{n\pi}\right)\sin n\omega t$$

i) Expand the Fourier series for i(t) up to the 3rd harmonics.

ii) Determine the Fourier series of i(t) in its exponential form.

Siri Fourier untuk satu arus adalah diberi sebagai berikut:

$$i(t) = \frac{5}{7} + \sum_{n=odd}^{\infty}\left(\frac{8}{n\pi^2}\right)\cos n\omega t + \sum_{n=1}^{\infty}\left(\frac{(-1)^n}{n\pi}\right)\sin n\omega t$$

i) Kembangkan siri Fourier untuk i(t) sehingga harmonik ke-3.

ii) Tentukan siri Fourier untuk i(t) dalam bentuk eksponen.

(8 marks)

Laplace Transform Pairs

Function	$f(t)$	$F(s)$
Unit impulse	$\delta(t)$	1
Step function	$u(t)$	$\frac{1}{s}$
Constant	1	$\frac{1}{s}$
Ramp unit	$r(t) = t\,u(t)$	$\frac{1}{s^2}$
Parabola unit	$p(t) = \frac{1}{2}t^2 u(t)$	$\frac{1}{s^3}$
n^{th} integral of impulse	$\delta^{(-n)}(t)$	$\frac{1}{s^n}$
n^{th} derivative of impulse	$\delta^n(t)$	s^n
Power of t	$\frac{t^{n-1}}{(n-1)!}$	$\frac{1}{s^n}$
Exponential	e^{-at}	$\frac{1}{s+a}$
t-multiplication exponential	te^{-at}	$\frac{1}{(s+a)^2}$
Repeated t-multiplication exponential	$\frac{1}{(n-1)!}t^{n-1}e^{-at}$	$\frac{1}{(s+a)^n}$
Sine	$\sin \omega t$	$\frac{\omega}{s^2+\omega^2}$
Cosine	$\cos \omega t$	$\frac{s}{s^2+\omega^2}$
Damped sine	$e^{-at}\sin \omega t$	$\frac{\omega}{(s+a)^2+\omega^2}$
Damped cosine	$e^{-at}\cos \omega t$	$\frac{s+a}{(s+a)^2+\omega^2}$
t-multiplicated sine	$t\sin \omega t$	$\frac{2\omega s}{(s^2+\omega^2)^2}$
t-multiplicated cosine	$t\cos \omega t$	$\frac{s^2-\omega^2}{(s^2+\omega^2)^2}$

Forcing functions and their assumed solutions

Forcing function		Assumed solution
Constant	$f(t) = A$	$x_f(t) = K_2$
Exponential	$f(t) = Me^{\alpha t}$	