Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2015/2016

COURSE NAME	:	TRANSFORM CIRCUIT ANALYSIS
COURSE CODE	:	BEF 22803
PROGRAMME	:	BACHELOR OF ELECTRICAL ENGINEERING WITH HONOURS
EXAMINATION DATE	:	DECEMBER 2015 / JANUARY 2016
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTIONS PAPER CONSISTS OF **SEVEN (7)** PAGES

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Q1 (a) Sketch the waveforms of the following functions:

(i) $u(t) = \begin{cases} 0 & t < 2 \\ t+2 & t \geq 2 \end{cases}$

(3 marks)

(ii) $f(t) = 2u(t-2) + 3u(t-4) - 6u(t-6)$

(3 marks)

(iii) $g(t) = \sin(t)u(t-2\pi)$

(3 marks)

(b) Determine the piecewise function of signal *f(t)* shown in **Figure Q1(b)**.

(5 marks)

(c) Determine the normal mathematical function of signal *h(t)* in **Figure Q1(c)**.

(6 marks)

Q2 (a) Find $v_o(t)$ of the circuit shown in **Figure Q2(a)**. Use Laplace transformation to analyse the circuit in frequency (s) domain. Assume there is no initial condition on the inductor.

(10 marks)

(b) Find $v_o(t)$ in the circuit shown in **Figure Q2(b)**. At initial condition, the capacitor has a voltage of 5V. Use Laplace transformation to analyse the circuit in frequency (s) domain.

(10 marks)

Q3 (a) Graphically convolve *x(t)* and *y(t)* to find *z(t)*. You may solve the problem by either folding *x(t)* or *y(t)*. Provide *z(t)* in piecewise function and draw its signal. Signals *x(t)* and *y(t)* are shown in **Figure Q3**. Each step of the convolution will be given mark, therefore you must show your solution clearly.

(10 marks)

(b) Draw the Bode plots (magnitude and phase plots) of transfer function *H(s)*. Use logarithmic graph paper provided.

$$H(s) = \frac{800s}{(s+20)(s+400)}$$

(10 marks)

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Q4 (a) Sketch an example of odd symmetry signal.

(2 marks)

(b) Sketch an example of half-wave symmetry signal.

(2 marks)

(c) Determine the Fourier series of the waveform in **Figure Q4(c)**.

(16 marks)

Q5 (a) Estimate the first three terms of the current *i(t)* given in **Figure Q5(a)** if the input voltage is given by:

$$v(t) = \frac{40}{\pi}\sum_{n=1}^{\infty}\frac{sin(n314t)}{2n} - \frac{cos(n314t)}{n^2\pi^2}\ V$$

(10 marks)

(b) The current flow as shown in **Figure Q5(b)** is given by:

$$i(t) = 1.5\cos(314t + 60^o) + 0.6\cos(942t + 20^o)\ A$$

Estimate the input voltage supply (ignore the DC element) and determine the average power absorbed by the network.

(10 marks)

-END OF QUESTIONS-

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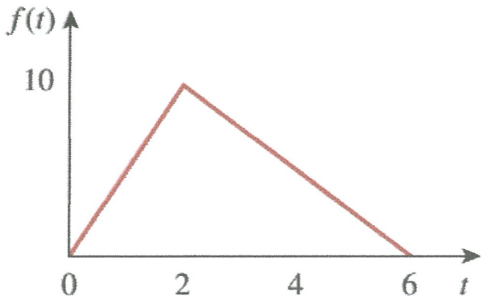

FIGURE Q1(b)

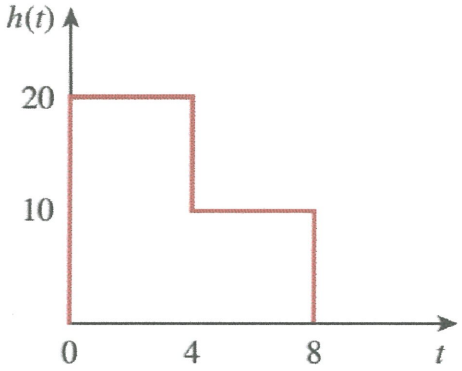

FIGURE Q1(c)

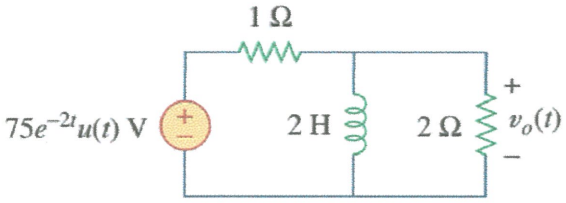

FIGURE Q2(a)

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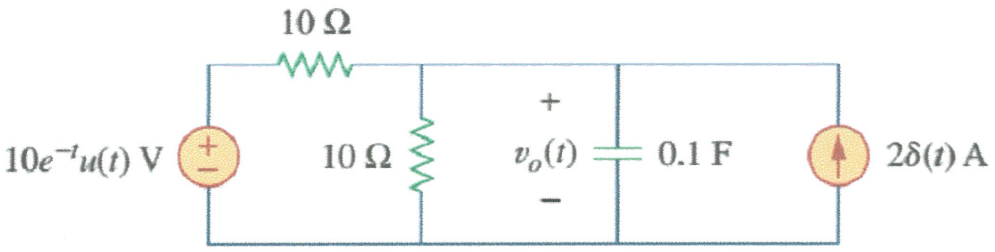

FIGURE Q2(b)

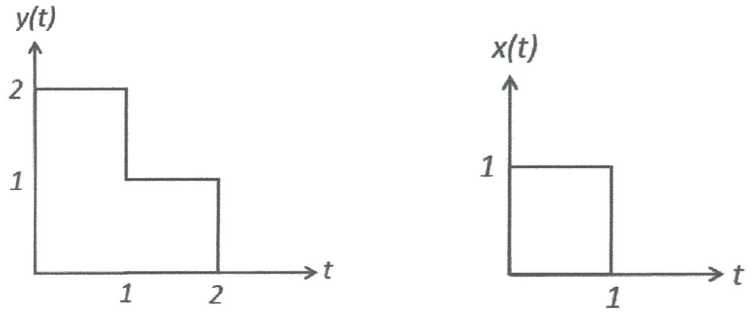

FIGURE Q3

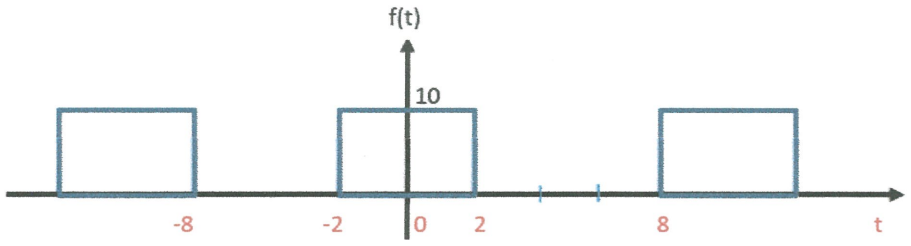

FIGURE Q4(c)

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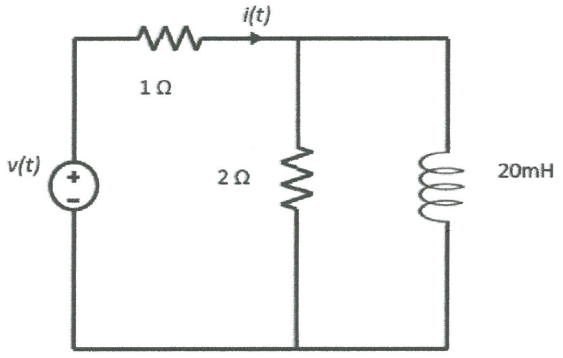

FIGURE Q5(a)

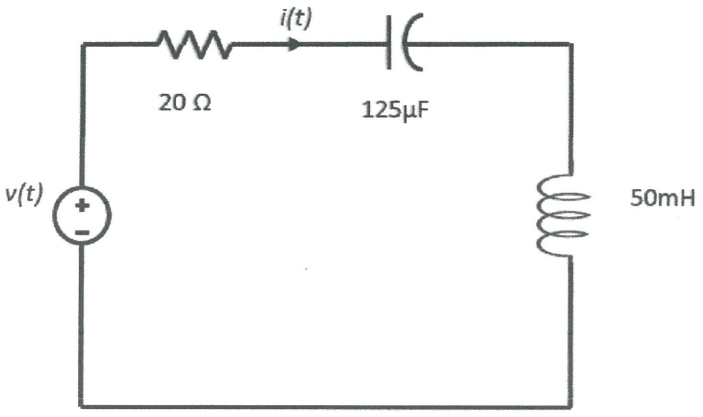

FIGURE Q5(b)

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TABLE 1: LAPLACE TRANSFORM TABLE

	$f(t)$	$F(s)$	
1	$\delta(t)$	1	
2	1	$\frac{1}{s}$	$s > 0$
3	t	$\frac{1}{s^2}$	$s > 0$
4	t^n, n=1,2,…	$\frac{n!}{s^{n+1}}$	$s > 0$
5	e^{at}	$\frac{1}{s-a}$	$s > a$
6	te^{-at}	$\frac{1}{(s-a)^2}$	
7	$\frac{t^n e^{-at}}{n!}$	$\frac{1}{(s-a)^{n+1}}$	
8	$\sin at$	$\frac{a}{s^2+a^2}$	$s > 0$
9	$\cos at$	$\frac{s}{s^2+a^2}$	$s > 0$
10	$e^{at}\sin bt$	$\frac{b}{(s-a)^2+b^2}$	$s > a$
11	$e^{at}\cos bt$	$\frac{s-a}{(s-a)^2+b^2}$	$s > a$
12	$y'(t)$	$sY(s)-y(0)$, and $Y(s)=L\{y(t)\}$	
13	$y''(t)$	$s^2Y(s)-sy(0)-y'(0)$	
14	$e^{at}f(t)$	$F(s-a)$	
15	$t^n f(t)$, n=1,2,…	$(-1)^n\frac{d^n}{ds^n}F(s)$	
16	$f(t)u(t-a)$	$e^{-as}L\{f(t+a)\}$	

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