UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2012/2013

COURSE NAME	:	TRANSFORM CIRCUIT ANALYSIS
COURSE CODE	:	BEF 22803
PROGRAMME	:	BEF
EXAMINATION DATE	:	JANUARY 2013
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTION	:	ANSWER **FIVE (5)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **NINE (9)** PAGES

Q1

$$f(t)=\begin{cases}4 & if\ \ 0<t<\pi \\ 0 & if\ \ \pi<t<2\pi \\ 3\sin t & if\ \ t>2\pi\end{cases}$$

(a) Given a piecewise function of f(t)
   (i) Define the function of f(t)
   (ii) Sketch the function of f(t)
   (iii) Formulate the Laplace Transform of F(s)

(6 marks)

(b) Explain the relationships between unit step and unit impulse function with the help of diagram.

(6 marks)

(c) Figure Q1(c) shows the impulse response $h(t)$ and input signal $u(t)$. Calculate the convolution of the two signals $h(t)$ and $u(t)$.

(8 marks)

Q2 (a) Solve the Laplace transform for the function h(t) given below.

$$h(t)=2\int_0^t (t-\tau)e^{2\tau}d\tau$$

(5 marks)

(b) In a circuit of Figure Q2(b), switch S is kept open for a long time and its closed at t=0.
   (i) Transform the circuit to Laplace transform circuit.
   (ii) Find $i_1(t)$ and $i_2(t)$ for $t \geq 0$.
   (iii) Formulate the voltage across 6Ω resistor $v_6(t)$.

(15 marks)

Q3 (a) Find the solution of the initial value problem given below.

$$y''+4y = g(t), \quad y(0)=3 \;\; y'(0)=-1$$

(5 marks)

(b) Figure Q3(b) shows the inductor of 2 henrys, resistor of 16Ω and a capacitor of 0.02 farads are connected in series with an e.m.f of E volts. At t=0 the charge on the capacitor and current in the circuit are zero. If E=300 volts, calculate,

(i) the charge, Q and

(ii) current, I

at any time t>0.

(15 marks)

Q4 (a) In the circuit of Figure Q4(a), switch S_1 closes at t=0, while at the same time same time, switch S_2 opens. Given that $v_c(0^-)=3V$.

(i) Sketch the s-domain equivalent circuit.

(ii) By using Laplace transform method, calculate $V_{out}(t)$ for t>0

(10 marks)

(b) Figure Q4(b) shows the circuit consist of R_1 and R_2 which value are 20Ω and 80Ω respectively. The value of capacitor is 0.125 F.

(i) Evaluate the Fourier transform of $v_i(t)$.

(ii) Calculate the value of $v_o(t)$.

(10 marks)

Q5 (a) Figure Q5(a) shows the periodic signal f(t).

(i) Formulate the Fourier series for the periodic function

(ii) Sketch the amplitude and phase spectra.

(10 marks)

(b) The circuit shown in Figure Q5(b) is supplied by the voltage source of $v_s(t) = 12e^{-2t}$ V. Calculate,

(i) the energy delivered by the source voltage

(ii) the energy dissipated by 4Ω resistance.

(iii) the percentage of source energy transferred to the load.

(iv) the percentage of the energy content in 4Ω resistor if the frequency $v_o(t)$ is between $0 \leq \omega \leq 2$ rad/s

(10 marks)

-END OF QUESTIONS-

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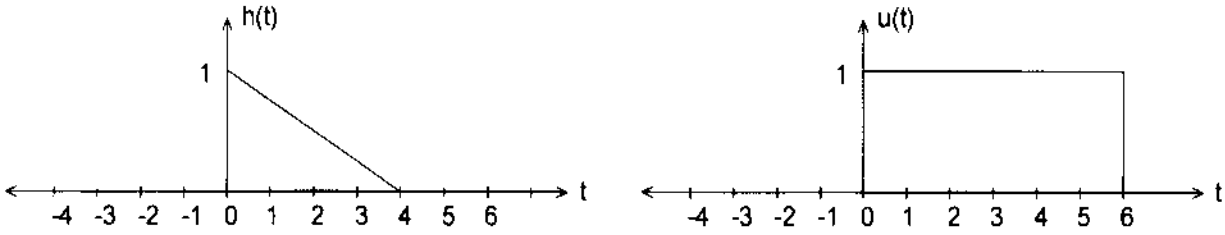

FIGURE Q1(c)

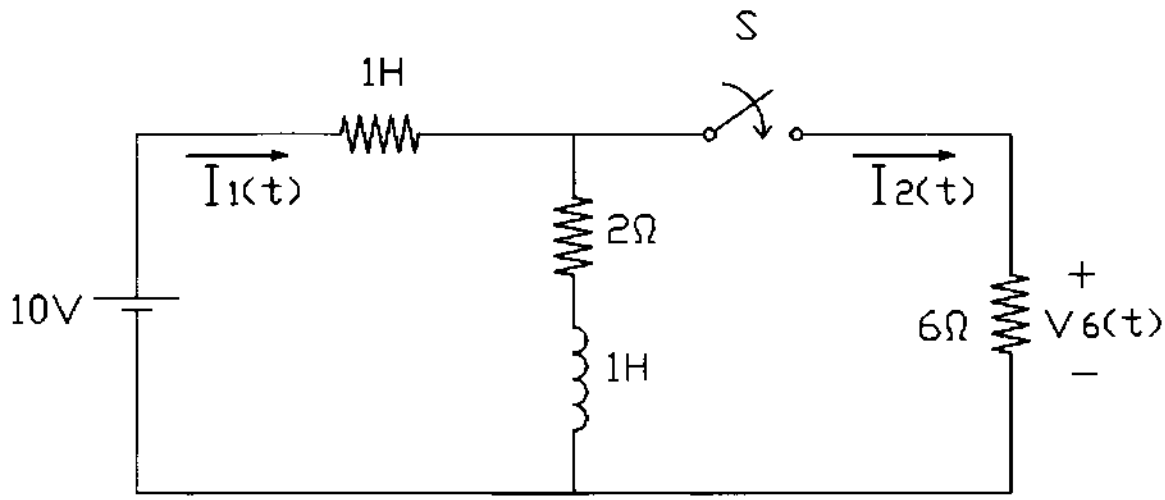

FIGURE Q2(b)

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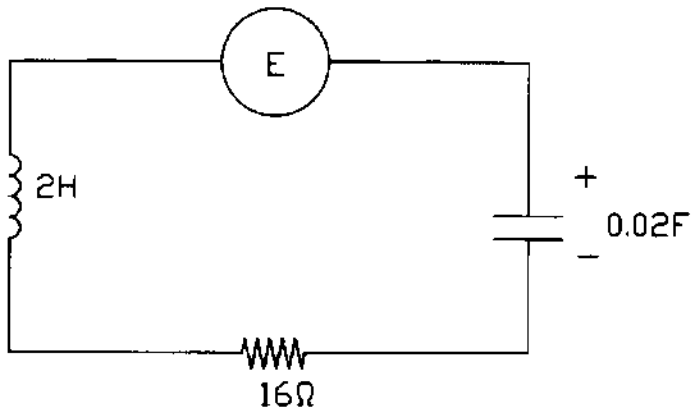

FIGURE Q3(b)

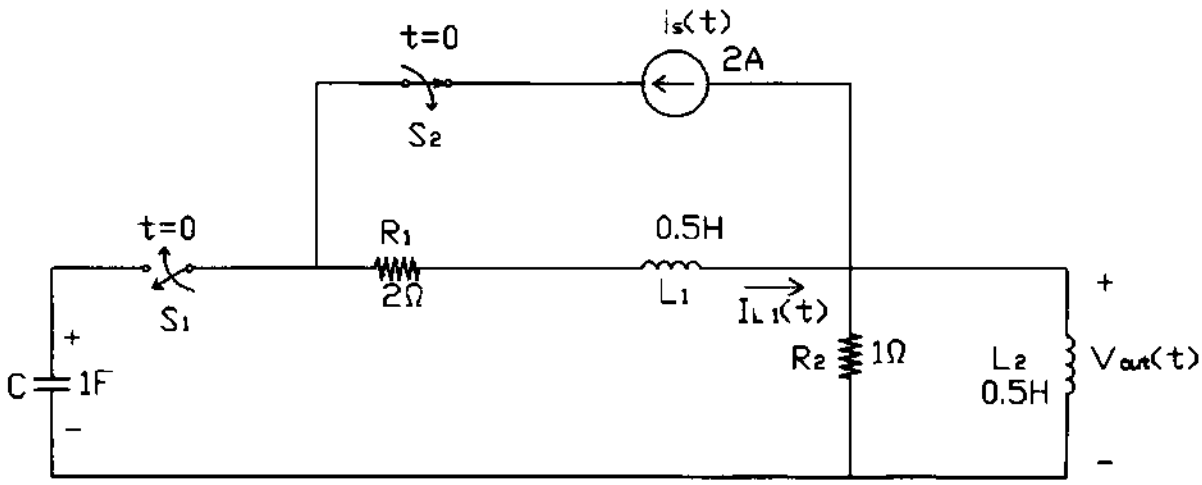

FIGURE Q4(a)

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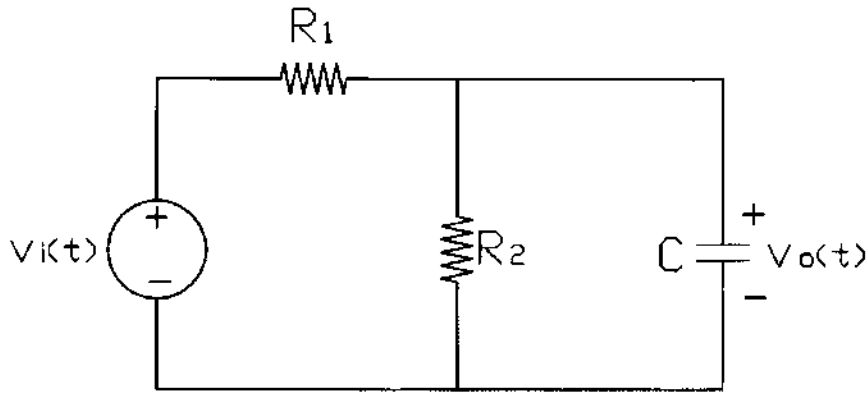

FIGURE Q4(b)

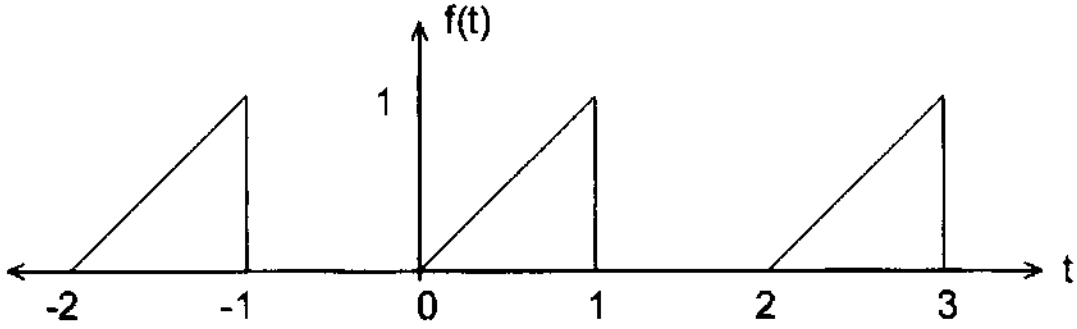

FIGURE Q5(a)

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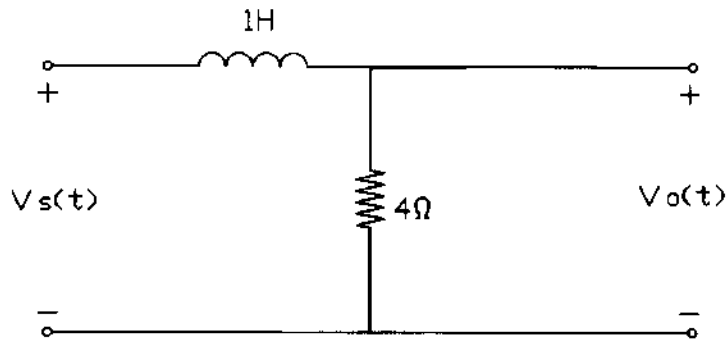

FIGURE Q5(b)

Laplace Transform Table

	$f(t)$	$F(s)$	
1	1	$\frac{1}{s}$	$s > 0$
2	t	$\frac{1}{s^2}$	$s > 0$
3	t^n, n=1,2,…	$\frac{n!}{s^{n+1}}$	$s > 0$
4	e^{at}	$\frac{1}{s-a}$	$s > a$
5	sin at	$\frac{a}{s^2+a^2}$	$s > 0$
6	kos at	$\frac{s}{s^2+a^2}$	$s > 0$
7	sinh at	$\frac{a}{s^2-a^2}$	$s > \|a\|$
8	kosh at	$\frac{s}{s^2-a^2}$	$s > \|a\|$
9	e^{at} sinbt	$\frac{b}{(s-a)^2+b^2}$	$s > a$

10	$e^{at}\cos bt$	$\frac{s-a}{(s-a)^2+b^2}$	$s > a$
11	$t^n e^{at}$	$\frac{n!}{(s-a)^{n+1}}$	$s > a$
12	$t \sin at$	$\frac{2as}{(s^2-a^2)^2}$	$s>0$
13	$t \cos at$	$\frac{s^2-a^2}{(s^2+a^2)^2}$	$s>0$
14	$t \sinh at$	$\frac{2as}{(s^2-a^2)^2}$	$s > \lvert a\rvert$
15	$t \cosh at$	$\frac{s^2+a^2}{(s^2+a^2)^2}$	$s > \lvert a\rvert$
16	$y'(t)$	$sY(s)-y(0)$, and $Y(s) = L\{y(t)\}$	
17	$y''(t)$	$s^2Y(s)-sy(0)-y'(0)$	
18	$e^{at} f(t)$	$F(s-a)$	
19	$t^n f(t)$, $n=1,2,\ldots$	$(-1)^n \frac{d^n}{ds^n} F(s)$	
20	$\mu_a(t) f(t)$	$e^{-as} L\{f(t+a)\}$	
21	$\mu_a(t) f(t+a)$	$e^{-as} L\{f(t)\}$	
22	$f(t)$	$\frac{\int_0^{p} e^{-st} f(t)dt}{1-e^{-ps}}$	
23	$\int f(\tau)g(t-\tau)d\tau$	$F(s)G(s)$	
24	$\int f(\tau)d\tau$	$\frac{1}{s}F(s)$	