UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2012/2013

COURSE NAME	:	TRANSFORM CIRCUIT ANALYSIS
COURSE CODE	:	BEF 22803
PROGRAMME	:	2 BEF
EXAMINATION DATE	:	JUNE 2013
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

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

Q1 (a) Figure Q1(a) shows the output voltage at a converter. Write the equation using the step function formula for Figure Q1(a).

(5 marks)

(b) Express the function of $f(t) = \sin(\omega t)$ is equal to $\frac{\omega}{s^2+\omega^2}$.

(5 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 $u(t)$.

(10 marks)

Q2 (a) Solve the Laplace transform of each of the following function:

(i) $f(t) = 40e^{-8(t-3)}u(t-3)$.

(ii) $f(t) = (5t-10)[u(t-2) - u(t-4)] + (30-5t)[u(t-4) - u(t-8)] + (5t-50)[u(t-8) - u(t-10)]$.

(10 marks)

(b) Determine the inverse transform for the function,

$$V(s) = \frac{2}{s^3 + 12s^2 + 36s}.$$

(10 marks)

Q3 (a) Figure Q3(a) shows the electrical circuit for a typical electric system.

(i) Determine the transfer function for $H(s) = \frac{V_o(s)}{I_g(s)}$.

(ii) Show the poles and zeros value for *H(s)*.

(iii) Plot the locations of the poles and zeros in root locus plant and with stability explanation.

(10 marks)

(b) The numerical expression for a transfer function is

$$\frac{v_o}{v_i} = \frac{110s}{(s+10)(s+100)}.$$

(i) Draw the bode diagram for the amplitude for the transfer function given above.

(ii) Calculate the amplitude of $v_o(t)$ in steady state if the $v_i(t) = 5\cos(500t + 15^0)$.

(10 marks)

Q4 (a) The Fourier transform of f(t) is given by,

$$\begin{aligned} F(\omega) &= 0, \quad -\infty \le \omega < -2; \\ F(\omega) &= 2, \quad -2 < \omega < -1; \\ F(\omega) &= 1, \quad -1 < \omega < 1; \\ F(\omega) &= 2, \quad 1 < \omega < 2; \\ F(\omega) &= 0, \quad 2 < \omega < \infty. \end{aligned}$$

Evaluate *f(t)* for functions above

(7 marks)

(b) Figure Q4(a) shows the circuit consists of R and C with the value of 1000 Ω and 0.1uF respectively. The input voltage $V_s(t)$ to the source is shown in Figure Q4(b).

(i) Developed the Fourier series of the input ramp voltage waveform shown in Figure Q4(b).

(ii) Solve the RMS value of the capacitor voltage, v(t) for Figure Q4(a).

(13 marks)

Q5 (a) The current in a 40Ω resistor is given by $i = 20e^{-2t}u(t)A$. By using the Parseval theorem calculate the total energy dissipated in the resistor which can be associated with the frequency band of $0 \leq \omega \leq 2\sqrt{3}$ rad/s.

(8 marks)

(b) The input voltage to the low pass RC filter shown in Figure Q5(b) is

$$v_i(t) = 15e^{-5t}u(t).$$

(i) Find the percentage of the 1Ω energy available in the input signal is available in the output signal.

(ii) Calculate the percentage of the output energy is associated with the frequency range of $0 \leq \omega \leq 10$ rad/s.

(12 marks)

-END OF QUESTIONS-

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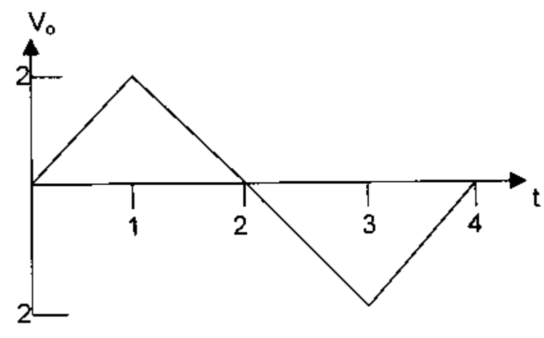

FIGURE Q1(a)

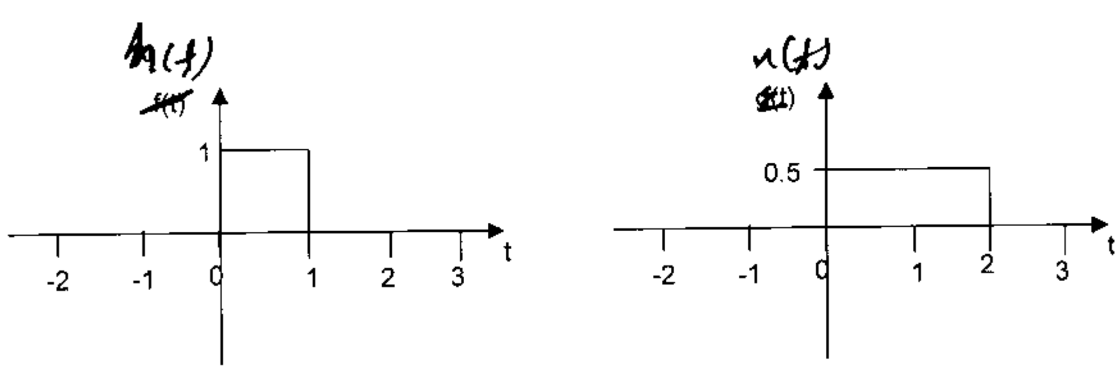

FIGURE Q1(c)

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11	$t^n e^{at}$	$\dfrac{n!}{(s-a)^{n+1}}$	$s > a$
12	$t \sin at$	$\dfrac{2as}{(s^2-a^2)^2}$	$s>0$
13	t kos at	$\dfrac{s^2-a^2}{(s^2+a^2)^2}$	$s>0$
14	$t \sinh at$	$\dfrac{2as}{(s^2-a^2)^2}$	$s > \lvert a \rvert$
15	t kosh at	$\dfrac{s^2+a^2}{(s^2+a^2)^2}$	$s > \lvert a \rvert$
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	$t^n f(t)$, $n=1,2,...$	$(-1)^n \dfrac{d^n}{ds^n}F(s)$	
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	$f(t)$	$\dfrac{\int_0^p e^{-st}f(t)dt}{1-e^{-ps}}$	
23	$\int_0^t f(\tau)g(t-\tau)d\tau$	$F(s)G(s)$	
24	$\int_0^t f(\tau)d\tau$	$\dfrac{1}{s}F(s)$	