UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2012/2013

COURSE NAME	:	SIGNALS AND SYSTEMS
COURSE CODE	:	BEB 20203
PROGRAMME	:	BEB
EXAMINATION DATE	:	JUNE 2013
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FIVE (5)** QUESTIONS ONLY

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

Q1 (a) Prove the $x(t)$ given below is a periodic signal. Then, calculate the fundamental period.

$$x(t) = 3\cos\left(5t + \frac{\pi}{6}\right)$$

Hint: For any integer value of M, $\cos(\theta + 2\pi M) = \cos\theta$

(6 marks)

(b) A continuous-time signal is given as $x(t) = 3 + 2t + 5t^2$. Examine the Even and Odd part of the signal above.

(8 marks)

(c) Given the continuous-time signal $x(t)$, as depicted in Figure Q1. Illustrate:

(i) $x_a(t) = 2x(t)$

(3 marks)

(ii) $x_b(t) = x(2t)$.

(3 marks)

Q2 (a) State whether the following systems are time invariant or not.

(i) $y(t) = 3x(t^2)$

(ii) $y(t) = 3x^2(t)$

(8 marks)

(b) Test the following systems for linearity.

(i) $y(t) = t\,x(t)$

(ii) $y(t) = x^2(t)$

(8 marks)

(c) Given that y(t) = x(t) + 2x(3 – t). Distinguish the causality of the system.

(4 marks)

Q3 (a) Determine the trigonometric form of Fourier series of the waveform shown in Figure Q3.

(14 marks)

(b) For an Exponential form Fourier series, the C_0 is given as $\frac{A}{2}$ and $C_n = \frac{jA}{2n\pi}$. For a given value A = 20, plot the double sided magnitude and phase spectrum diagram for a given value of n from -3 to 3.

(6 marks)

Q4 (a) Fourier Transform gives an unique and powerful way to view electromagnetic waveform such as sound waves, satellite broadcasting signal etc. Define Fourier Transform of a continuous-time signal, $x(t)$.

(6 marks)

(b) By using the Fourier Transform, calculate the convolution of $x_1(t) = e^{-2t}\,u(t)$ and $x_2(t) = e^{-6t}u(t)$.

(14 marks)

Q5 (a) The impulse response of a system is given as;

$$h(t) = 2e^{-3t}u(t)$$

By using Fourier Transform, formulate the response of the system for given input $x(t) = 2e^{-5t}\,u(t)$.

(10 marks)

(b) Let $x(t) = e^{-at}\,u(t)$, where $a > 0$ and

$= e^{-at}$ for $t \geq 0$.

By using Laplace Transform, plot the Region of Convergence (ROC) diagram.

(10 marks)

Q6 (a) By referring to Figure Q6, calculate the Laplace Transform of that periodic square wave.

(10 marks)

(b) The impulse response of a system is given as;

$$h(t) = (2+t)e^{-3t}u(t)$$

Evaluate the transfer function of the system above.

(10 marks)

- END OF QUESTION -

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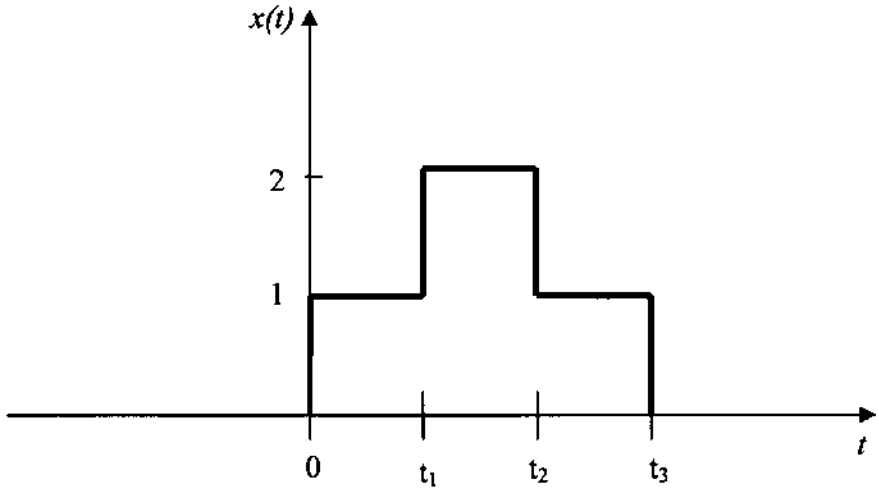

FIGURE Q1

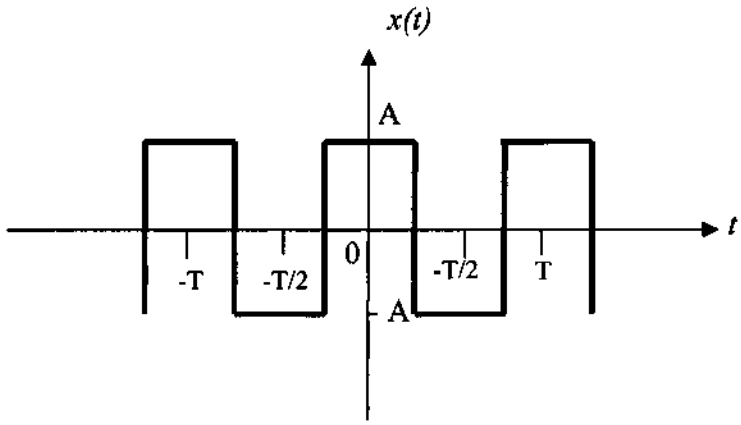

FIGURE Q3

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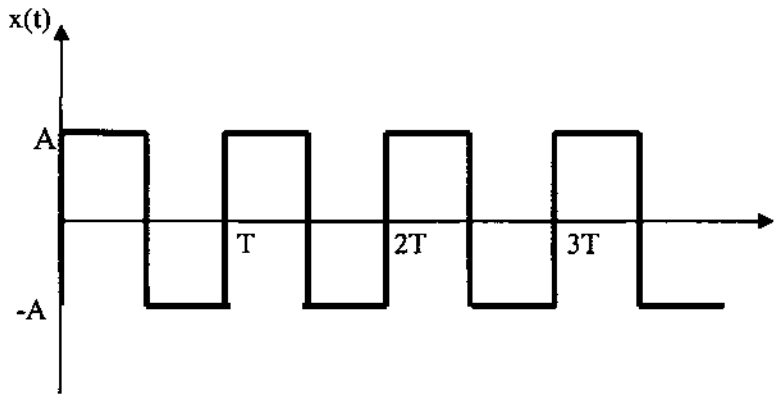

FIGURE Q6

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Some useful Laplace Transform pairs

1) $L\{e^{-at}u(t)\} = \frac{1}{s+a}$, $L\{t\,u(t)\} = \frac{1}{s^2}$

2) If $L\{x(t)\} = X(s)$, then $L\{e^{-at}x(t)\} = X(s+a)$

3) $s = \sigma + j\omega$

Fourier Transform

1) $F\{e^{-at}u(t)\} = \frac{1}{j\omega + a}$