KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS
ELECTRICAL ENGINEERING DEPARTMENT
SEMESTER 122

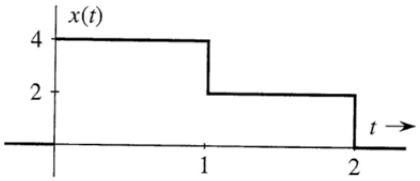
EE 207 MAJOR EXAM II
DATE: WEDNESDAY 20/04/2013
TIME: 7:00 - 8:30 PM

ID:	**NAME: Key**	**SER:**	**SECTION:**

	Maximum Score	**Score**
Problem 1	**16**	
Problem 2	**13**	
Problem 3	**11**	
TOTAL	**40**	

Problem 1:

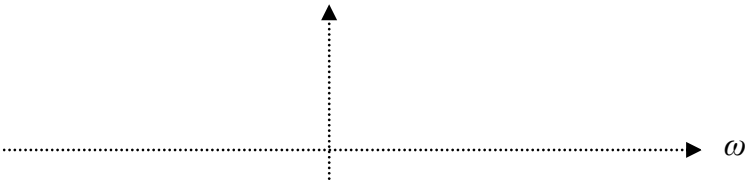
a) (3 marks) Using the Fourier Integral definition, find the Fourier Transform of the shown signal

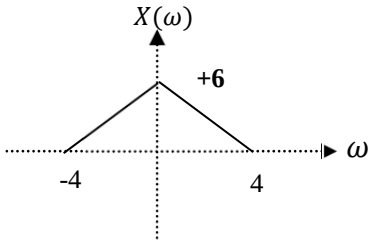


b) (3 marks) A signal $x(t)$, has the spectrum shown in the figure, Sketch the spectrum of the following signal.

$$x(t)(1 + 0.5e^{j8t})$$

Show all important values on both amplitude and frequency axes.



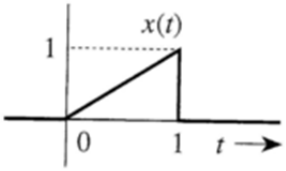


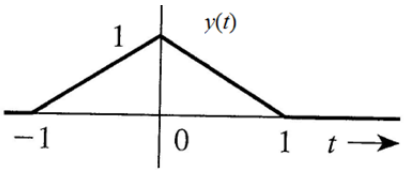
c) (2 marks) Find the Inverse Fourier Transform of the following signal $X(\omega) = e^{-a|\omega|}$.

d) (4 marks) The Fourier transform of the triangular pulse $x(t)$ shown is expressed as

$$X(\omega) = \frac{1}{\omega^2}\left(1 + e^{-j\omega} + j\omega e^{-j\omega}\right)$$

Using this information and the Fourier transform properties, find the Fourier transform of $y(t)$ shown in the figure.





e) (4 marks) An input signal, $x(t) = 4e^{-3t}u(t)$, is applied to a system whose impulse response is $h(t) = 5e^{-3t}u(t)$. Use the Fourier transform to find the out of the system, $y(t)$.

Problem 2:

a) A signal $x(t)$ is given by: $x(t) = 2 + 4cos(6\pi t) - 8sin(15\pi t)$

i. **(1 mark)** Determine the fundamental frequency ω_0 of the signal $x(t)$.

ii. **(3 marks)** Determine the Complex Fourier Series coefficients, C_{kx}, of $x(t)$

iii. **(2 marks)** Determine the magnitudes and phases of the coefficients C_{kx}

iv. **(1 mark)** Plot the magnitude spectrum of $x(t)$

v. **(3 marks)** $x(t)$ is passed through a lowpass filter with frequency response given by:

$$H(\omega) = \frac{4}{3 + j\omega}$$

Determine the Complex Fourier Series coefficients for the output signal, C_{ky}, of $y(t)$.

b) **(3 marks)** The Complex Fourier Series coefficients of a periodic signal, $x(t)$, are given as:

$$C_0 = 5, and\ C_k = \frac{j10}{2\pi k}, \quad k = \pm 1, \pm 2, \ldots$$

The signal $x(t)$ is transformed into $y(t)$ using the following expression:

$$y(t) = 2x(3t) + 4$$

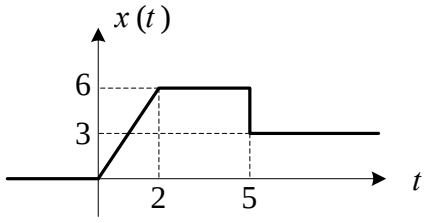
Determine the Complex Fourier Series coefficients of $y(t)$, C_{ky}

Problem 3:

i. **(2 marks)** Laplace transform of the signal $x(t)$ is given by $X(s) = 10se^{-3s}$. Find the Laplace transform $Y(s)$ of the signal $y(t) = tx(t)$.

ii. **(3 marks)** The Laplace transform of the signal $x(t)$ is given by $X(s) = \frac{2s-1}{s^2+6}$. Find the Laplace transform $Y(s)$ of the signal $y(t) = 3e^{-5t}x(0.25t)$.

iii. **(4 marks)** Find the Laplace transform of the signal $x(t)$ shown in the figure.



iv. **(2 marks)** Find the inverse Laplace transform of $X(s) = \frac{300e^{-2s}}{s^2+100}$.