BIRZEIT UNIVERSITY

BIRZEIT UNIVERSITY
Faculty of Engineering
Electrical Engineering Department
Signals and Systems - ENEE334
Final Exam

Instructors: Mr. Ashraf Al-Rimawi **Jan.17, 2013**

Problem 1 (20 pts):

For the following systems

a. $y(t) = x(t+2)\sin(\omega t + 2),\ \ \omega \neq 0$

b. $y(t) = \int_t^{t+1} x(\lambda)d\lambda$

c. $y(t) = \sqrt{x^2(t)}$

d. $y(t) = \begin{cases} 0 & x(t) < 0 \\ x(t) + x(t-2) & x(t) \geq 0 \end{cases}$

Determine whether the systems are linear, time-invariant, and causal? Justify your answers.

Problem 2 (20 pts):
Consider the following continuous-time periodic signal $x(t)$,

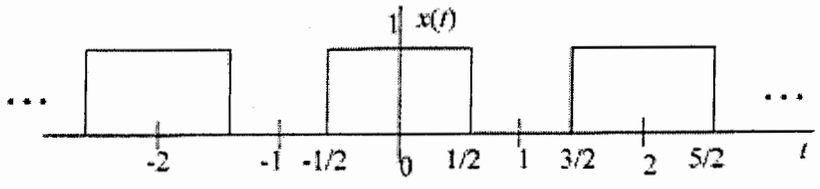

Fig 1

Is filtered with a filter of impulse response $h(t) = \cos(3\pi t)\ sinc(2t)$ as shown in Fig2

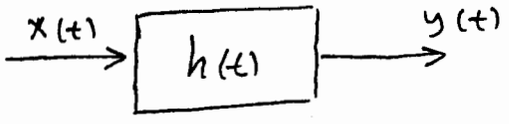

Fig 2

a. Determine the Complex Fourier series coefficient X_n of the signal $x(t)$

b. Determine the Trigonometric Fourier series coefficients

c. Sketch the exponential fourier series spectra of the signal $x(t)$

d. For the Linear-Time invariant systems (LTI) shown in Fig 2. Sketch $X(f)$, $H(f)$, and $Y(f)$

e. What is the power of the $x(t)$

Problem 3 (20pts):

A. Consider a system with the relationship of its input and output is given by

$$y(t) = \int_0^t e^{-\tau} x(t-\tau) d\tau$$

1. Find the system impulse response $h(t)$ of the system
2. Determine the output $y(t)$ of the system if the input $x(t) = u(t+1)$

B. Consider the system shown in fig 3 and the spectrum $X(f)$ of an input $x(t)$ is shown in Fig 3

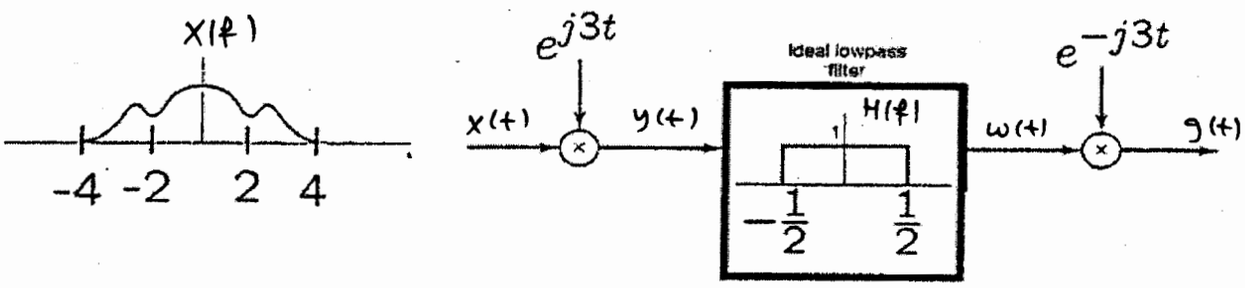

Fig 3

Sketch the spectrum of $Y(f)$, $W(f)$, and $G(f)$

Problem 4 (20 pts):

The signal

$$x(t) = 3 + 4\cos(10\pi t) + 5\cos(14\pi t) + 2\cos(20\pi t)$$

Is sampled at a rate of 30 samples per second. Plot the spectrum of the sampled signal showing all components for $|f| < 80$. Fully explain how $x(t)$ can be reconstructed from the samples.

Problem 5 (20 pts):

Convolve $h(nT)$ and $x(nT)$ shown in Fig 4

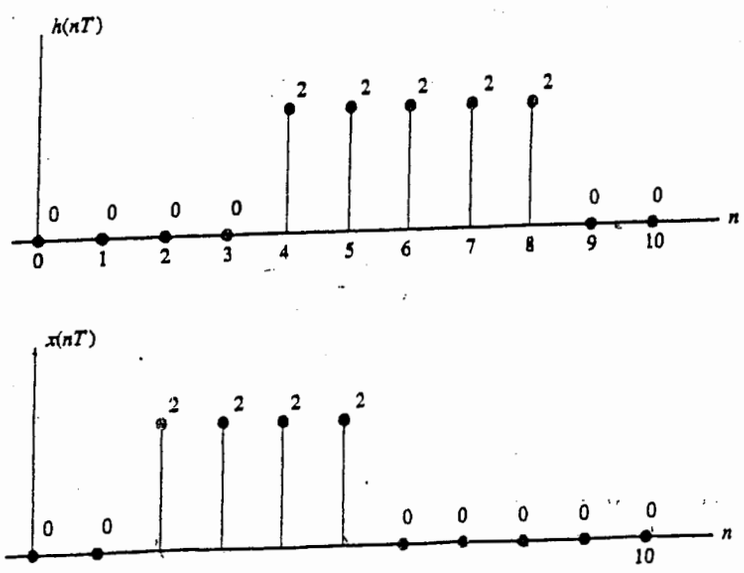

Fig 4