Name: _____ **Student ID:**_____

Signals and Systems Homework 5

Due Time: 23:59 April 20, 2018

1. (15)Suppose $g(t) = x(t)cos(t)$ and the Fourier transform of the $g(t)$ is

$$G(jw) = \begin{cases} 1, |w| \leq 2 \\ 0, else \end{cases}$$

   (a) Determine $x(t)$ Draw the frequency domain.

   (b) Specify the Fourier transform $X_1(jw)$ of a signal $x_1(t)$,

$$g(t) = x_1(t)cos(\frac{2}{3}t)$$

2. (15)Consier a LTI system whose response to the input $x(t) = [e^{-t} + e^{-3t}]u(t)$ is $y(t) = [2e^{-t} - 2e^{-4t}]u(t)$

   (a) Find the frequence response of this system.

   (b) Determine the impulse response of the system.

   (c) Find the differential equation of the system.

3. (10)Consider a causal LTI system with frequence response

$$H(jw) = \frac{1}{jw+3}$$

For an input

$$y(t) = [e^{-3t} - e^{-4t}]u(t)$$

determine $x(t)$

4. (20)Ideal low pass filter frequency response is shown. Draw the spectrum of the output signal when input is the following function.

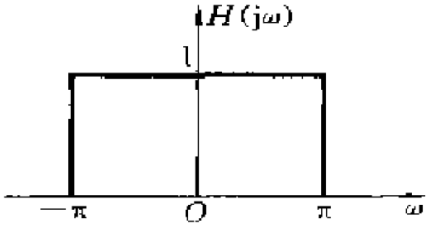

Figure 1: Lowpass Fliter

(a) $f(t) = \frac{sin(\pi t)}{\pi t}$

(b)

$$f(t) = \begin{cases} 1, |t| \leq 1 \\ 0, |t| > 1 \end{cases}$$

5. (20)The spectrum of input band-limited signals is shown in figure a. The highest angular frequency is w_m and $w_b > w_m$, the cutoff frequency of figure b(HP) is w_b,

$$H_1(jw) = \begin{cases} K_1, |w| > w_b \\ 0, |w| < w_b \end{cases}$$

LP is

$$H_2(jw) = \begin{cases} K_2, |w| < w_b \\ 0, |w| > w_b \end{cases}$$

draw the spectrum of $x(t)$ and $y(t)$.

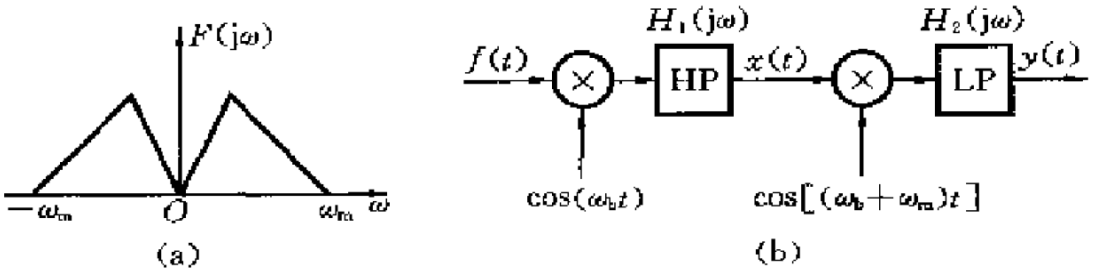

Figure 2: Singal and System

6. (20)The bandpass filter responds to the figure.

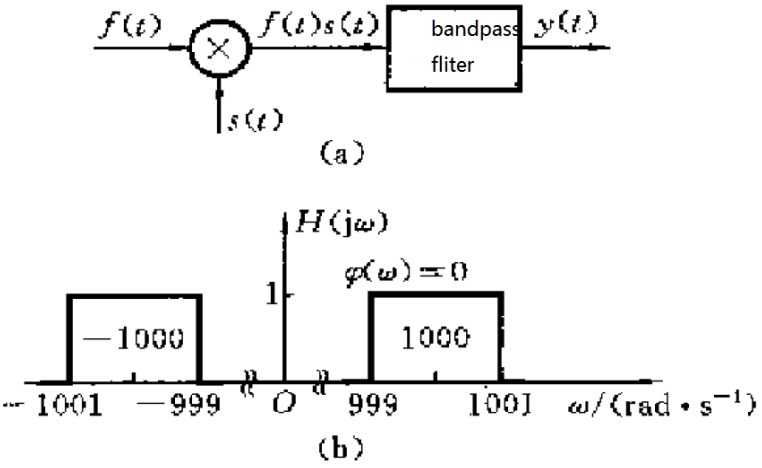

Figure 3: Singal and System

The inputs are $f(t) = \frac{sin(2*\pi t)}{2\pi t}$, $s(t) = cos(1000t)$
Determin the output signal $y(t)$