

GEORGIA INSTITUTE OF TECHNOLOGY  
School of Electrical Engineering

Quiz #2

Date: May 25, 1999

Course: EE 2201B

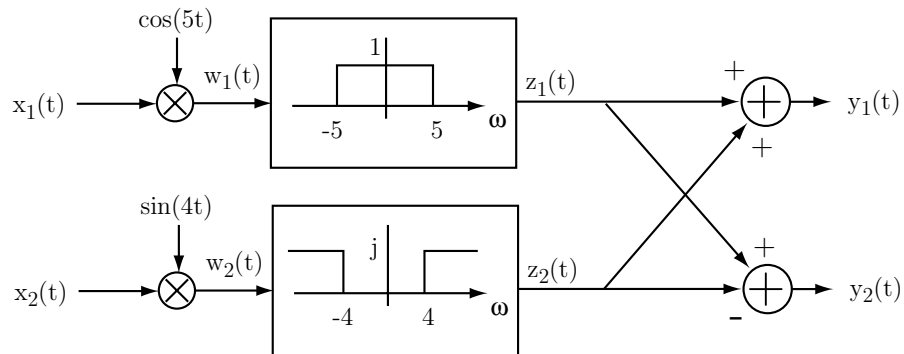
Name: \_\_\_\_\_  
  Last,  First

- Closed book, closed notes, but two  $8\frac{1}{2}'' \times 11''$  handwritten sheets are allowed. One hour and twenty minute time limit.
- None of the problems require involved calculations. Reconsider your approach before doing something tedious.
- All work should be performed on the quiz itself. If more space is needed, use the backs of the pages.
- This quiz will be conducted under the rules and guidelines of the Georgia Tech Honor Code and no cheating will be tolerated.

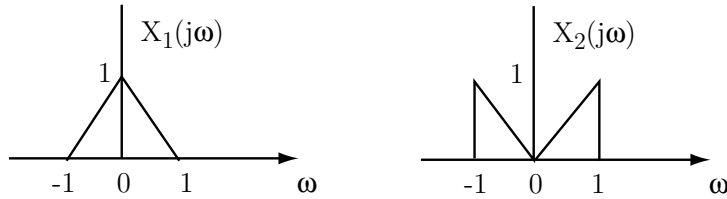
<i>Problem</i>	<i>Score</i>
1	
2	
3	
4	
Total	

**Problem 1:** (30 points)

Consider the following modulation scheme:



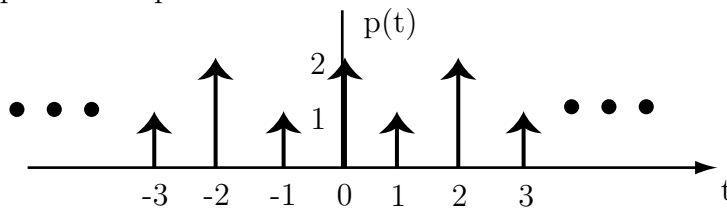
where the Fourier transforms of the signals  $x_1(t)$  and  $x_2(t)$  are:



Sketch accurately the Fourier transforms  $W_1(j\omega)$ ,  $W_2(j\omega)$ ,  $Z_1(j\omega)$ ,  $Z_2(j\omega)$ ,  $Y_1(j\omega)$ , and  $Y_2(j\omega)$ .

**Problem 2:** (20 points)

Consider the periodic impulse train:

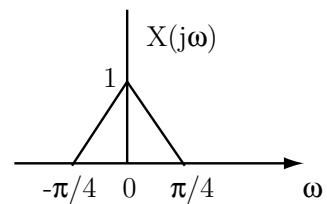


(a)  $P(j\omega)$ , the Fourier transform of  $p(t)$  has the form

$$P(j\omega) = a\pi \sum_{\substack{k=-\infty \\ k \text{ even}}}^{\infty} \delta(\omega - b\pi k) + c\pi \sum_{\substack{k=-\infty \\ k \text{ odd}}}^{\infty} \delta(\omega - b\pi k)$$

Find the constants  $a$ ,  $b$ , and  $c$ .

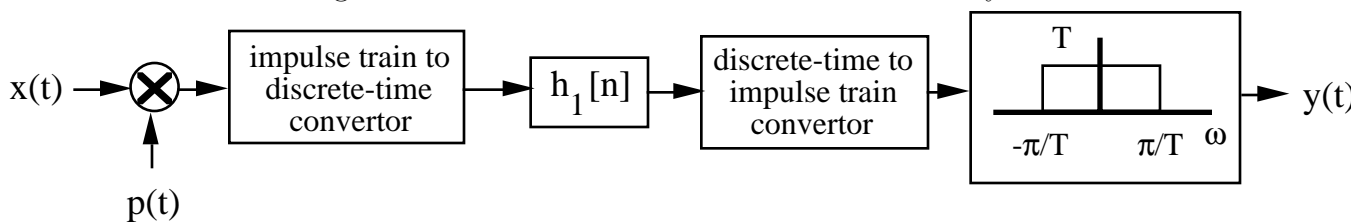
(b) If  $y(t) = x(t)p(t)$  and  $x(t)$  has the Fourier transform:



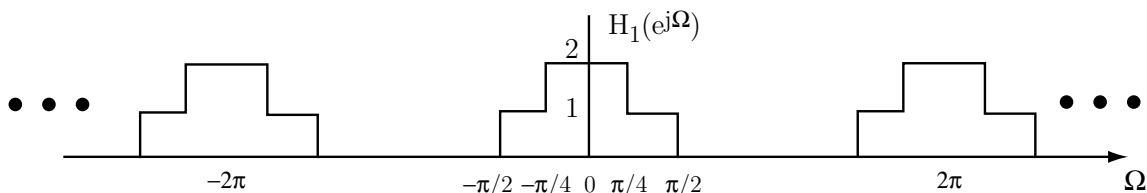
then find and sketch  $Y(j\omega)$ .

**Problem 3:** (20 points)

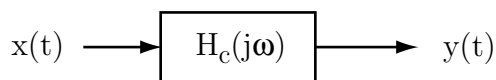
Consider the following combined discrete-time and continuous-time system:



where  $p(t) = \sum_{n=-\infty}^{\infty} \delta(t - nT)$  with  $T = 1/5$ . The system  $h_1[n]$  has the discrete-time Fourier transform



For input signals that are bandlimited so that  $X(j\omega) = 0$  for  $|\omega| > \pi/T$ , this entire system is equivalent to a single continuous-time LTI system

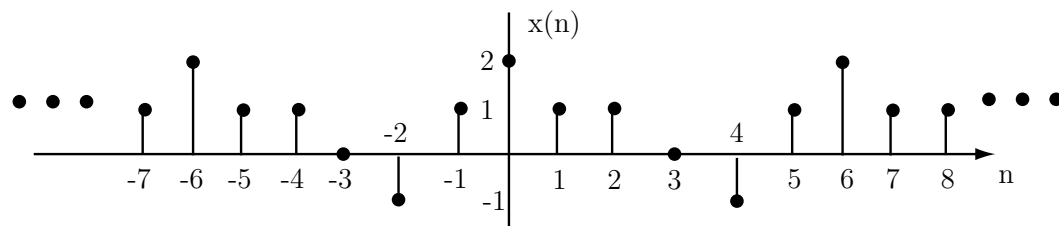


(a) What is  $y(t)$  if  $x(t) = \cos(2\pi t + \frac{\pi}{2})$ ?

(b) The impulse response of the discrete-time system has the form  $h_1[n] = a \cos(bn) \frac{\sin(cn)}{n}$ . Find the constants  $a$ ,  $b$ , and  $c$ .

**Problem 4:** (20 points)

Consider the following periodic discrete-time signal:



- (a) Find the discrete-time Fourier series representation of  $x[n]$  including the coefficients  $a_k$  and period  $T$ .

- (b) What is the discrete-time Fourier transform of  $x[n]$ ?