ROSE-HULMAN INSTITUTE OF TECHNOLOGY
Department of Electrical and Computer Engineering

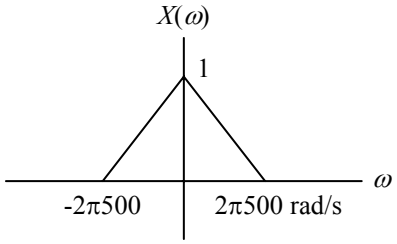
ECE 380 Discrete-Time Systems — Winter 2003-2004

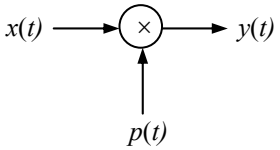
Homework 1 — Mark A. Yoder

Read Sections 7.0 through 7.3 of Oppenheim and Willsky. All of the "Basic Problems With Answers" that deal with continuous-time sampling are excellent practice material. Also, do the following:

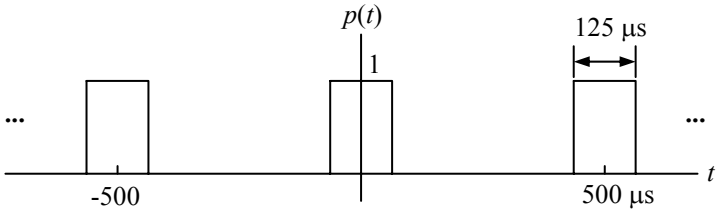
1. O & W, problems 7.1, 7.2, 7.3.

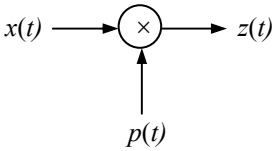
2. Suppose that a signal $x(t)$ has spectrum $X(j\omega)$ shown below. Suppose $x(t)$ is multiplied by the impulse train $p(t) = \sum_{n=-\infty}^{\infty} \delta\left(t - n\left(500\ \mu s\right)\right)$. Find and plot the spectrum $Y(j\omega)$ of the output $y(t)$.



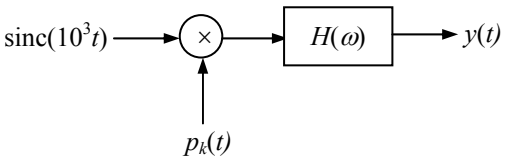


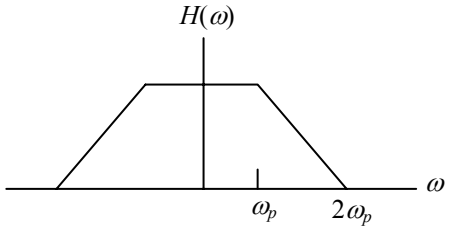
3. Suppose that the signal $x(t)$ from the previous problem is multiplied by the pulse train $p(t)$ shown. Find and plot the spectrum $Z(j\omega)$ of the output $z(t) = x(t)\ p(t)$.

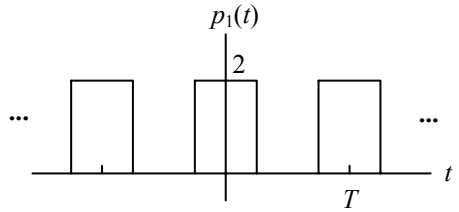


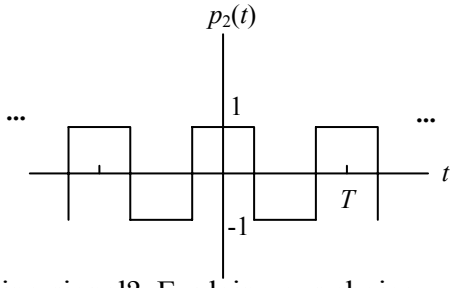


4. Consider the system below where the input signal is sampled, then filtered so that the output $y(t)$ replicates the input signal.









A. Which of $p_1(t)$ or $p_2(t)$ is suitable as the sampling signal? Explain your choice.
B. Find values of T and ω_p that will allow $y(t)$ to replicate the input.