University of Kentucky
Department of Electrical and Computer Engineering

EE421G: Signals and Systems I – Fall 2007

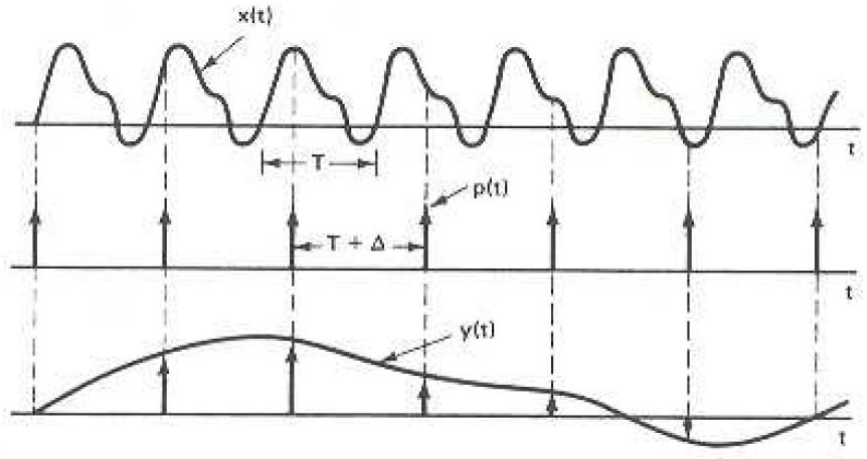
Problem Set 9

Issued: October 29, 2007 Due: November 5, 2007 (In class)

Reading Assignments:
Read Chapter 5.1 – 5.3 of Chen

Paper and Pencil Assignments:

1) Problem 5.1
2) Problem 5.2
3) Problem 5.8
4) Problem 5.11
5) Problem 5.12
6) It is often necessary to display on an oscilloscope screen waveforms having very short time structures, for example, on the scale of thousandths of a nanosecond. Since the rise time of the fastest oscilloscope is longer than this, such display cannot be achieved directly. If however, the waveform is periodic, the desired result can be obtained indirectly using an instrument called a sampling oscilloscope. As shown in the figure below, the fast waveform x(t) is sampled once every period but at successively later points in successive periods. If the resulting impulse train is then passed through an appropriate low-pass interpolating filter the output, y(t), will be proportional to the original fast waveform slowed down or stretched out in time; i.e. y(t) is proportional to x(at) where a<1.



Assume that the input is a sinusoid $x(t) = A+B\cos[(2\pi/T)t+\theta]$. Draw a block diagram of a system that impulse train samples x(t) via p(t) and then "immediately" reconstructs y(t) from the impulse train sampled signal using a low-pass filter. What is the maximum cutoff of the low-pass filter? Find the range of Δ so that y(t) is proportional to x(at) with a<1.