EE301 Signals and Systems **In-Class Exam**
Exam 2 **Tuesday, Mar. 10, 2005**

Cover Sheet

Test Duration: 75 minutes.
Coverage: Chaps. 1,2,3, and 4, Emphasis on Chap. 4
Open Book but Closed Notes. NO LOOSE SHEETS OF ANY KIND
Calculators NOT allowed.
This test contains **one** problem with many parts.
All work should be done in the blue books provided.
You must show all work for each problem to receive full credit.
Do **not** return this test sheet, just return the blue books.

Consider the input signal $x(t)$ below which is the SQUARE of a signal equal to the sum of a sinc function plus a sinewave.

$$x(t) = \left\{ \frac{\sin(2t)}{\pi t} \; + \; \cos(8t) \right\}^2$$

(a) Plot the magnitude $|X(\omega)|$ of the Fourier Transform of this signal as a function of frequency. Show as much detail as possible.

For EACH of the remaining parts of this problem, the signal above is input to an LTI system whose impulse response is given (a different impulse response for each part.) For EACH part, you must do EACH of the following THREE steps. You MUST show your work, explaining how you got your answer concisely but with sufficient detail to receive full credit.

(i) Plot the magnitude $|H_i(\omega)|$ of the Fourier Transform of the impulse response $h_i(t)$.

(ii) Plot the magnitude $|Y_i(\omega)|$ of the Fourier Transform of the output signal $y_i(t)$.

(iii) Determine a simple, closed-form expression for the time-domain output $y_i(t)$.

(b) $h_1(t) = \dfrac{\sin(5t)}{\pi t}$

(c) $h_2(t) = \dfrac{\sin(4t)}{\pi t} \; \cos(8t)$

(d) $h_3(t) = \dfrac{\sin(t)}{\pi t} \; \cos(8t)$

(e) $h_4(t) = \dfrac{\sin(t)}{\pi t} \; \dfrac{\sin(5t)}{\pi t}$

(f) $h_5(t) = \left\{ \dfrac{\sin(3t)}{\pi t} \; \dfrac{\sin(t)}{\pi t} \right\} \cos(8t)$

(g) $h_6(t) = \left\{ \dfrac{\sin(t)}{\pi t} \right\}^2 \cos(8t)$

(h) $h_7(t) = \dfrac{\sin(t)}{\pi t} \; \cos(16t)$

(i) $h_8(t) = \dfrac{\sin(2t)}{\pi t} \; \cos(13t)$

(j) $h_9(t) = \dfrac{\sin(t)}{\pi t} \; \cos(5t)$

(k) $h_{10}(t) = \left\{ \dfrac{\sin(4t)}{\pi t} \right\} \left\{ \sum_{n=-\infty}^{\infty} \delta\left(t - n\dfrac{2\pi}{9}\right) \right\}$