EE301 Signals and Systems **Exam 1**
Room EE129, 7-8 pm **Monday, Feb. 11, 2008**

Cover Sheet

Test Duration: 60 minutes.
Coverage: Chaps. 1,2.
Open Book but Closed Notes.
Calculators NOT allowed.
This test contains **two** problems.
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.

Prob. No.	**Topic(s)**	**Points**
1.	Continuous Time Signals and System Properties	50
2.	Discrete Time Signals and System Properties	50

Problem 1. [50 points]

Two linear and time-invariant (LTI) systems are connected in parallel as depicted in the figure above. The input-output (I/O) relationship for System 1 is

$$y_1(t) = \int_{t-1}^{t} x(\tau)d\tau$$

The I/O relationship for System 2 is

$$y_2(t) = -\int_{t-4}^{t-2} x(\tau)d\tau$$

(a) Determine and plot the impulse response $h_1(t)$ for System 1.

(b) Is System 1 causal? You must use $h_1(t)$ to justify your answer.

(c) Is System 1 stable? You must use $h_1(t)$ to justify your answer.

(d) Determine and plot the impulse response $h_2(t)$ for System 2.

(e) Is System 2 causal? You must use $h_2(t)$ to justify your answer.

(f) Is System 2 stable? You must use $h_2(t)$ to justify your answer.

(g) Determine and plot the impulse response $h(t)$ of the overall system.

(h) Determine and plot the output $y(t)$ of the overall system when the input is the signal

$$x(t) = u(t) - u(t-1)$$

(i) Determine and plot the output $y_1(t)$ of just System 1 when the input is the signal

$$x(t) = t\{u(t) - u(t-2)\}$$

Hint: example in textbook.

Problem 2. [50 points]

Two LTI systems are again connected in parallel as in the figure in Problem 1, except now they are Discrete-Time (DT) systems. The input-output (I/O) relationship for DT System 1 is

$$y_1[n] = \sum_{k=n-2}^{n} x[k]$$

The I/O relationship for System 2 is

$$y_2[n] = -\sum_{k=n-7}^{n-4} x[k]$$

(a) Determine and (stem) plot the impulse response $h_1[n]$ for System 1.

(b) Is System 1 causal? You must use $h_1[n]$ to justify your answer.

(c) Is System 1 stable? You must use $h_1[n]$ to justify your answer.

(d) Determine and (stem) plot the impulse response $h_2[n]$ for System 2.

(e) Is System 2 causal? You must use $h_2[n]$ to justify your answer.

(f) Is System 2 stable? You must use $h_2[n]$ to justify your answer.

(g) Determine and (stem) plot the impulse response $h[n]$ of the overall system.

(h) Determine and (stem) plot the output $y[n]$ of the overall system when the input is the signal

$$x[n] = u[n] - u[n-3]$$

(i) Determine and plot the output $y[n]$ of the overall system when the input is the signal

$$x[n] = (-1)^n\{u[n] - u[n-2]\}$$