October 1, 2007
Midterm Exam I
EE 3302: Signals and Systems

NOTE: Please, complete the following table and keep record of your assignment number.

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**Exercise 1.** Consider the continuous-time signal

\[ x(t) = -2u(6t + 3) \]

where \( u(t) \) is the causal unit step function.

A) Sketch and label carefully \( x(t) \) [pt. 10].

**Exercise 2.** Consider the signal

\[ x(t) = -2u(t + 2) + 2u(t - 2) \]

where \( u(t) \) is the causal unit step function.

A) Derive the energy and the time-averaged power of signal \( x(t) \) over \(-\infty < t < \infty\) [pt. 10].

**Exercise 3.** A continuous-time LTI system has impulse response

\[ h(t) = u(t) \sin(t) \]

where \( u(t) \) is the causal unit step function.

A) Determine whether or not the system is [pt. 10]:

- memoryless,
- causal,
- stable.

**Exercise 4.** Consider the LTI system with the following input \((x)\) output \((y)\) relation

\[ y(t) = x(t + 2) + \int_{t-1}^{t} x(\tau) \, d\tau \]

A) Derive, sketch and label the impulse response of the system, and determine whether or not the system is causal [pt. 15].
**Exercise 5.** Consider the discrete-time LTI system with impulse response

\[ h[n] = \begin{cases} 
1 & n = -1 \\
1 & n = 1 \\
0 & \text{otherwise}
\end{cases} \]

The signal at the system input is

\[ x[n] = \begin{cases} 
1 & n = -1 \\
1 & n = 0 \\
1 & n = 1 \\
0 & \text{otherwise}
\end{cases} \]

A) Derive the expression of the signal at the output of the system. Sketch the output signal [pt. 20].

**Exercise 6.** Consider a continuous-time LTI system. The unit impulse response of the system is

\[ h(t) = u(t) - u(t - 1) \]

where \( u(t) \) is the causal unit step function. The signal at the system input is

\[ x(t) = \delta(t + 2) + u(t) - u(t - 1) \]

where \( \delta(t) \) is the unit impulse function.

A) Derive the output signal of the LTI system analytically, i.e., \( y(t) \). Sketch and label carefully \( y(t) \) [pt. 20].