Problem Solving Session III

ENGR 3302: Signals and Systems

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

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**Exercise 1.** A continuous-time LTI system has impulse response

\[ h(t) = u(-t) e^t \]

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

A) Determine whether or not the system is [pt. 10]:
- memoryless,
- causal,
- stable.

**Exercise 2.** A continuous-time LTI system has impulse response

\[ h(t) = \begin{cases} 
-e^t & 2 < t < 100 \\
0 & \text{otherwise}
\end{cases} \]

A) Determine whether or not the system is [pt. 10]:
- memoryless,
- causal,
- stable.

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

\[ h[n] = \cos \left( \frac{n\pi}{4} \right) \]

A) Determine whether or not the system is [pt. 10]:
- memoryless,
- causal,
- stable.

**Exercise 4.** A continuous-time LTI system has impulse response

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

where \( u(t) \) is the casual unit step function.
A) Determine whether or not the system is [pt. 10]:
   • memoryless,
   • causal,
   • stable.

**Exercise 5.** Consider the continuous-time LTI system with the following input \( (x) \) output \( (y) \) relation
\[
y(t) = \int_{-\infty}^{t-2} 5 \cdot x(t + 1) \, dt
\]
A) Derive, sketch, and label the impulse response of the system, i.e., \( h(t) \), and determine whether or not the system is causal [pt. 15].

**Exercise 6.** Consider the continuous-time LTI system with the following input \( (x) \) output \( (y) \) relation
\[
y(t) = \int_{t-4}^{\infty} 3 \cdot x(\tau) \, d\tau - x(t-1)
\]
A) Derive, sketch and label the impulse response of the system, i.e., \( h(t) \), and determine whether or not the system is stable [pt. 15].

**Exercise 7.** Consider the discrete-time LTI system with the following input \( (x) \) output \( (y) \) relation
\[
y[n] = x[n - 2] + \sum_{k=n}^{n+1} x[k]
\]
A) Derive, sketch and label the impulse response of the system, i.e., \( h[n] \), and determine whether or not the system is stable [pt. 15].

**Exercise 8.** 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].