Ve216 Midterm Exam 1, 03/10/2023, 10:00 - 11:40

!! KEEP THIS PAGE FACE-UP UNTIL YOU ARE TOLD TO BEGIN !!

- This is a closed book exam. You are permitted to use one A4 page of notes (both sides), all of which must be in your own handwriting.
- Electronic media with wireless capability are not allowed. You may use calculators without wireless capability.
- There are 4 problems worth a total of 100 points. The questions are not necessarily in order of increasing difficulty.
- This exam has 4 pages and 2 cover pages. Make sure your copy is complete.
- Problems where the number of points are followed by an exclamation point are basic skill problems and will be graded without partial credit.
- Box your final answer. You will be graded on both the final answer and the steps leading to it. Correct intermediate steps will help earn partial credit. For full credit, ~~cross out~~ any incorrect intermediate steps.
- If you need to make any additional assumptions, state them clearly.
- Legible writing will help when it comes to partial credits.
- Simplify your results when possible.
- **Any** writing after the time is up is an honor code violation. Write your name, ID, and sign the honor code pledge *before* starting the exam so that you can stop writing immediately when the time is up.

1. (35! points)
A certain system has the following input-output relationship.

- Prove that the system is linear or give a counter example.
- Prove that the system is time-invariant or give a counter example.
- Determine if the system is causal or noncausal.
- Determine if the system is a memoryless or memory system.
- Determine if the system is BIBO stable or unstable.

- [15! points] $y(t) = \begin{cases} \int_{t-3}^{t-1} e^{-(t-\tau)^2} x(\tau)\, d\tau, & x < 0, \\ \int_{1}^{3} e^{-\tau^2} x(t-\tau)\, d\tau, & x \geq 0. \end{cases}$

- [15! points] $y(t) = \frac{x(t)}{x(t-1)}, \quad |x(t)| > \epsilon > 0, \forall t$

- [5! points] Give an example of an input-output relationship for a CT system that is *dynamic, noncausal, and stable*.

2. (15 points)
Determine if each of the following statements is true in general. If it is, provide your proofs. If it is not, find corresponding counteraxamples.
If $y(t) = x(t) * h(t)$ then $y(at + b) = ax(at + b) * h(at), \quad a > 0$

end