

# **EE3210 Signals and Systems**

Semester B 2023-2024

## **Assignment 1**

**Due Date: 28 Feb. 2024**

1. Consider a continuous-time signal  $x(t)$

$$x(t) = \begin{cases} \sin\left(\frac{\pi}{2}t\right), & t \geq 0 \\ 0, & t < 0 \end{cases}$$

- (a) Determine if the signal  $x(t)$  is periodic or not. If it is a periodic signal, determine its fundamental period.
- (b) Determine  $x(t)$  is an energy or power signal and then compute its energy or power.
2. (a) Verify that the product of two even signals or two odd signals is an even signal.
- (b) Verify that the product of one even signal and one odd signal is an odd signal.
3. Given a continuous-time system with input  $x(t)$  and output  $y(t)$ :

$$y(t) = x(t - 2) + x(2 - t)$$

Determine whether the system is memoryless, invertible, stable, causal, linear, and/or time-invariant. Briefly explain your answers.

4. Determine  $y(t) = x(t) \otimes h(t)$ , where  $x(t) = e^t u(-t)$ ,  $h(t) = e^{-t} u(t)$ . Plot the output signal  $y(t)$ .
5. We have learned the commutative property of LTI system in Lecture 3. Verify the commutative property, i.e.,

$$x(t) \otimes h(t) = h(t) \otimes x(t)$$

6. Consider a discrete-time LTI system with input  $x[n] = \left(\frac{1}{2}\right)^{n-2} u[n - 2]$  and impulse response  $h[n] = u[n + 2]$ . Compute the system output  $y[n]$ . Is the system stable? Why? Is the system causal? Why?
7. Choose a real-world system in daily life. The system can be a software or hardware. Identify the input, output and function of this system. Briefly explain if your chosen system is linear and time-invariant.