

Name: _____

ECE 317
Summer 2005
Proficiency Test

Write out and sign the Honor Code:

Directions: Solve each of the following problems *by yourself*. Show all your work.

1) Consider the signal $x(t) = 2e^{-t}u(t+1)$

A) Sketch $x(t)$.

B) Is $x(t)$ of finite or infinite duration? Is $x(t)$ causal? Is $x(t)$ bounded? Explain your answers.

C) Is $x(t)$ an energy signal? Explain why or why not.

D) Sketch the signal $y(t) = 0.25x(2t)$. Explain how $y(t)$ compares to $x(t)$.

2) Suppose that an LTI system is described by the differential equation

$$a_2 \frac{d^2 y(t)}{dt^2} + a_1 \frac{dy(t)}{dt} + a_0 y(t) = b_1 \frac{dx(t)}{dt}, \text{ assuming no initial conditions}$$

A) Find the transfer function of the system. Then determine the poles and zeros of the transfer function in terms of the a and b coefficients.

B) To ensure system stability, what restrictions must be placed on the coefficients?

Explain your answer. You can assume that $(a_1^2 - 4a_2a_0) < 0$.

3) An LTI system is described by $H(s) = \frac{3s}{s+2}$

A) Derive an expression for the step response, $y_s(t)$.

B) Sketch $y_s(t)$.

C) Determine and sketch the magnitude response of the system.

D) What type of filter does this system represent?

E) Determine the expression for the system's steady-state response to an input

$$x(t) = \cos(2t)\cos(t)u(t).$$