

## ELEG 3124 Assignment # 5

Define a rectangular pulse  $p(t) = u(t+1) - u(t-1) = \begin{cases} 1, & -1 \leq t \leq 1 \\ 0, & \text{otherwise} \end{cases}$ .

1. An LTI system has an impulse response  $h(t) = tu(t-5)$ . If the input is  $x(t) = t^2[u(t-1) - u(t-3)]$ , find the output.
2. Determine whether the continuous-time LTI systems characterized by the following impulse responses are causal or non-causal, stable or non-stable.
  - (a)  $h(t) = e^{4t}u(-t)$
  - (b)  $h(t) = (-t)e^{-t}u(-t)$
  - (c)  $h(t) = e^{-|2t|}$
  - (d)  $h(t) = p(t/2)$ .
  - (e)  $h(t) = \delta(t) + e^{-3t}u(t)$
3. Are the LTI systems with the following impulse responses invertible? If invertible, find the inverse system.
  - (a)  $h(t) = 3\delta(t+3)$
  - (b)  $h(t) = \delta(t-3) + \delta(t-5)$ .
4. Consider a circuit with a voltage source,  $v(t)$ , a resistor with resistance  $R$ , and a capacitor with capacitance  $C$  connected in series. If the input of the system is the voltage source  $v(t)$ , and the output of the system is the voltage across the capacitor,  $v_c(t)$ . Write the system equation in the form of a differential equation.