UNIVERSITY of HOUSTON | ECE

ECE 3337: Signals & Systems Analysis
Class Worksheet 5

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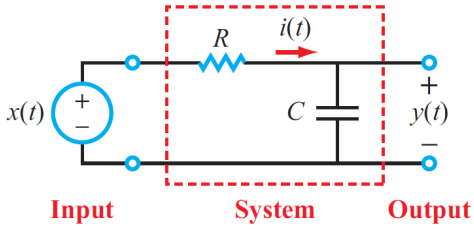
1. (30 points) Consider the following resistor - capacitor (RC) circuit,



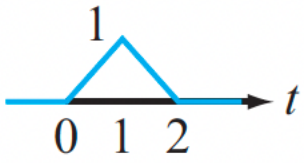
(a) RC circuit

   a. (15 points) Use the convolution integral to derive a formula for the step response $y_{STEP}(t)$ for this circuit using the formula for the impulse response of this circuit $h(t) = \frac{1}{RC} e^{-t/RC} u(t)$. Make sure to show your derivation steps.
   b. (15 points) Use the convolution integral to derive a formula for the ramp response $y_{RAMP}(t)$ for this circuit using the formula for the impulse response of this circuit $h(t) = \frac{1}{RC} e^{-t/RC} u(t)$. Make sure to show your derivation steps.

2. (40 points) Calculate the following convolution integrals. Make sure to show all the detailed steps, especially the calculation of the integration limits and the range of validity of time.

   a. $y_1(t) = u(t) * u(t-2)$
   b. $y_2(t) = \delta(t-1) * r(t-4)$
   c. $y_3(t) = e^{-at}u(t) * u(t-1)$
   d. $y_4(t) = e^{-2t}u(t) * e^{-3t}u(t)$

3. (30 points) The step response of a system is plotted below:



   a. (15 points) Calculate the impulse response of this system
   b. (15 points) Calculate the ramp response of this same system. Make sure to show all of the detailed steps.