

# Review of Signals and Systems-II

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Aug., 2017



# Important Instructions

- Try to complete all tasks within 2 hours. After 2 hrs, evaluation starts.
- For each subtask, create mfiles (eg. *CT\_HT.m*) and save them with suitable name.
- Prepare a word document naming your name and ID. In it, save all results including plots.
- In all plots, put x-label, y-label, legend, font 'Arial'(Size = 10), and, Width '2'.



# Task 1: Convolution of continuous-time signals

- Understand following commands/operators
  - size
  - max
  - zeros
  - &&
  - conv
  - subplot
- **Question (a):** Convolution of identical rectangular pulses
  - 1 Write a MATLAB function for  $x(t) = u(t+1) - u(t)$ . Name it rect\_pulse.m.
  - 2 Write a program to find convolution of two identical, rectangular pulses  $x(t) = u(t+1) - u(t)$ 
    - Use  $f_s = 100$ ;  $T_s = \frac{1}{f_s}$ ;  $t = -5:T_s:5$
    - **hint:** Call 'rect\_pulse.m' in your main program.
  - 3 Plot both input and output (use subplot)
  - 4 **Question:** What is the output if  $x(t) = \text{rect}(2t)u(t)$  convolved with itself?



# Task 1: Q. (b):

- **Question (b):** Convolution of non-identical rectangular pulses
  - 1 Write two MATLAB functions `rect_pulse1.m` and `rect_pulse2.m`. Modify your logic based on data in the question below.
  - 2 Write a program to find convolution of two non-identical rectangular pulses  $x_1(t) = \text{rect}(t + 0.5)u(-t)$  and  $x_2(t) = \text{rect}(t + 0.4)u(-t)$ 
    - Hint: Call '`rect_pulse1.m`', '`rect_pulse2.m`' in your main program. In the main program, set  $f_s = 100$ ;  $T_s = \frac{1}{f_s}$ ;  $t1 = -5:T_s:5$ ;  $t2 = -4:T_s:4$ ;
  - 3 Plot both input pulses and output pulse in the same figure. Differentiate them by color/line style



## Task 2: RC network impulse response

- **Question:** What is the impulse response  $h(t)$  of RC network shown?

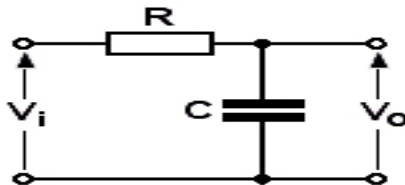


Figure: RC network.

- **Questions:**
  - Write a program to plot the impulse response and its amplitude spectrum (Hints: Write a function using `fft` and `fftshift` commands. Call it in main program. Set time constant  $\tau = RC = 1$ . Make sure that spectrum is centered at origin.)
  - Let the input be a rectangular pulse  $x(t) = \text{rect}(3t)$ . What is the area under output autocorrelation function (ACF)? (Non-MATLAB question)