Principles of Communication Systems Lab (303 P)

Lab-2 (Review of signals and systems)

(Due Date: 24-8-2021, Time: 1 pm)

Instructions:

1. NO PLAGIARISM. Your solution must be written in your words.
2. Please strictly follow the LaTex template for making lab reports. The template has been uploaded on LMS.
3. Please mention legends, axis labels, titles etc in your plot/subplot for better understanding and clarity.
4. For best quality, please add .eps format of simulation plot in the report. You can directly export .eps plot from MATLAB.
5. The report to be submitted must include MATLAB code and all observations pertaining to each plot below the same.
6. Kindly number your answers correctly.
7. Please feel free to ask any questions in class or via LMS..

Questions:

1. Consider a square wave with fundamental frequency 50 Hz with the maximum and minimum amplitude to be +1 and -1 respectively. Generate and plot (both continuous time and discrete time) 5 complete cycles of it with the following duty cycles.

   (a) Duty cycle 50%

   (b) Duty cycle 25%

   (c) Duty cycle 75%

   Note: Do not use inbuilt function 'square'! Take a large no. of samples to get a smooth curve. Plot all the sub-parts in the same plot using subplot.

2. Consider the signals $x_1[n] = 1$, for $n_{11} \leq n \leq n_{12}$, and $x_2[n] = 1$, for $n_{21} \leq n \leq n_{22}$ and perform the following operations

   (a) Find and plot (both continuous time and discrete time) the convolution between $x_1[n]$ and $x_2[n]$ for $n_{11} = n_{21} = -2$ and $n_{12} = n_{22} = 2$. Do not use the inbuilt function 'conv'!

(b) Find and plot (both continuous time and discrete time) the convolution between $x_1[n]$ and $x_2[n]$ for $n_{11} = -2$, $n_{12} = 2$, $n_{21} = 0$ and $n_{22} = 4$. Do not use the inbuilt function 'conv'!

(c) Find and plot (both continuous time and discrete time) the convolution between $x_1[n]$ and $x_2[n]$ for $n_{11} = -5$, $n_{12} = 5$, $n_{21} = -1$ and $n_{22} = 6$. Do not use the inbuilt function 'conv'!

(d) Verify and plot the above results using the inbuilt function 'conv'

3. Consider a single-tome signal $m_1(t) = A_1 \cos(2\pi f_1 t)$ and a multi-tone signal $m_2(t) = A_1 \cos(2\pi f_1 t) + A_2 \cos(2\pi f_2 t)$ with $A_1 = 2$, $A_2 = 6$, $f_1 = 50$ and $f_2 = 100$.

   (a) Plot $m_1(t)$ and $m_2(t)$

   (b) Plot the frequency spectrum $m_1(t)$ and $m_2(t)$, and identify the tones

   (c) Plot the phase spectrum of $m_1(t)$ and $m_2(t)$

Note: Take a large no. of samples to get a smooth curve. Plot all the sub-parts in the same plot using subplot.