SEAS WINTER 2020
Semester-6
Digital Signal Processing

LAB 1

Objectives:

Understanding different concepts of signals and systems signal operations, sampling theorem using MATLAB script and Function.

Prerequisites:

- Basics of Signals and Systems**,** Signal Operations**,** Sampling Theorem

Important Notes:

- Plot results for problem (2) to (10) using subplot and keep input sequence and time index is user defined.
- Choose Time Index as per requirement of suitable waveform graph.

Solve following Problem statements using MATLAB:

1. Generate deterministic continuous time signal having equation x(t)= $3t/(4+t^2)$ and discrete time signal having equation x(n)= $3n/(4+n^2)$. Use subplot command to display both figures.
2. Plot the continuous and discrete time sinusoidal wave for given amplitude, frequency, phase and sampling frequency.
3. Generate the function for signal addition. Add two sequences $x_1(n)$ ={1,-1,2,5,1,5,-1} and $x_2(n)$ ={-2,-8,9,4,2,3,5}.
4. Generate the function for signal multiplication. For Two sequences $x_1(n)$ ={1,-1,2,5,1,5,-1} and $x_2(n)$ ={-2,-8,9,4,2,3,5}.
5. Generate the function for timing shifting. For sequences x(n) ={1,-1,2,5,1,5,-1}.
6. Generate the function for signal folding. Fold the sequence x(n) ={1,-1,2,5,1,5,-1}.
7. Generate the function for time multiplication. Use it for sequence $x_1(n)$ ={1,-1,2,5,1,5,-1}.
8. Generate function for unit sample signal $\delta(n)$. Also plot $\delta(n-1)$ and $\delta(n+1)$.

9. Generate function for unit step signal $u(n)$. Also plot $u(n-1)$ and $u(n+1)$.

10. Generate function for unit ramp signal $u_r(n)$. Also plot $u_r(n-1)$ and $u_r(n+1)$.

11. Plot all the given signals and comment on their output for periodicity writing common MATLAB code.
    a. X(n) = $\cos(0.002\pi n)$
    b. X(n) = $Sin(30\pi \frac{n}{105})$
    c. X(n) = $Sin(5n)$
    d. X(n) = $cos(32\pi \frac{n}{10})$
    e. X(n) =10 $cos(7n + \frac{\pi}{6})$
    f. X(n) = $2e^{j(n-\pi)}$

12. Plot all the given signals and comment on their output for periodicity writing common MATLAB code.

$$(1)x(n) = 3\cos(\frac{n\pi}{6}) + 5\cos(\frac{3n\pi}{4})$$

$$(2)x(n) = \cos(\frac{n}{7})\cos(\frac{n\pi}{7})$$

$$(3)x(n) = \cos(\frac{n\pi}{6})\cos(\frac{n\pi}{9})$$

$$(4)x(n) = 2\cos(\frac{n\pi}{4}) - \sin(\frac{n\pi}{6}) + 3\cos(\frac{n\pi}{8} + \frac{\pi}{3})$$

13. Sample the sinusoid x = sin(2 pi f t), where f = 2 kHz, and plot the sampled signals over the continuous-time signal.

    - Let x1 be the signal sampled at 10 kHz.
    - Let x2 be the signal sampled at 3 kHz.

    Plot required waveforms and comment on the same by writing common MATLAB code.