National Institute of Technology Calicut

Department of Electronics and Communication Engineering

EC 3093D DIGITAL SIGNAL PROCESSING LAB

Sixth Semester B Tech Electronics & Communication Engineering

Experiment 1: Generation of basic sequences and random signals, convolution of signals (Matlab and Python Implementation).

Note: All the experiments must be implemented in both Matlab and Python.

Generation of Basic Sequences

1. Generate unit impulse, unit step and unit ramp sequences

2. Generate the first few samples of the following real exponential sequences:
   (a) $20(0.9)^n$
   (b) $0.2(1.2)^n$
   (c) $(-0.8)^{n^4}$
   (d) $-4(0.8)^n$

3. Generate the complex exponential sequence, $\mathbf{x} = e^{(-\frac{1}{12}+j\frac{\pi}{6})n}$

4. Generate the following discrete time sequences and display each of them:
   (a) $\mathbf{x}_1(n) = cos(0.2\pi n)$, $\mathbf{x}_2(n) = cos(1.8\pi n)$ and $\mathbf{x}_3(n) = cos(2.2\pi n)$. Compare the plots generated for three cases and comment on your result.

   (b) Let, $\mathbf{x}_4(n) = cos(\frac{4\pi n}{17})$
   $\mathbf{x}_5(n) = 3cos(1.3\pi n) - 4sin(0.5\pi n + 0.5\pi)$
   $\mathbf{x}_6(n) = 5cos(1.5\pi n + 0.75\pi) + 4cos(0.6\pi n) - sin(.5\pi n)$.
   In each case, determine the period of the sequence theoretically and verify the results.

(c) $\mathbf{x}(n) = 2[n(0.9)^n]$ for $n = 0 : 50$

(d) $\mathbf{x}(n) = (0.95)^n sin(0.1\pi n)$ for $n = 0 : 50$

(e) Generate 10 periods of $\mathbf{x}(n)$ =(-4 -3 -2 -1 0 1 2 3 4 -4 -3 ....)

Generation of Random Signals

5. Generate and display a random signal of length 100 whose elements are uniformly distributed in the interval [-2 2].

6. Generate and display a Gaussian random signal of length 75 whose elements are normally distributed with a zero mean and a variance of 3.

Convolution

7. Perform the convolution of $\mathbf{x}(n) = 0.5(u[n-5] - u[n-10])$ and $\mathbf{h}(n) = u[n] - u[n-2]$. Plot $\mathbf{x}(n)$, $\mathbf{h}(n)$ and $\mathbf{y}(n)$ with correct time index.

8. Find the step response of the system $\mathbf{h}(n) = (0.9)^n u[n]$.

9. Compute the convolution of $\mathbf{x}(n) = (u[n] - u[n-10])$ and $\mathbf{h}(n) = (0.9)^n u[n]$. Show the first 50 values.

10. Compute the convolution of $\mathbf{x}$=[-1 0.5] and $\mathbf{h}$=[2 4 -2] using functions and display the results.
