AV 331 : DIGITAL SIGNAL PROCESSING

Labsheet - 1

1. Basic Signal Generation and Plotting: Generate standard signals with a single MATLAB command: Use "stem" command to plot them and label and mark values on x- and y- axis.
   a) Unit impulse signal with x-axis range -10 to 10
   b) Unit step signal with x-axis range -10 to 10
   c) Real exponential signal with a = 0.9 and x-axis range 0 to 10
   d) A random signal of length 100 whose elements are uniformly distributed in the interval [−2, 2].
   e) A Gaussian random signal of length 75 whose elements are normally distributed with zero mean and a variance of 3.

2. Basic Signal Operations:
   a) Generate a ramp signal x[n] with x-axis range 0 to 10 (Display Stem plot)
   b) Signal delay: From x[n], generate a delayed sequence with a delay of 5 samples.
   c) Signal advance: From x[n], generate an advanced sequence with an advance of 5 samples.
   d) Amplitude Scaling: Obtain a signal y[n] that is 5 times the amplitude of x[n].
   e) Time scaling: Obtain y[n] = x[a*n] with
      i) a=2 (down sampling)
      ii) a=0.5 (upsampling: Insert zeroes for non-integer indices of x[n])
   f) Time reversal: Obtain a sequence y[n] = x[-n].

3. Complex Exponentials:
   a) Plot real and imaginary parts of complex exponential signal: $y[n] = r^n \exp(jn\pi 3)$, where r = 0.8 ; (and r = 1.2) and 0 <= n <= 20
   b) Plot magnitude and phase signals of the above complex exponential using appropriate MATLAB functions.

4. Sinusoids:
   a) Write a program to generate a sinusoidal sequence of length 50, frequency 0.08, amplitude 2.5, and phase shift 90 degrees and display it.
   b) Write a MATLAB program to generate and display five sample sequences of a random sinusoidal signal of length 31 $\{X[n]\} = \{A \cdot \cos(\omega 0n + \phi)\}$ where the amplitude A and the phase ϕ are statistically independent random variables with uniform probability distribution in the range $0 \le A \le 4$ for the amplitude and in the range $0 \le \phi \le 2\pi$ for the phase.
5. Given two sinusoids with the following amplitude and phases: $x1(t) = 5 \cos(2\pi * 5t)$, $x2(t) = 5 \cos(2\pi * 12\, t + 0.25\pi)$ Create a MATLAB program to sample each sinusoid and generate a sum of sinusoids, that is, x(n) = x1(n) + x2(n), using a sampling rate of 80 Hz, and plot the sum x(n) for 1second.