

## BT640 Neural Imaging & Signal Processing



### Tutorial-2

Course Instructor: Dr. Cota Navin Gupta (cngupta@iitg.ac.in)

Teaching Assistants: Ms. Tanmayee Samantaray (tanma176106113@iitg.ac.in)

Ms. Doli Hazarika (dhazarika@iitg.ac.in)

1) Generate and plot the following aperiodic signals:

1. Unit Impulse signal
2. Unit Step Signal

Show both the signals on the same plot.

2) Generate and plot the following periodic signals:

1. Square wave signal
2. Sawtooth wave signal
3. Triangular wave signal
4. Sinusoidal wave signal

Show them on the same plot.

3) For the sinusoidal signal generated in Q.2.4, perform the following operations and plot them:

1. Scaling
2. Folding
3. Shifting (Left Shift and Right Shift)

4) Generate the following signals:

(Assume frequency=5Hz,  $T_s=0.01$ secs,  $T_T=2$ secs)

1. Sinusoidal signal
2. Cosine signal

Plot both the signals on the same plot and observe the difference. Write down the observations along with the code.

5) Generate two sinusoidal signals of frequencies 4Hz and 8 Hz with sampling time 0.01 secs and use enough points to make the sine wave 1 second long.

- A. Plot the result.
- B. Perform addition and multiplication of the signals.
- C. Find the mean, variance and RMS of both the signals.

6) Generate a 500 point 2Hz and 8Hz sine wave of same length. Make  $T_T=1$ s. Are these two waveforms orthogonal?

- 7) Generate a set of 2000 samples of Gaussian distributed random numbers, plot the gaussian distributed random numbers and their distribution. Compute its mean, standard deviation, variance and skewness. Write your understanding on gaussian noise along with the code.
- 8)
  1. Load the file handle.mat in MATLAB.
  2. Write the data into a .wav file and play the file.
  3. Create random noise and add the noise to the .wav file generated in 8.2.
  4. Play the noisy file.
  5. Show both the signals on the same plot.
- 9) Write a program for convolution between two signals.
- 10) Compute the Fourier transform of the signal having sampling frequency 1000 Hz and having 1024 points. Also plot the magnitude and phase spectrum of the signal.