1.Using PYTHON, prepare a signal that contains the sum of two cosine waves of equal amplitude at **50** *Hz* and **55 *Hz.*** Let the sampling rate **be** 1 ***kHz.***

(a) Compute the power spectrum of the signal with a rectangular window of duration 0.5s and 2s.

(b) Compute the power spectrum of the signal with a Hanning window of duration 0.5s and 2s.

To obtain the power spectrum, take the FFT and square the result. Compare the spectra obtained in parts (a) - (b) and comment upon their similarities and/or differences. In order tovisualize the differences clearly, use 2,048-point FFTsand plot the logarithm of the magnitude-squared spectra with an expanded scale from 0 to 100 *Hz* only.

2.Two VAG signals are given in the files vag1.dat and vag2.dat The sampling rate is **2 *kHz.*** Obtain and plot their power spectra (PSDs). Compute the mean frequency as the first moment of the PSD for each signal. Computealso the skewness of each **PSD.** Compare the spectra and the parameters derived and give your evaluation of the frequency content of the signals.

3.Compute the PSDs of a few channels of the EEG in the file eeg1-xx.dat using Welch’s procedure. Study the changes in the PSDs derived with variations in the window width, the number of segments averaged, and the type of the window used. Compare the results with the PSDs computed using the entire signal in each channel. Discuss the results in terms ofthe effects of the procedures and parameters on spectral resolution and leakage.