**EXPERIMENT NO. 9**

**AIM:** Power spectral density of different types of audio signals.

**APPARATUS USED:** MATLAB 11

**THEORY:**

**Power Spectral Density (PSD)**

The power spectral density (PSD) of an analog signal y is a function of frequency, Ryy(f), whose area equals the total signal power. Its units are, e.g., watts/hertz, and Ryy(f)∆f approximates signal power over a small range of frequencies ∆f centered at f. The Wiener- Khintchine theorem states that Ryy(f) is the DFT of the autocorrelation function ryy(t) of y. The value Ryy(0) = ryy(0) gives the average power in the signal.

For signals sampled over a ﬁnite interval of time, the best we can do is estimate the PSD. This result is because the spectra of ﬁnite sequences suﬀer from both poor resolution and leakage (nonzero spectral components at frequencies othe than harmonics of y due to sampling over noninteger multiples of the signal period).

PSD estimates of noisy analog signals from a ﬁnite number of its samples are based on three fundamentally diﬀerent approaches:

• **Non-parametric methods**

Make no assumptions about the data in the sample and work directly with the DFT.

Welch: pwelch( )

• **Parametric methods**

Model the data in the sample as the output of a linear system excited by white noise (noise with zero mean and constant PSD), estimate the ﬁlter coeﬃcients, and use these to estimate the PSD.

Burg: pburg

Yule-Walker: pyulear

**STEPS FOLLOWED:**

1. It applies the window specified by the ***window***vector to each successive detrended section of ***x***.
2. It transforms each section with an ***nfft***-point FFT.

1. It forms the periodogram of each section by scaling the magnitude squared of each transform.

1. It averages the periodograms of the overlapping sections to form ***Pxx***, the power spectrum of***x***.
2. ***Psd*** calculates the power spectral density using the Welch method

**RESULT:**

PSD of different audio signals have been plotted and observed.

