Signals and Systems Laboratory
Indian Institute of Technology Jammu
Experiment No.-4

Objective-

a. Calculate the functions, x[n]=sin(2πfnT), x[n]=exp(-nT/5), etc. Write a DFT routine and calculate the DFT, X[k]=DFTx[n]. The FFT can be implemented in C/C++, Python, etc. Using the tools used in Lab 2, plot x[n] and X[k].

b. Record your own voice and perform DFT and IDFT.

Apparatus- python+matplotlib, MS-Excel, LibreOffice-Calc, Matlab, Scilab, etc
Theory- Discrete Fourier Transform (DFT) is used for transforming discrete-time sequence x(n) of finite length into discrete-frequency sequence X(k) of finite length. It is very powerful tool for frequency analysis of discrete-time signals.
Mathematically, the DFT of discrete-time sequence x(n) is denoted by X(k), given by,

$$X(k) = \sum_{n=0}^{N-1} x(n).e^{-j2\pi kn/N}$$

here, k = 0, 1, 2,.....,N-1. Since, this summation is taken for N points; it is called as N-point DFT.
Inverse Discrete Fourier Transform:
We can obtain discrete sequence x(n) from its DFT. It is called as inverse discrete fourier transform (IDFT).
Mathematically, the IDFT is given by:

$$x(n) = \frac{1}{N} \sum_{k=0}^{N-1} X(k).e^{j2\pi kn/N}$$

here, n = 0, 1, 2,.....,N-1. This is called as N-point IDFT.
Observations-
Result- DFT of two given signals have been computed and plotted using different tools-python, Matlab, Scilab.
Precautions:-

- Program must be written carefully to avoid errors.
- Programs can never be saved as standard function name.
- Commands must be written in proper format.