National Institute of Technology Calicut

Department of Electronics and Communication Engineering

EC 3093D DIGITAL SIGNAL PROCESSING LAB

Sixth Semester B Tech Electronics & Communication Engineering

Experiment 2: Computation of DTFT and DFT .

Note: All the experiments must be implemented in both Matlab and Python.

1. Evaluation of DTFT
   (a) Write a program to evaluate DTFT which can be expressed as a rational function in e^{-jw}. What is the expression for the DTFT to be evaluated? What is the kind of symmetry exhibited by the magnitude and phase spectrum?
   (b) Modify the above program to evaluate the following DTFT in the range $0 \leq \omega \leq \pi$:

$$X(e^{jw}) = \frac{1 + e^{-jw}}{1 + 0.8e^{-jw} + 0.64e^{-j2w}}$$

   (c) Modify the above program to compute and plot the magnitude and phase of the DTFT of the sequence $x[n] = \cos(0.4\pi n)$,$0 \leq n \leq 15$ in the range $-\pi \leq w \leq \pi$. Consider $x[n] = \cos(0.4\pi n)$,$0 \leq n \leq 63$ and plot the DTFT again.Comment on your results.
   (d) Using freqz(), determine and plot the magnitude and phase spectra for the moving average filter with M=2, M=3 and M=4 for $-\pi \leq w \leq \pi$

2. Evaluation of DFT:

   (a) Write a function dft() which computes the DFT of x(n).Using your function,compute and plot the magnitude and phase of the DFT of x[n]=[1 2 3 4].verify your answer with function fft()

   (b) Write a program to verify the fact that the DFT values X[k] are the samples of the DTFT $X(e^{-jw})$ at $w = 2\pi k/N$ k=0,1,...N-1.