Bangladesh University of Engineering and Technology

Department of Electrical and Electronic Engineering (EEE)

Course No.: EEE 312 **Section:** A2

Experiment No. 5

Assignment – 5: FIR Filter Design

Instructions: *Include your Matlab code snippets and all necessary command window output+plots in your report.*

1. Graphically verify the (i) Main lobe widths and (ii) Peak-to-side lobe amplitudes (dB) for different types of window functions for a length of $M = 25$.

2. A discrete-time signal is provided as, $x(n) = 2\sin(0.32\pi n) + 3\sin(0.37\pi n) + \sin(0.4\pi n)$ with a signal length M of your choice. You are to separately use (i) Rectangular, (ii) Bartlett, (iii) Blackman windows on this signal and visualize the frequency domain magnitude distribution. Iteratively find for each case what minimum value of M would make you distinguish the frequency components. Does these M values have any relationships with the 'Main lobe widths' of the individual windows?

3. A discrete-time signal is given to you,

$$y(n) = \sin(0.15\pi n) + \sin(0.35\pi n) + \sin(0.62\pi n)$$

Design an LPF, a BPF, and an HPF to extract the three frequency sinusoids from the signal with Kaiser windowing. For each filter, ripples should follow this condition: $[\delta_p, 5\delta_s < 0.03]$. Choose stop-band and pass-band frequencies (ω_p, ω_s) so that the Kaiser window length remains less than 50. Finally, show each extracted sinusoid in both time and frequency domain.