



Faculty of Electrical & Electronics Engineering

DIGITAL SIGNAL PROCESSING

CHAPTER 5: FIR FILTER DESIGN

PROJECT / ASSIGNMENT (30 Marks)

Name: _____

Date: _____

Project/Assignment Instructions:

- (i) This is a group project.
- (ii) Deadline (Due date): **will be determined.**
- (iii) Submission method: Hardcopy report and softcopy of the MATLAB coding. The hardcopy format shall follow the standard report format. All group members must sign the cover sheet of the report.
- (iv) The coverage of the project is teaching materials/slides on the related topics slides and reference books as stated below;
 - 1. J.G. Proakis and M.G Manolakis, *Digital Signal Processing: Principles, Algorithms, and Applications*, New Jersey, USA: Prentice Hall, 1996 (Chapter 7 & 8).
 - 2. S.K. Mitra, *Digital Signal Processing: A Computer-Based Approach*, 3rd Ed., New York, USA: McGraw-Hill, 2006 (Chapter 8-10)
 - 3. E. C. Ifeachor & B. W. Jervis, *Digital Signal Processing: A Practical Approach*, 2nd Ed., Essex, England: Prentice Hall, 2002 (Chapter 6, 7, 8).
 - 4. R. J. Thervo, *Practical Signals Theory with MATLAB Applications*, USA: Wiley & Sons, 2010 (Chapter 9).
 - 5. A. Palamides & A. Veloni, *Signals and Systems Laboratory with MATLAB*, USA: CRC Press, 2011 (Chapter 8, Chapter 11).The other Digital Signal Processing reference books can be referred as well including engineering letter, magazine or website.
- (v) Software: MATLAB.
- (vi) The project requires presentation from each group.

Project/Assignment Background:

A digital filter is the basic building block in any Digital Signal Processing (DSP) system. It is used to filter the source signals to the specified frequencies for the process of DTS (discrete-time systems). The **frequency response** of the filter depends on the value of filter coefficients which can be obtained from the filter specifications. The quality of the filtered signal depends on the **filter coefficients**. Many software or application programs are available to compute the values of coefficients based on the desired frequency response. In this course, students are exposed to computer-aided digital filter design using MATLAB.

Project/Assignment Task:

As an Electronics Engineer in XYZ company, you are required to design the FIR Bandpass digital filter to meet the following specifications;

Passband frequency: 4000 – 10000 Hz
Stopband attenuation: > 55 dB
Passband ripple: < 0.8 dB
Transition width: 2000 Hz
Sampling frequency: 36 kHz

Calculate and develop MATLAB program to determine the following parameters;

- (i) Filter length using suitable window and optimal methods.
- (ii) Plot the frequency response for both methods.
- (iii) Derive equation of impulse response from both methods.
- (iv) Plot the filter coefficients using both methods at $0 \leq n \leq N$. Describe your observation in term of filter length for both methods.
- (v) Obtain the transfer function of the system and then plot the zero-pole location of the system.

