Activity No. 13	
Optimized Filter Designer in Matlab	
Course Code: CPE027	**Program:** BSCpE
Course Title: Digital Signal Processing and Application	**Date Performed:** Dec. 2, 2022
Section: CPE41S3	**Date Submitted:** Dec. 2, 2022
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1. Objective:

To demonstrate how Filter Designer function works MATLAB

2. Intended Learning Outcomes (ILOs):

After completion of this activity the students should be able to:

2.1 Design Digital Filters into data
2.2 Simulate Filter Filters in MATLAB
2.3 Filtered and unfiltered output signal in the MATLAB platform by following the necessary parameters

3. Resources:

The activity will require the following software, tools and equipment:

3.1 Desktop/ Laptop Computer
3.2 MATLAB

4. Procedures

Optimized FIR Filter

Create a Folder for Your Tutorial Files

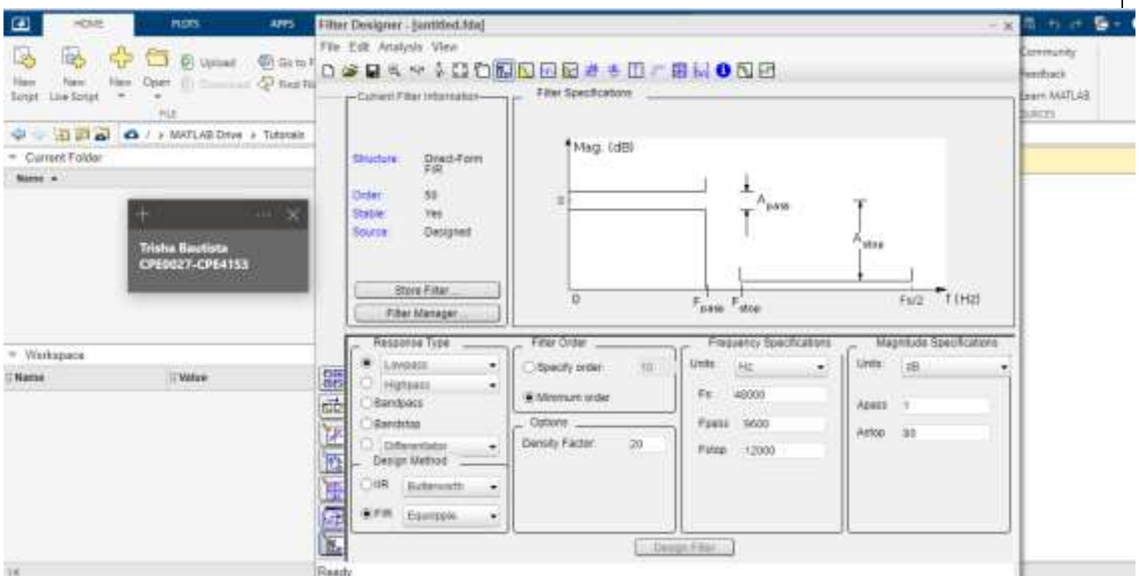
Set up a writable working folder outside your MATLAB® installation folder to store files that will be generated as you complete your tutorial work. This activity will require that you create the folder hdlfilter_tutorials on drive C.

Design the FIR Filter in Filter Designer

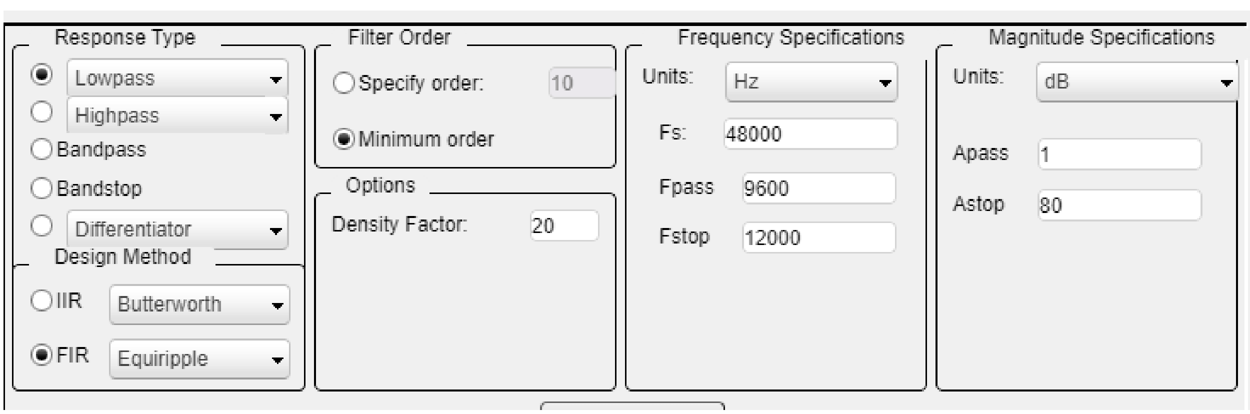
This tutorial guides you through the steps for designing an optimized quantized discrete-time FIR filter, generating Verilog code for the filter, and verifying the Verilog code with a generated test bench.

This section assumes that you are familiar with the MATLAB user interface and the Filter Designer.

1. Start the MATLAB software.
2. Set your current folder to the folder you created in Create a Folder for Your Tutorial Files.
3. Start the Filter Designer by entering the filterDesigner command in the MATLAB Command Window. The Filter Design & Analysis Tool dialog box appears.

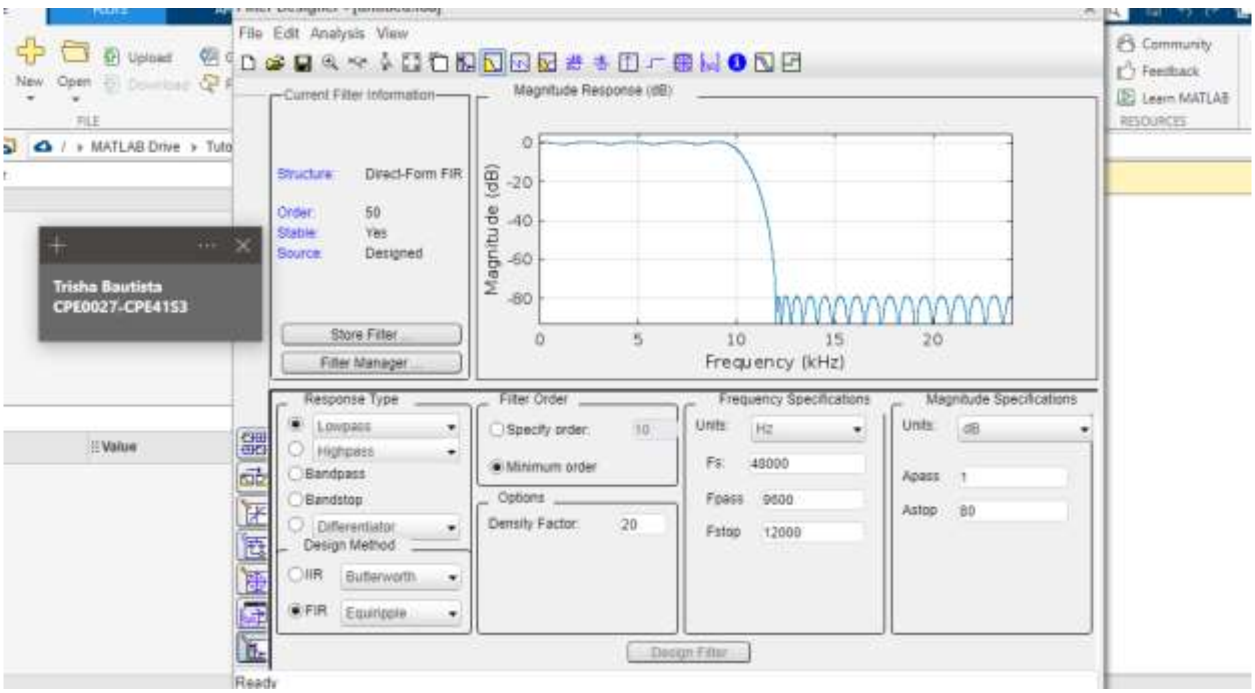


4. In the Filter Design & Analysis Tool dialog box, set the following filter options:



5. These settings are for the default filter design that the Filter Designer creates for you. If you do not have to change the filter, and **Design Filter** is grayed out, you are done and can skip to Quantize the FIR Filter.
6. Click **Design Filter**. The Filter Designer creates a filter for the specified design. The following message appears in the Filter Designer status bar when the task is complete.
7. Designing Filter... Done

   For more information on designing filters with the Filter Designer, see the DSP System Toolbox™ documentation.



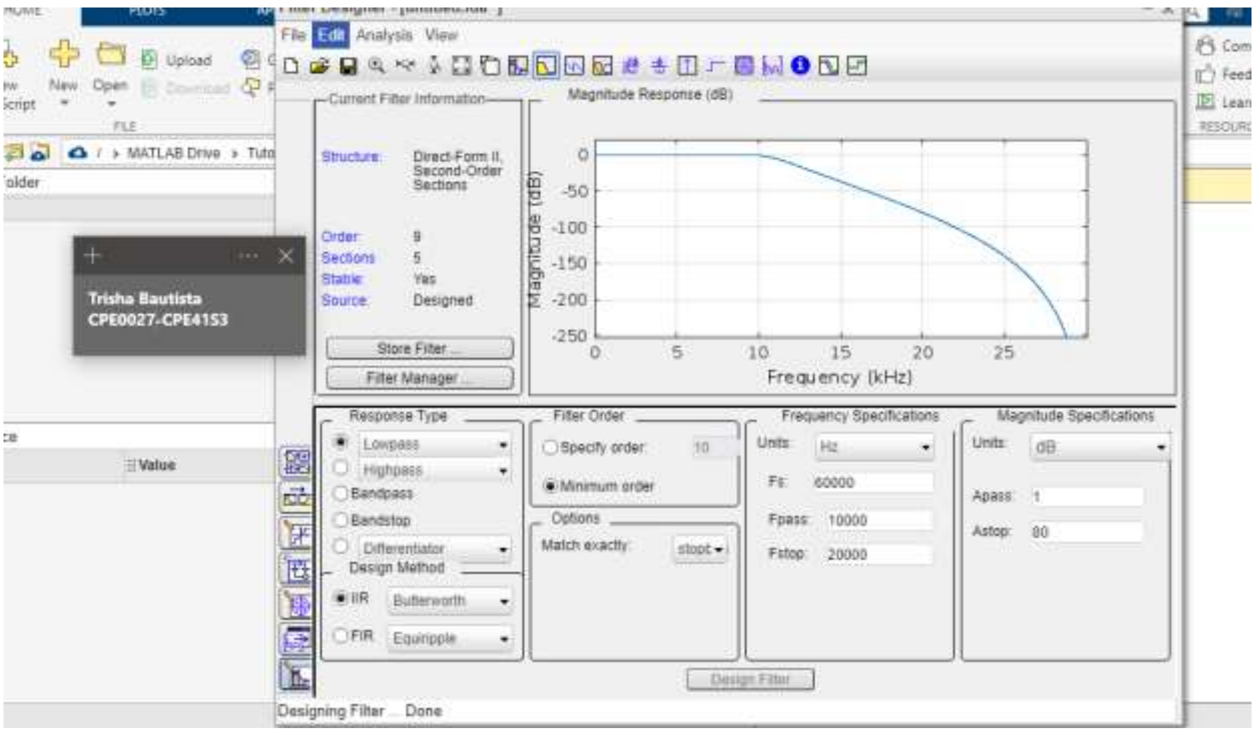
Analyze the following scenarios in Filter Designer

Set the following Parameters per each type

A.

- Response Type Lowpass
- Design Method IIR Butterworth
- Frequency specifications Fs: 60000
- Fpass 10000
- Fstop 20000

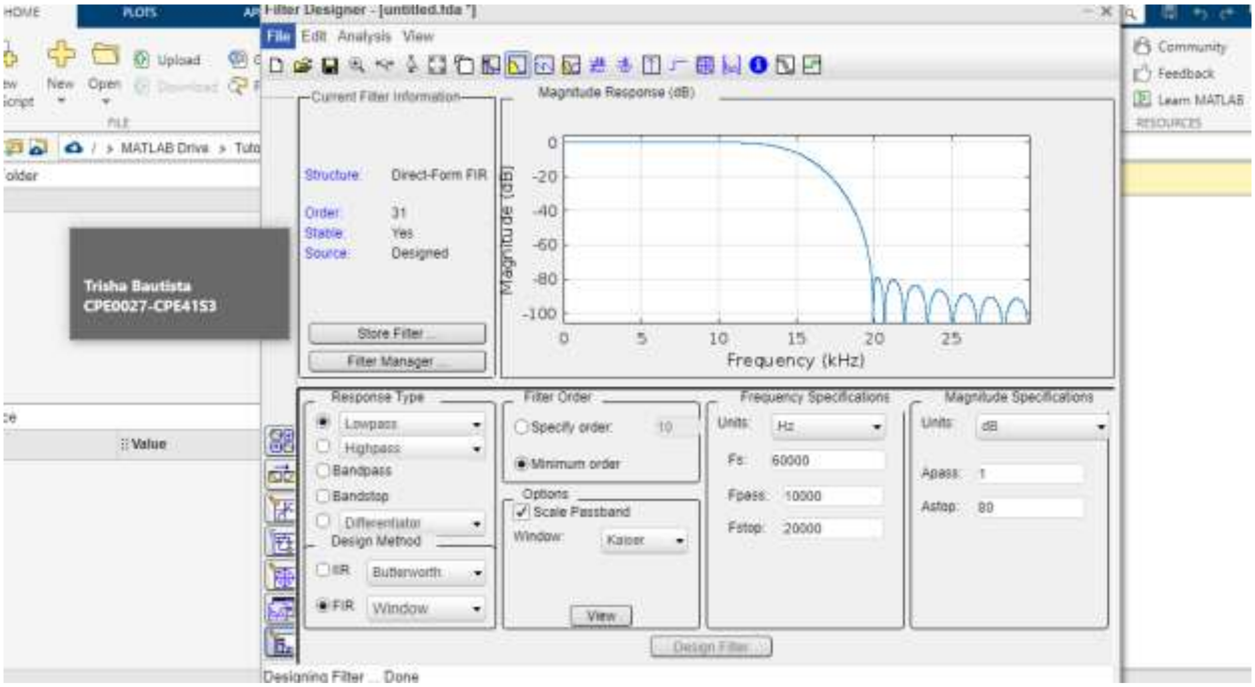
Screenshot of output here:



B.

- Response Type Lowpass
- Design Method FIR Window
- Frequency specifications Fs: 60000
- Fpass 10000
- Fstop 20000

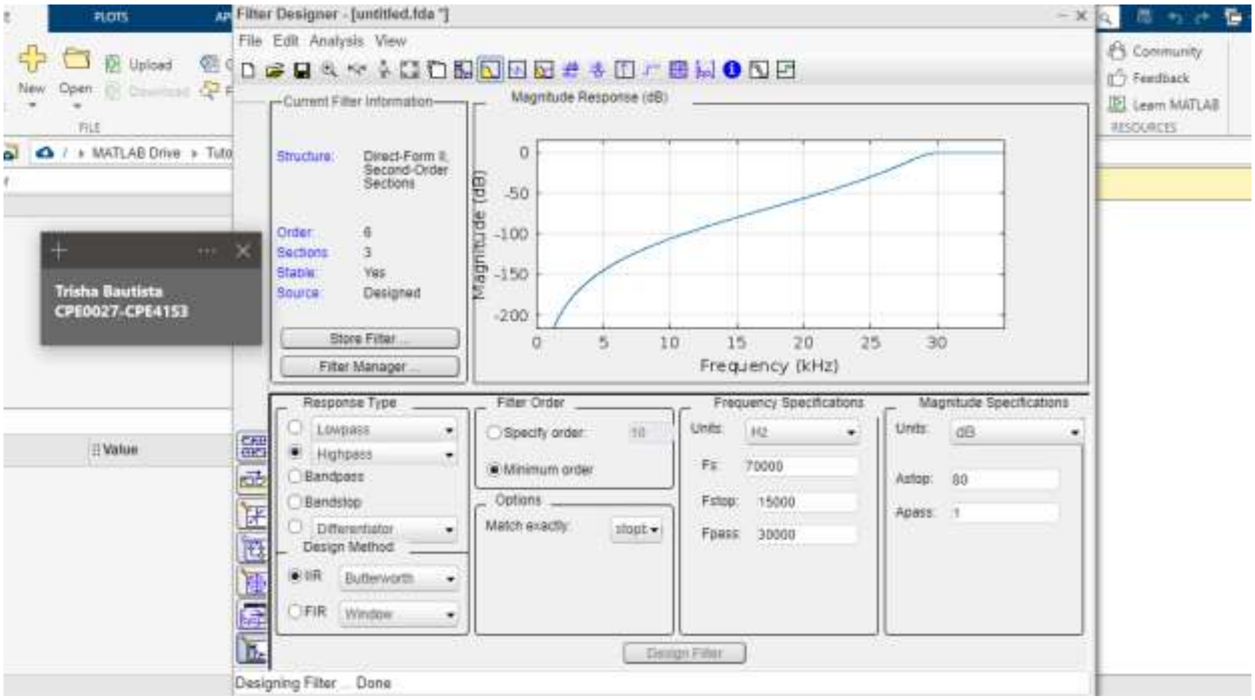
Screenshot of output here:



C.

- Response Type Highpass
- Design Method IIR Butterworth
- Frequency specifications Fs: 70000
- Fpass 15000
- Fstop 30000

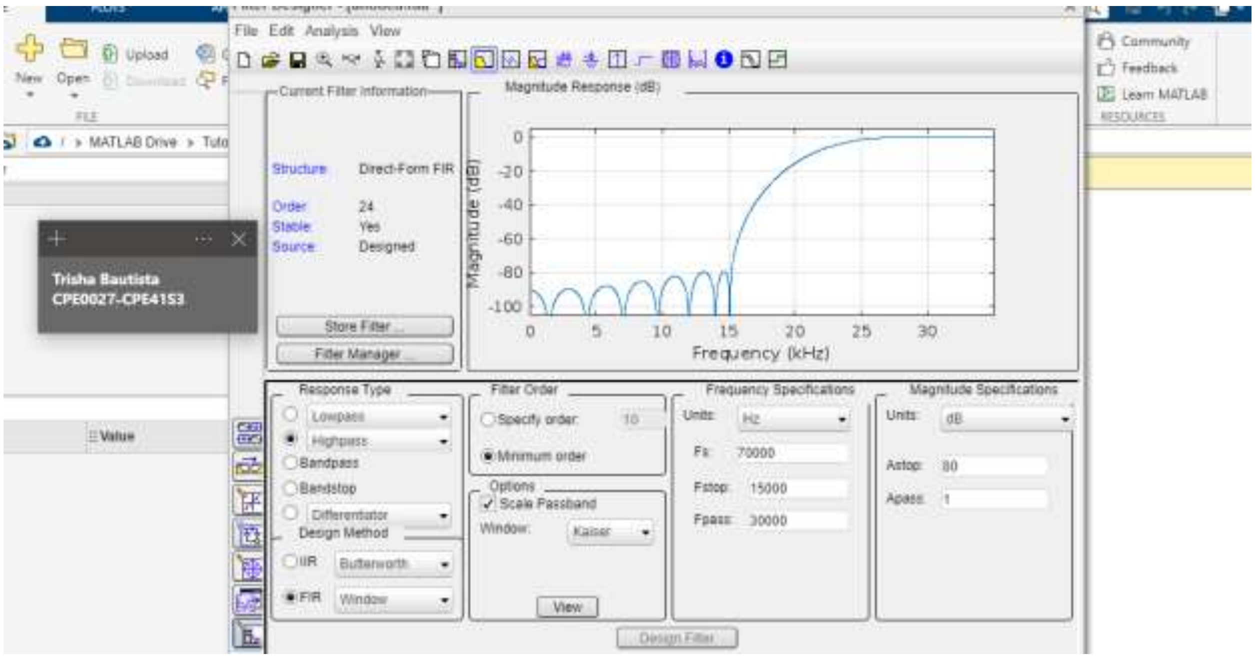
Screenshot of output here:



D.

- Response Type Highpass
- Design Method FIR Window
- Frequency specifications Fs: 70000
- Fpass 15000
- Fstop 30000

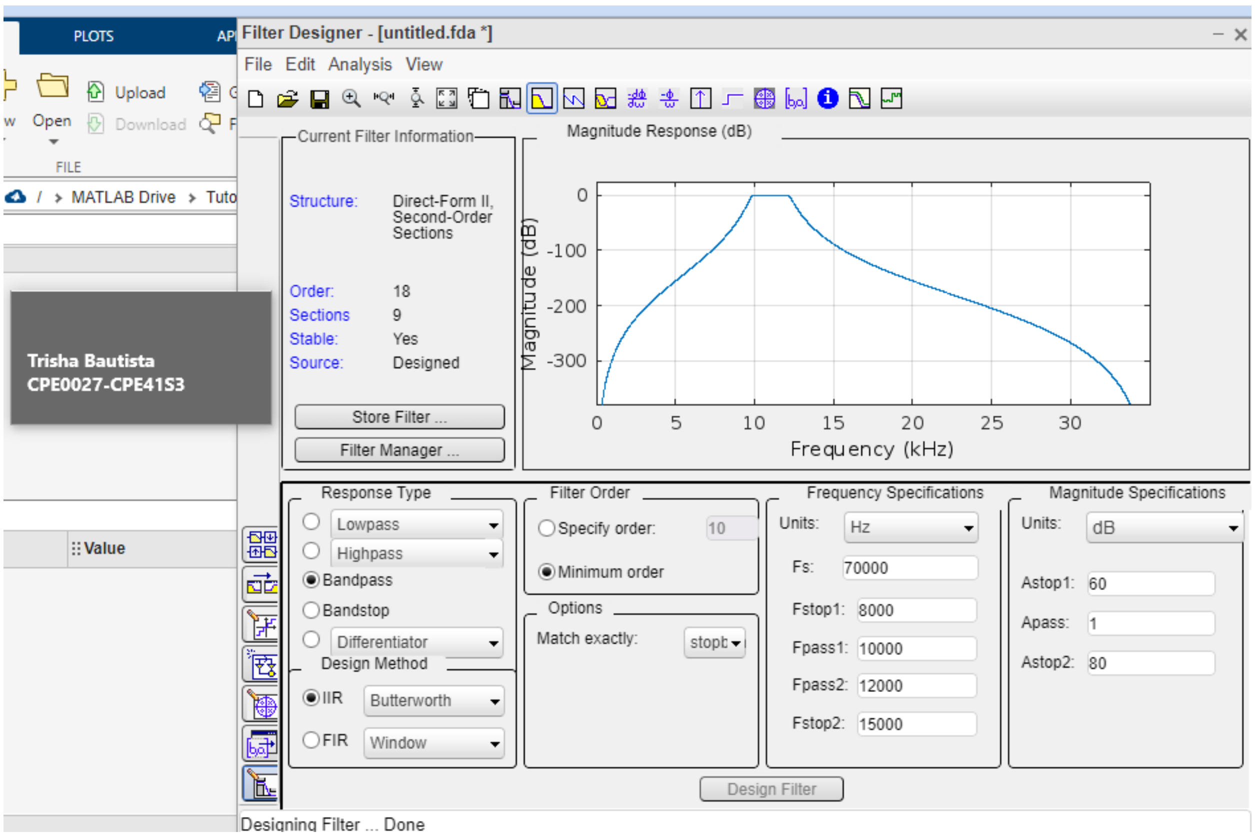
Screenshot of output here:



E.

- Response Type Bandpass
- Design Method IIR Butterworth
- Frequency specifications Fs: 70000
- Fpass1 10000
- Fstop1:8000
- Fpass2: 12000
- Fstop2:15000

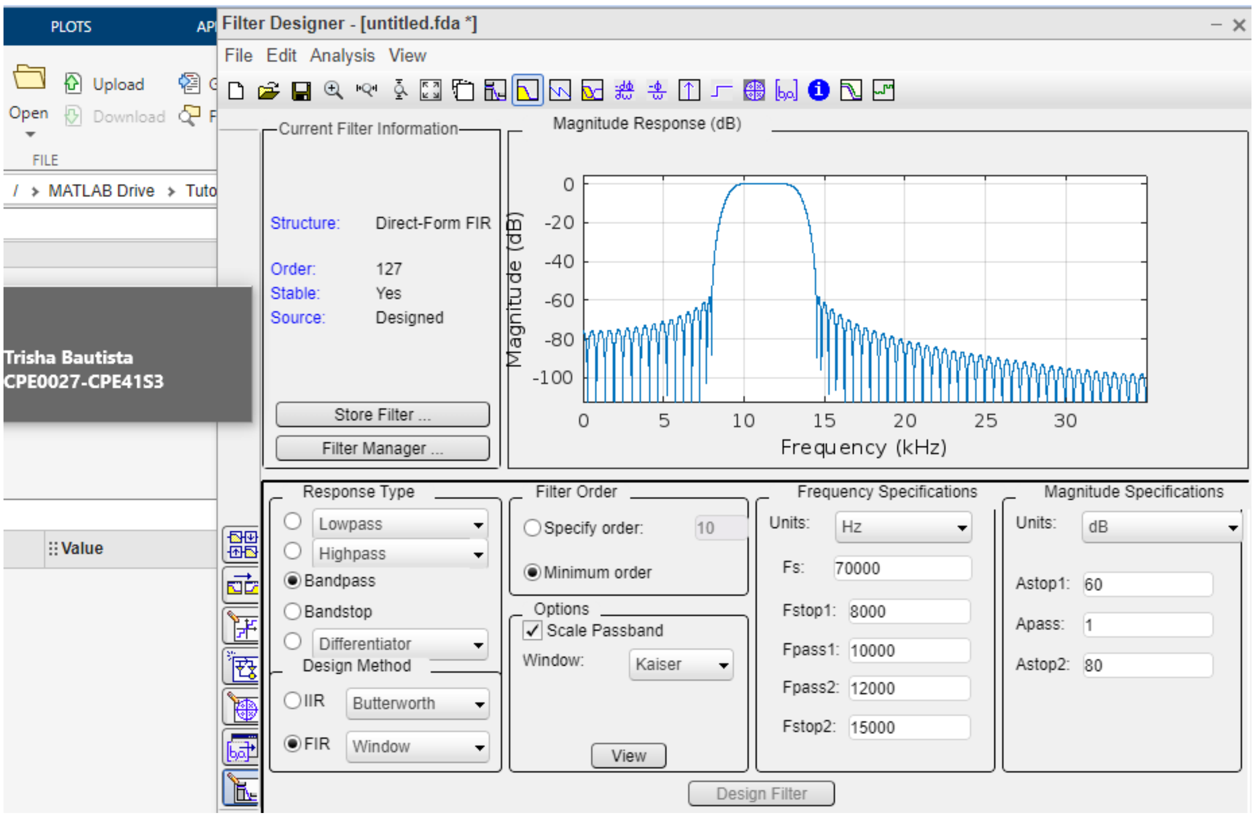
Screenshot of output here:



F.

- Response Type Bandpass
- Design Method FIR Window
- Frequency specifications Fs: 70000
- Fpass1 10000
- Fstop1:8000
- Fpass2: 12000
- Fstop2:15000

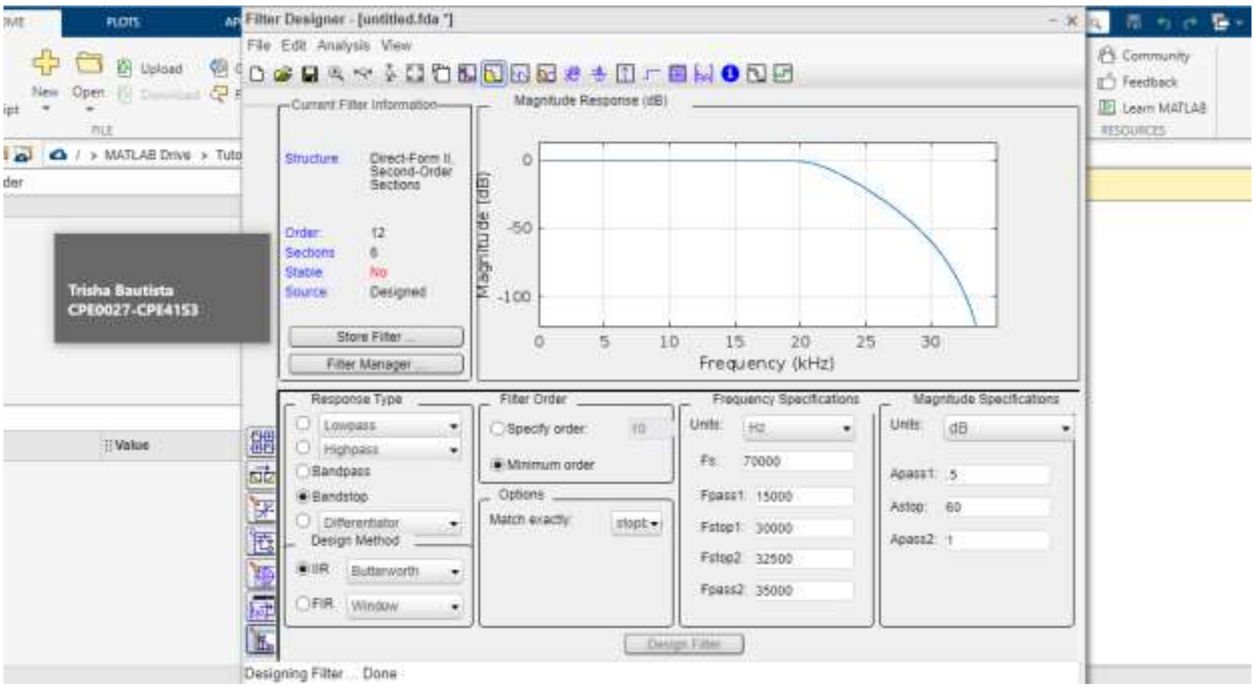
Screenshot of output here:



G.

- Response Type Bandstop
- Design Method IIR Butterworth
- Frequency specifications Fs: 70000
- Fpass1: 15000
- Fstop1: 30000
- Fpass2: 35000
- Fstop2: 32500

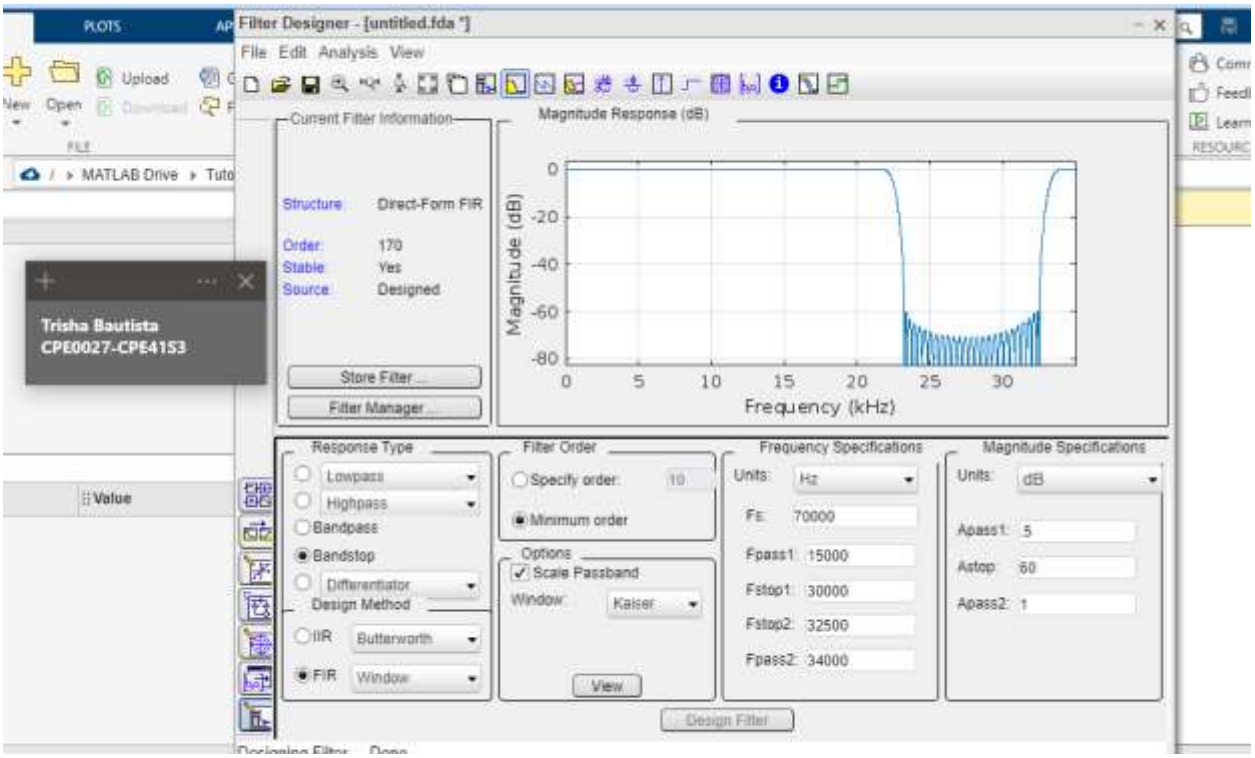
Screenshot of output here:



H.

- Response Type Bandstop
- Design Method FIR Window
- Frequency specifications Fs: 70000
- Fpass1: 15000
- Fstop1: 30000
- Fpass2: 34000
- Fstop2: 32500

Screenshot of output here:



5. Observation (Discussed here what have you observe in the entire activity):

After completing this task, I came to the realization that combining filter design with Matlab is the best way to understand how to create filters and how to use filters to generate signal outputs. This was one of the key takeaways for me. In addition to this, it replicates output signals in their filtered and unfiltered forms with the properties that are detailed further below. In addition, my research has shown that the value of Fstop must not be higher than the value of Fpass; else, the design filter would not work well.

6. Conclusions

After finishing the work, I learned that digital filtering techniques are most commonly utilized when applied to time-domain data, such as in applications that include real-time filtering. A digital filter may be able to run quicker than an FFT technique in which a forward FFT translates a signal from the time domain into the frequency domain. This, however, is dependent on the features of the system. When a FIR window is used, the development of a signal output that is sensitive to changes in signal amplitude will occur as a result of the process. Filters are designed to improve the overall quality of signals and get them ready for further processing by removing undesirable artifacts from the signals. A wide variety of signal processing operations cannot be completed without the utilization of digital filters.

7. Assessment (Rubric for Laboratory Performance):

Title (5%)
Introduction & Objectives (15%)
Materials and Methods (20%)
Data Analysis & Discussion (25%)
Conclusion (20%)
Literature Cited (5%)
Report format and quality (10%)