



Department of Electrical & Electronics Engineering  
College of Engineering  
EEEB3024 Digital Signal Processing  
Semester 1, Academic Year 2022/2023

## Group Project – Frequency Shift & Filter Design

**Group Project:** You must attempt this project in a group of 2-3 people.

### Evaluation:

Marks are based on the report (20%) and demonstration (80%). Marks are divided as follows:

#### Report (20%)

Criteria	Marks (20%)	
Appearance and Formatting	5	
Language	5	
Content & Data presentation: i.e. Figures, Tables, etc.	10	

#### Demonstration (80%)

Criteria	Marks (80%)	
<i>Familiarity on tool(s)</i>		
- Able to implement DSP theory	20	
- Able to demonstrate important MATLAB functions	20	
- Code neatness		
<i>Operation of tools(s)</i>		
- Able to generate output graphs	20	
- Able to explain output graphs	20	

### Report due date:

The group project report is to be submitted by 16 December 2022.

### Demonstration schedule:

You will need to demonstrate that your project works. The demonstration is scheduled between 5-16 December 2022.

### Task 1:

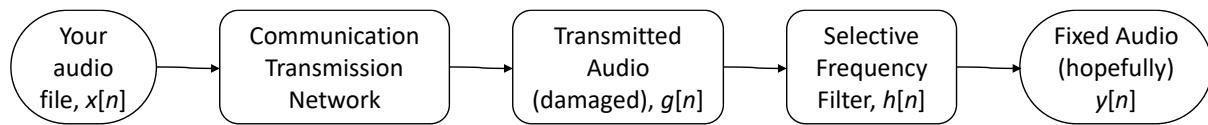
A middle C audio tone is generated at 261.6 Hz. The [GroupProjectPart1.m](#) file will increase the frequency of this audio by 30 Hz. The 30 Hz value is set in line 12 of the m-file.

*Task 1A* – Adjust all plots so that they display meaningful graphs. For example, the time domain plot displays too many cycles. Also label all graphs and axes with the correct values.

*Task 1B* – Instead of increasing frequency, we want to reduce the audio frequency by 30 Hz (i.e.:  $f_0 = -30$ ). To achieve this, write the codes for negative frequency shift.

## Task 2:

You want to send an audio message file across a network. However this network is adding some noise to the audio message. Frequency domain filtering is a useful method to reduce or remove unwanted noise from audio signals.



1. Record one person's voice reading any of the statements in **Appendix A**. You can use software such as Audacity, Windows Voice Recorder, Mac's Voice Memo app, or your mobile phone's audio recorder.
2. Save the file as a .wav or .mp3 file. Other files types are acceptable as long as Matlab can read it.
3. Download the files from [Github](#). Place the files in your Matlab working directory.
4. Use transmitThisAudio.m to create a transmitted file using your audio recording.
5. You must design at least one FIR or IIR filter to be applied, using the step-by-step techniques learnt in class.
6. You may apply more than one filter.
7. Display **at least** the following graphs in both time and frequency domains:  $g[n]$ ,  $h[n]$ , and  $y[n]$ . Define the frequency domain  $x$ -axis limits to focus on the spectrum content. Properly label all graphs with names and units.
8. You are free to use any Matlab technique to accomplish your task, as best you can.
9. **Marks are given on effort.** Show your work. Do your best.

## What to report on:

Generally: introduction, methodology/design, analysis, discussions, conclusion, references.

Specifically:

1. Report on both tasks inside one manuscript.
2. Show and explain frequency domain plots of the audio before and after filtering.
3. Compare the differences between FIR and IIR filters. Then present and discuss in detail your design for the FIR or IIR filter you used to accomplish the task above.
4. Explain your Matlab approach and explain some important excerpts of your codes.
5. Include your complete m-file script as an appendix to the report.
6. Report format: IEEE manuscript template.

<https://www.ieee.org/conferences/publishing/templates.html>

**Tips:**

<code>sound(x,Ft)</code>	Convert matrix of signal data to sound
<code>clear sound</code>	Stops the audio from playing
<code>B = transpose(A)</code>	To transpose a matrix

**Appendix A – Statements to read (choose 1, read slowly, with feeling)**

Num	<YOUR ID NUMBER> + one statement below
1	Yang bulat tidak datang bergolek, yang pipih tak datang melayang
2	Berjagung-jagung dahulu sementara menunggu padi masak
3	Bersihkan halaman sendiri dahulu, baru bersihkan halaman orang
4	Diibaratkan sebagai condong ditumpil, lemah dianduh
5	Hendak belajar berenang dapatkan itik, hendak belajar memanjat dapatkan tupai
6	Jika ada kemenyan sebesar lutut pun, jika tidak dibakar tidak akan berbau

Example:

*EP1005060 Jika ada kemenyan sebesar lutut pun, jika tidak dibakar tidak akan berbau*

All the best!