

**Software Project - EEE 3218 – Digital Signal Processing Lab**

**Spring - 22**

An audio file '*final.wav*' which contains combined and overlapping **modified** sounds of the instruments - trumpet, piano, violin, and guitar, has been provided. Another file '*NonOverlapping.wav*' contains the non-overlapping **modified** sounds of the musical instruments – guitar, piano, trumpet and violin (in this order). Use "audioread" for audio signal input in MATLAB. Your task is to achieve the following goals using MATLAB codes:

- 1) Find the spectrum of each of the instrument's sound from 'NonOverlapping.wav' file and determine the frequency ranges.
- 2) Find the spectrum of the combined sound signal from 'final.wav' file and determine the frequency range.
- 3) Design a digital filter that would separate the sound of each instrument from "final.wav" file. Mention the filter type, filter design methods, filter order, and the cutoff frequency of the filter.
- 4) Extract each instrument sound in separate '.wav' file.
- 5) Closely observe the spectrum of all 4 separated wav-files individually. Can you suggest any way to pass the individual wav files separately through a channel of bandwidth 0 to 10 kHz?
- 6) Send any 2 of the above 4 separated signals through a 2-channel FDM (frequency division multiplexed) link. Use a carrier of X Hz where X is the last 4 least significant digits of your 9 digit ID. Choose another carrier cleverly to optimize the FDM link bandwidth while keeping the signal fidelity as high as possible.
- 7) The signal extracted from the 'final.wav' audio file lacks melody. Can you convert this into an overlapping yet melodious one with proper synchronization of octaves using MATLAB code?

**Rules for Submission:**

- Submission of report is individual.
- Your report should contain all the necessary graphs, data, codes, your observation and an explanation of each curve.
- You can take help from the '**filter designer**' toolbox only to verify the result.
- Create a **zip file** containing the pdf of the project report, the extracted signals, and the codes. Submit the zip file through google form which will be made available for submission in Google Classroom.
- **Do not copy from others. Plagiarism is strictly discouraged.**