E9 213 Time-Frequency Analysis
Assignment 3

Maximum Marks: 20
Due Date: 04/10/24, 11:59pm

General Instructions

- Use either **MATLAB** or **Python** to solve the programming problems. Be sure to include comments within your code to enhance readability.
- Develop your own functions for all questions.
- If you're coding in Python, organize your work within a single Jupyter Notebook (`.ipynb`). Clearly separate the code for each question into different cells and label them accordingly.
- In addition to your code, submit a PDF document that includes all the results (such as images or numerical outputs), along with your observations and conclusions.
- Name your code file as `A3_FirstNameLastName_code` and your report as `A3_FirstNameLastName_report.pdf`.
- Submit both files via email to oindrilah@iisc.ac.in with the subject line **TFA Assignment 3 Submission** before the deadline. Please note that late submissions will be penalised.

Problem 1. *Spectrogram of Generated Signals* *6 points*
Plot the spectrograms of the following signals:

1. $f_i[n]$ specified in Figure 1.
2. $$\phi_i[n] = \sum_{m=0}^{n} f_i[m]$$
$$s[n] = A\cos(2\pi\phi_i[n])$$

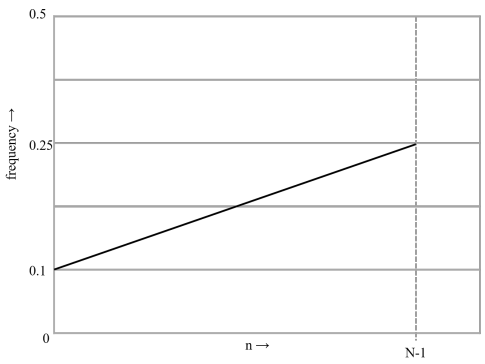

Figure 1: Custom Signal

Problem 2. *Spectrogram of Real Signals* *10 points*
Load the files and plot their waveform along with the spectrogram.
Files:

1. Gravitational Wave: Click here
2. Female Voice: Click here
3. Male Voice :Click here
4. Dog Bark 1 :Click here
5. Dog Bark 2 :Click here
6. Violin :Click here
7. ECG Signal :Click here
8. EEG Signal :Click here

Problem 3. *Narrowband and Wideband Spectrograms* *4 points*
Plot narrowband and wideband spectrograms for all the signals and specify which one should be used in each case and why?