Project Instructions

- The project consists of two main tasks given below. Each team must perform both the tasks.
- Each team must use the data files according to their team number as indicated.
- The processing must be done using MATLAB software; a tutorial will be conducted on this.
- Link for using MATLAB online: https://in.mathworks.com/products/matlab-online.html
- Submit a report of your understanding of the signals in TASK 1 & 2. Include plots obtained on MATLAB to justify your observations. A sample report format will be shared.
- Expected deliverables per team:
  a) A typed project report in PDF format
  b) MATLAB codes written for the processing and analysis part
  c) Snapshots of relevant figures
  d) All the above combined in a single zip folder and uploaded

TASK 1

(a) Files for TASK 1 – download the wav file with your team number.

(b) In MATLAB, load the signal in the wav file with your team number. Visualize the signal and identify its characteristics. Visualize its frequency characteristics with the spectrogram. Note down your observations in the report.

(c) Write a code to generate a signal of this type. The frequency of the signal should vary from $F_0 = N\ (mod\ 10) * 10$ to $F_1 = N * 100$ where N is your team number. Do not use inbuilt MATLAB signals or commands for this. Submit code file and result in png format.

TASK 2

(a) Download the ECG signal from this website. If your team number is xx, you must download the file with name 1xx.csv. Load the file into MATLAB and use first 3000 samples of it.

(b) Visualize the signal by plotting; this is an example of quasi-periodic i.e., approximately periodic signal. What is approximate period of this signal in seconds from the plot? Use sampling rate.

(c) Estimate period of the ECG signal as follows – design an LTI system with an appropriate impulse response and the ECG as input signal. The output of this system should give peaks with same period as input signal. Justify your design choice for LTI system. Is this choice unique? Hint: the impulse response is closely related to the input signal.

(d) Use the period found in part (c) to perform Fourier series analysis of one period of this ECG signal. Plot the Fourier series coefficients. Use the result to generate some synthetic ECG signals.

(e) **[OPTIONAL]** Repeat above task for any naturally or commonly occurring (quasi-)periodic signal.