

# Speech Signal Processing

Assignment 2

Course Code **EC5.408**

Max. points **20**

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## Note:

- Always cite your sources (be it images, papers or existing libraries). Follow proper citation guidelines
- Unless specifically permitted, collaborations are not allowed.
- Do not copy or plagiarise, if you're caught for plagiarism or copying, penalties are much higher (including an **F** grade in the course) than simply omitting that question.
- Need to mention clearly if any assumptions are being considered.
- No late submissions are accepted.

## Syntax to be followed for submission

- A single zip folder has to be uploaded in the moodle, which should contain the snapshots of your Numericals, observations to be saved in a pdf format and computer based questions (code) should be placed in the respective folder. And the name of the zip file should strictly be **EC5\_408\_A2\_RollNo.zip**

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- For this assignment you can use either *Python* or *Matlab* which ever your are comfortable.
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1. Load the audio file (H\_MKB.wav) which is provided to you into MATLAB/Python and perform the following task. Audio file is shared along with the assignment.

### **Note: Computer Based Question**

- (a) Create a time domain plot (**0.5 pts**)
  - (b) Apply framing on to the signal (**0.5 pts**)
  - (c) Find one voiced frame among the all the frames and plot it (**0.5 pts**)
  - (d) Compute Fourier transform on the voice frame which you have considered in the step (c) (**0.5 pts**)
  - (e) Apply log to the step (d) and plot it (**0.5 pts**)
  - (f) Compute exponential operation for the step (e) (**0.5 pts**)
  - (g) Compute Inverse Fourier transform for the step (f) and plot it (**0.5 pts**)
  - (h) Comment on step (c) and step (g). If the outputs are same justify why? viceversa (**1.5 pts**)
2. Load the audio file (chunk1.wav) which is provided to you into MATLAB/Python and perform the following task. Audio file is shared along with the assignment.

### **Note: Computer Based Question**

- (a) Create a time domain plot (**0.5 pts**)

- (b) In the time-domain plot, mark the regions where the pitch is the highest and the lowest. What are the pitch frequencies in those regions? **(0.5 pts)**
  - (c) Write a code to calculate number of zero-crossing present in the signal **(2 pts)**
  - (d) Compute of frame energy and comment of it **(1 pts)**
  - (e) Comment on what type of region it is voiced or unvoiced **(1 pts)**
3. Write a short note on the following:
- Zero-Crossing **(1 pts)**
  - Autocorrelation **(1 pts)**
  - Epochs **(1 pts)**
  - What are the assumptions to be considered while analyzing speech signal? **(2 pts)**
4. Load the audio files lataji\_nrm.wav and lataji\_sng.wav into MATLAB/Python and perform the following task. Audio file is shared along with the assignment.
- Note: Computer Based Question**
- (a) Create a time domain plots **(1 pts)**
  - (b) Plot the pitch contour **(2 pts)**
  - (c) Comment on the structure of pitch contour of both the signals. **(2 pts)**
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