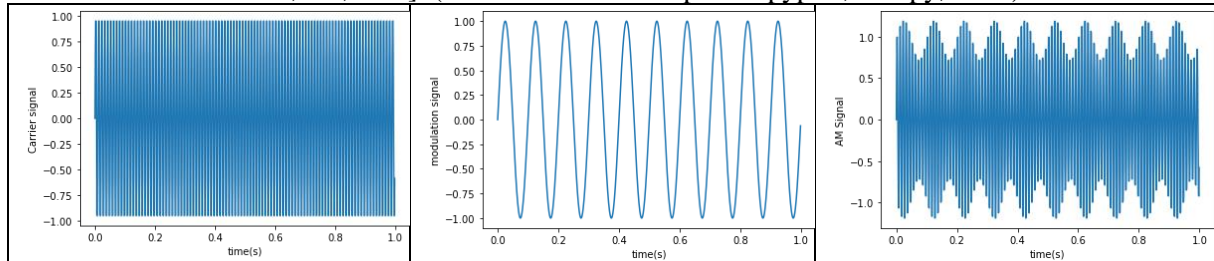


## Introduction to Python [ECE319]

### Open-ended Experiments 2023

- 1) Write a program in Python to create a class '**Modulation**' with instance variables **carrier\_frequency (fc)** and **sampling frequency (fs)**. Define two methods **sinewave()** for generation of sine wave of unit amplitude and a given frequency and **ampmod()** with input parameters of modulation frequency and modulation index, which returns the amplitude modulated signal. Call the methods and plot the carrier signal, modulation signal and amplitude modulated signal.

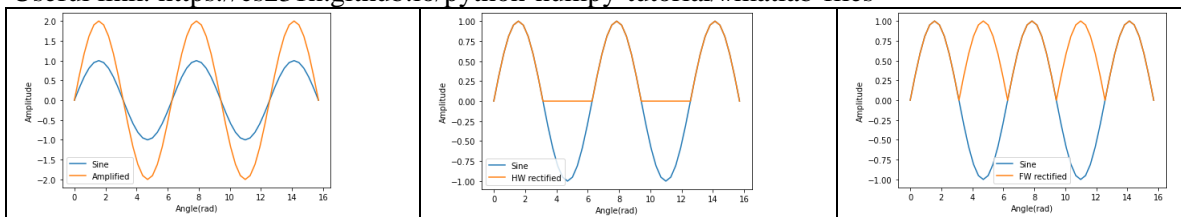
[Assume the following for plot generation: Total signal duration 1s,  $f_s=1000$  Hz,  $f_c=100$ Hz,  $f_m=10$ Hz, modulation indices 0.25, 0.5, 0.75]. (Useful libraries: matplotlib.pyplot, numpy, math)



- 2) Write a program in Python to
- Generate a sine wave
  - Implement **amplification**, **half-wave rectification** and **full-wave rectification**.
  - Display the original signal as well as amplified and rectified signals.

Useful libraries: matplotlib.pyplot, numpy

Useful link: <https://cs231n.github.io/python-numpy-tutorial/#matlab-files>



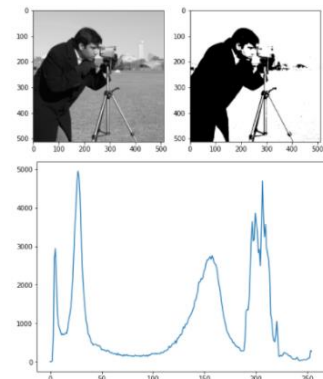
- 3) Write a program in Python to read and display a gray-scale **image**. Plot its **histogram** and identify an appropriate threshold value. Form a **binary image** of the original image. Display the **thresholded image**.

Useful libraries: skimage, skimage.data.camera(), matplotlib.pyplot, numpy

Useful Links:

Image processing: <https://scikit-image.org/docs/dev/api/skimage.data.html>

<https://cs231n.github.io/python-numpy-tutorial/#images>



- 4) Write a program in Python to
- Read and playback an example **audio file** from librosa library.
  - Plot** the audio signal as function of time.
  - Plot the **Fourier transform** and **Spectrogram** of the audio signal.

Refer: <https://www.geeksforgeeks.org/plotting-a-spectrogram-using-python-and-matplotlib/?ref=gcse>

- 5) **Encryption, Decryption** of strings: Write a Python Program to import suitable libraries and hence, encrypt and decrypt a string input from the user.

Refer: <https://www.geeksforgeeks.org/how-to-encrypt-and-decrypt-strings-in-python/>

- 6) Write a Python Program to print grade sheet for student: Given the following details of five students, write a program in Python to do the following:

- Define a class **Student** with
  - one class variable- **subjects** containing names of all subjects

- ii) two instance variables - **name** and **marks**.
  - iii) The class has a method **grd()** that prints the grade scored in each subject, given the marks scored in the subject.
  - iv) There is another method called **overall\_result()** that prints the average percentage and overall class secured by the student.
- b) For each student, print the result of the student, as shown in the attached example (use iterative loop)

#### Student Marks (for making dictionary):

	English	Physics	Chemistry	Math	Hindi	Age
Ravi	77	65	75	90	84	14
Anuj	45	55	65	62	70	15
Rashi	75	87	91	95	80	13
Danish	65	77	84	90	55	13
Ritu	76	85	88	78	65	14

#### Grade in each subject (for method grd()):

Marks in a Subject	Grade
<60	D
>=60 and <70	C
>=70 and <85	B
>=85 and <=100	A
else	E

#### Average Score to Class secured (for method overall\_result())

Average Marks	Class Secured
<60	II
>=60 and <75	I
>=75	Distinction

#### Expected Result:

```

Result of Ravi
Grade in English : B
Grade in Physics : C
Grade in Chemistry : B
Grade in Maths : A
Grade in Hindi : B
Percentage Score: 78.2 , Class: Distinction
Result of Anuj
Grade in English : D
Grade in Physics : D
Grade in Chemistry : C
Grade in Maths : C
Grade in Hindi : B
Percentage Score: 59.4 , Class: II

```

#### 7) Write a Python program for a **Dice Rolling Game**.

- a) Simulate the game as a mutli-player game. Ask the user how many players will play the game. (at least two players must play the game.).
- b) Players play in alternate turns. In one round, each player gets a chance to roll the dice.
- c) For each turn, the program generates two random integer number between 1 and 6 to simulate rolling of two dices. Display number on dice for each player.
- d) When each player has rolled the dice, the player with the highest number wins that round. Display winner of each round.
- e) Game goes on for 5 rounds.
- f) Overall winner(s) is the player who wins most number of rounds.

Create appropriate displays to display winner of each round and the overall winner

#### 8) Create a **word guessing game** in Python. Only vowels in a word will be displayed. The other letters are replaced with their location in the word. The player enters the location and the guessed character for that location. If the guess is correct, the guessed character is displayed as part of the word, else the game continues till the player guesses all the characters correctly. Player gets 12 turns at the max.

```

The given word is...      [0, 'a', 't', 'e', 4]
                          Guess the characters! (Turns left 8 )
[0, 'a', 2, 'e', 4]      Enter a location: 0
                          Enter the guessed character: w
                          Correct Guess!
                          ['w', 'a', 't', 'e', 4]
                          Guess the characters! (Turns left 7 )
                          Enter a location: 4
                          Enter the guessed character: r
                          Correct Guess!
                          ['w', 'a', 't', 'e', 'r']
                          You win
Guess the characters! (Turns left 10 )
Enter a location: 2
Enter the guessed character: t
Correct Guess!
[0, 'a', 't', 'e', 4]
[0, 'a', 't', 'e', 4]
Guess the characters! (Turns left 9 )
Enter a location: 0
Enter the guessed character: d
Incorrect Guess!

```

- 9) **Unsupervised learning:** Write a program in Python to implement k-means clustering to predict labels given a feature set. Given the data about Blood Pressure and Cholesterol for 20 patients, using k-means clustering to group the patients into having high risk of heart attack and those having low risk of heart attack. Display the results using group scatter plot.
- 10) **Supervised learning- Classification:** Write a program in Python to predict labels of certain observations given a feature set, using machine learning algorithms such as support vector machine.  
(Useful link: <https://www.kaggle.com/arshid/support-vector-machine-on-iris-flower-dataset>)
- 11) Suggest your own topic