Lab Assignment - 1

Signal Generation

Course Outcome: CO1: Familiarise the basic concepts of communication systems

MATLAB INSTALLATION

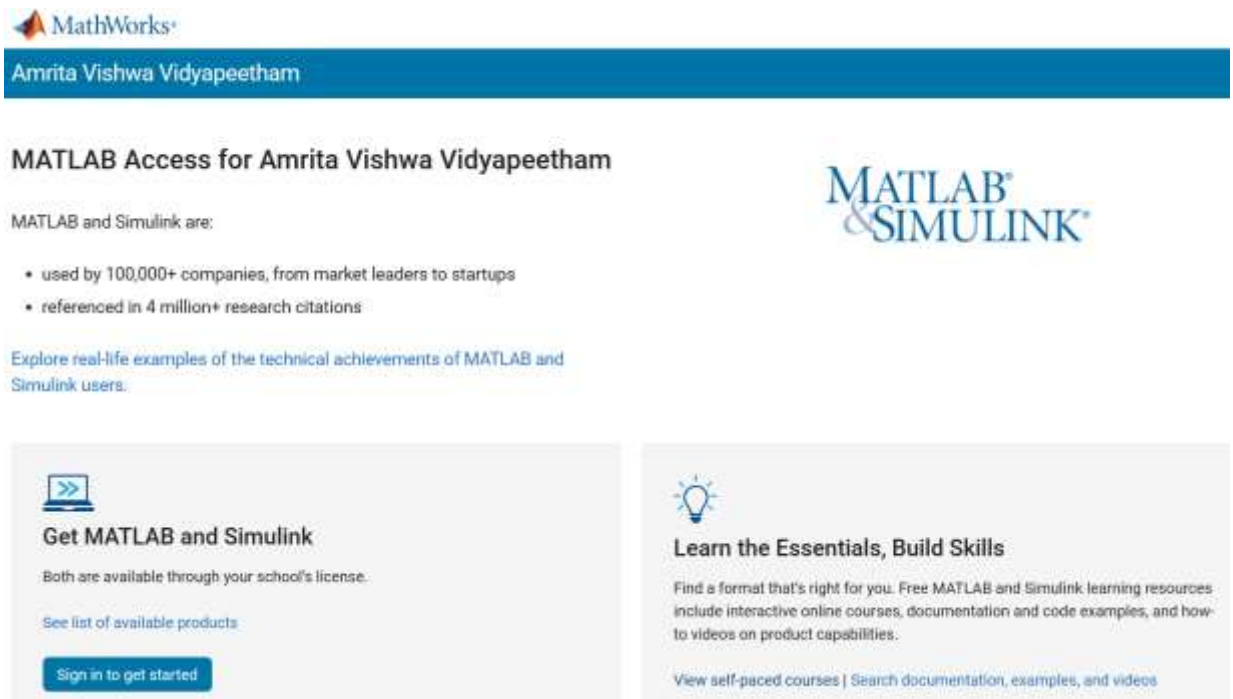
MATLAB is a software package for high-performance language for technical computing developed by MathWorks. It integrates computation,

visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation. The name MATLAB stands for matrix laboratory. MATLAB features a family of add-on application-specific solutions called toolboxes. Toolboxes are comprehensive collections of MATLAB functions (M-files) that extend the MATLAB environment to solve particular classes of problems. Areas in which toolboxes are available include Image processing, signal processing, control systems, neural networks, fuzzy logic, wavelets, simulation, and many others.

Installation

System Requirements: *https://in.mathworks.com/support/requirements/matlab-system-requirements.html*

To associate to the Campus-Wide License, open the portal MathWorks.



- Click on Sign in to get started

- Sign in using your MathWorks Account with your college email address. (click to know more)

Steps to Install MATLAB: (Instructional video)

- Click the download button for the current release.(Users can also download previous releases here).
- Choose a supported platform (Windows / Mac / Linux)and download the installer.
- Run the installer.
- In the installer, select Login with a MathWorksAccount and follow the online instructions.
- When prompted to do so, select the Academic–Total Headcount license labeled Individual.
- Select the products you want to download and install. You can add products later as well.
- After downloading and installing your products, keep the Activate MATLAB checkbox selected and clickNext.
- Select "Activate automatically using the internet.“
- Log into your MathWorks account
- Select the Academic–TotalHead count license labeled Individual.
- Click “Finish" to complete the activation process.

Several cloud-based tools are available such as:

- MATLAB Online-Use MATLAB in a web browser without installing, configuring, or managing any software. MATLAB Mobile-Evaluate MATLAB commands, create and edit files, visualize data, and view results all from your iPhone, iPad, or Android device.
- MATLAB Drive – MATLAB Drive provides a common cloud-based storage location for your MATLABfile.
- Learn to Use MATLAB and Simulink - **MATLAB Onramp, Simulink Onramp** and DeepLearning Onramp(free2-hour overview of MATLAB)and other course offerings.
- MATLAB Help – Provides link to installation support and documentation.

MATLAB functions and methods to be familiarised

1. Use MATLAB Help to familiarise basic functions: plot, stem, subplot, xlabel, ylabel, title, axis, clc, clear all, close all, input

2. Familiarise the usage of MATLAB inbuilt functions sin, square and sawtooth.

ASSIGNMENT

1. Plot the following **elementary signals**.

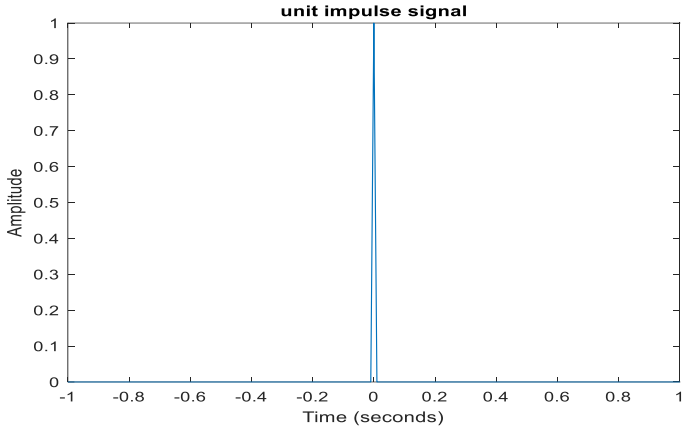
   (Plot both continuous and discrete time signals. For discrete time signal take sampling period = 0.2s (`t = (-1:0.2:1)`) and use `stem()` instead of `plot()`)

   a. Unit Impulse

   Program : continuous time signal

```
t = (-1:0.01:1);
impulse=t==0;
subplot(2,1,1);
plot(t,impulse)
title('unit impulse signal');
xlabel('Time (seconds)');
ylabel('Amplitude');
```

Plot:



   b. Unit Step

   c. Ramp

2. Generate and plot the following **continuous time signals** (Define the time vector, t to range from 0 to 1 second, with a sampling rate of 1000 Hz)

   a. Sinusoidal signal

   Program:

```
t = 0:0.001:1;  % Time vector
f = 5;  % Frequency of the sine wave
A = 1;  % Amplitude of the sine wave
y = A * sin(2 * pi * f * t);
plot(t, y);
```

```
title('Sine Wave');
xlabel('Time (seconds)');
ylabel('Amplitude');
```

i) What happens if you increase the frequency? How does it affect the waveform? (Plot)

ii) How does changing the amplitude affect the waveform? (Plot)

iii) How does changing the phase affects the waveform? (Plot for phi values pi/2, pi/4, pi, -pi/2)

b. Square signal

(Amplitude = 0.81, time period=0.5, use square() function, y = A*square(2 * pi * f * t))

c. Exponential signal (`exp(-2*t))`

d. sawtooth signal (`sawtooth(t))`

e. Triangular signal (Use sawtooth function with the width parameter set to 0.5)

3. Generate and plot the following signals. **(Signal Operations)**

a. x1(t) = sin(2*pi*t/T).*exp(-2*t)

b. x2(t) = 2*cos(2*pi*t/T2).*sin(2*pi*t/T3)

c. x3(t) = sin(2*pi*t/T).*exp(-2*t)+sin(2*pi*t/T1).*exp(-4*t)

d. x4(t) = aa*u(t), (take aa=5, u(t) is step signal, Plot both u(t) and x4(t))

Note : Try with different amplitudes and frequencies so that you will be able to understand thoroughly