NAME: Suryakant Upadhyay
PRN: 20220802043
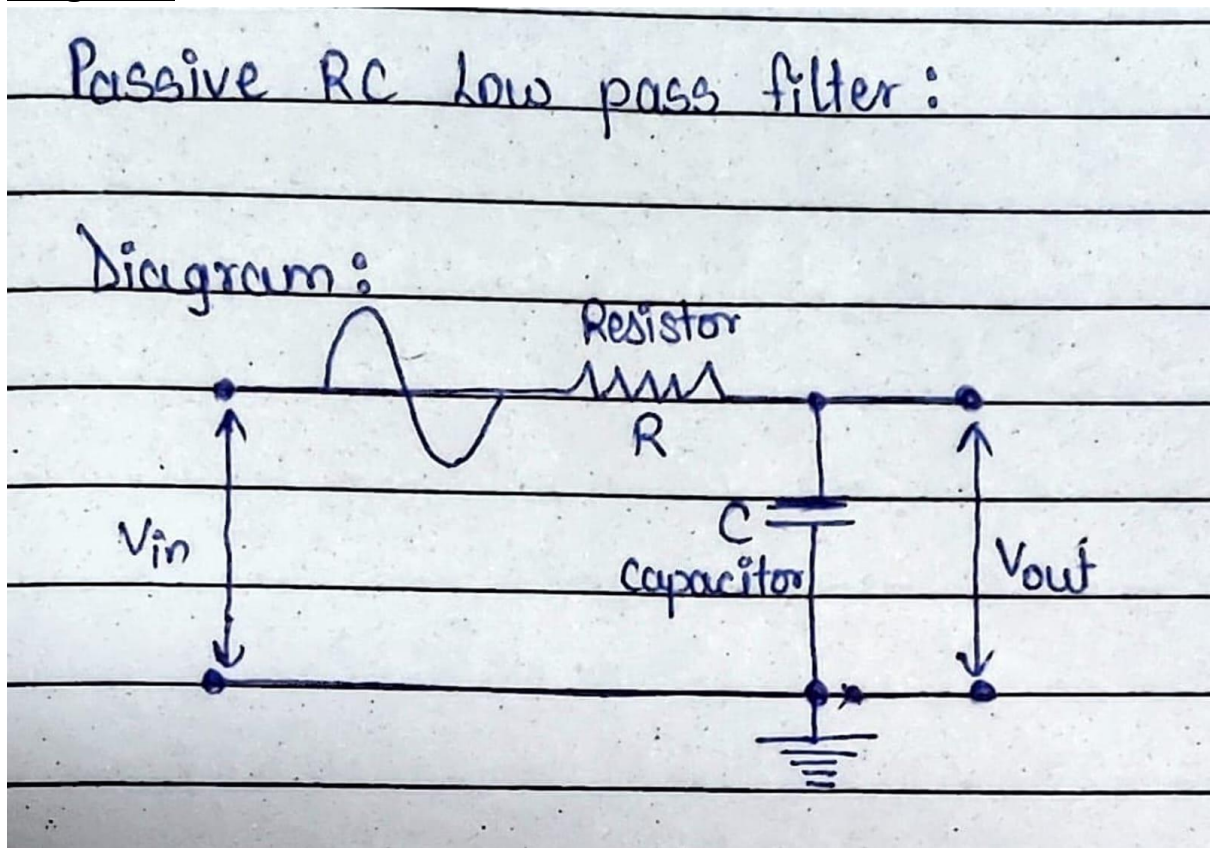**SUBJECT:** INTRODUCTION TO COMMUNICATION SYSTEMS
BATCH: A1

EXPERIMENT: 01

Title: Introduction to Spectrum analyzer (Dynamic Signal Analyzer in NI MyDAQ). Basics of filters and their signal output, Concept of bandwidth.
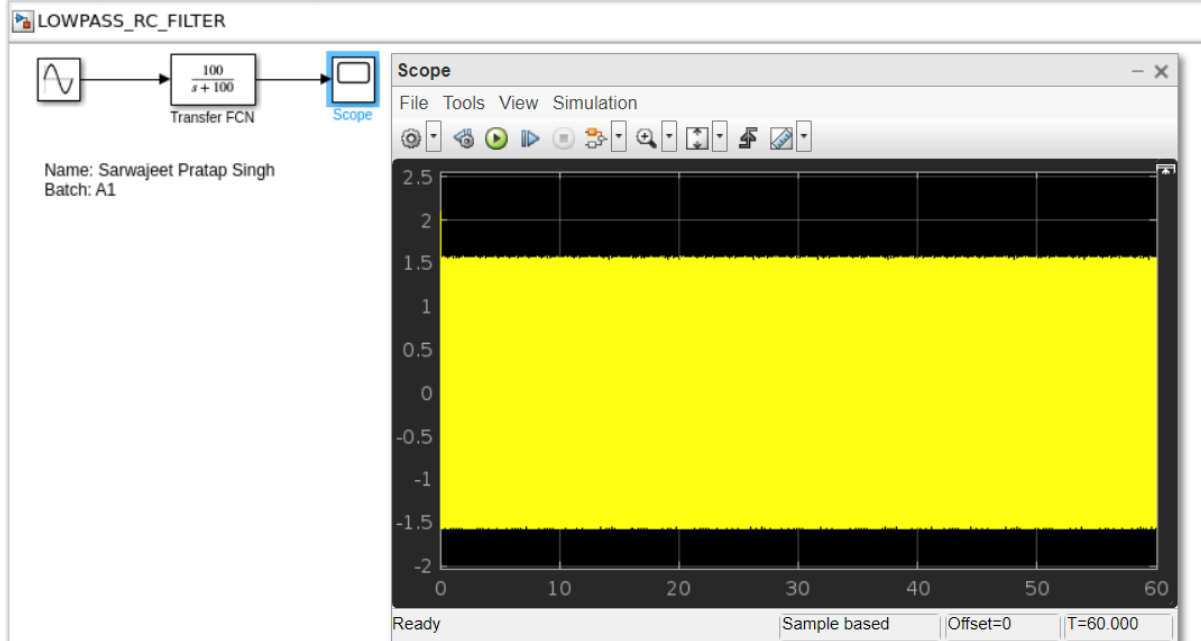
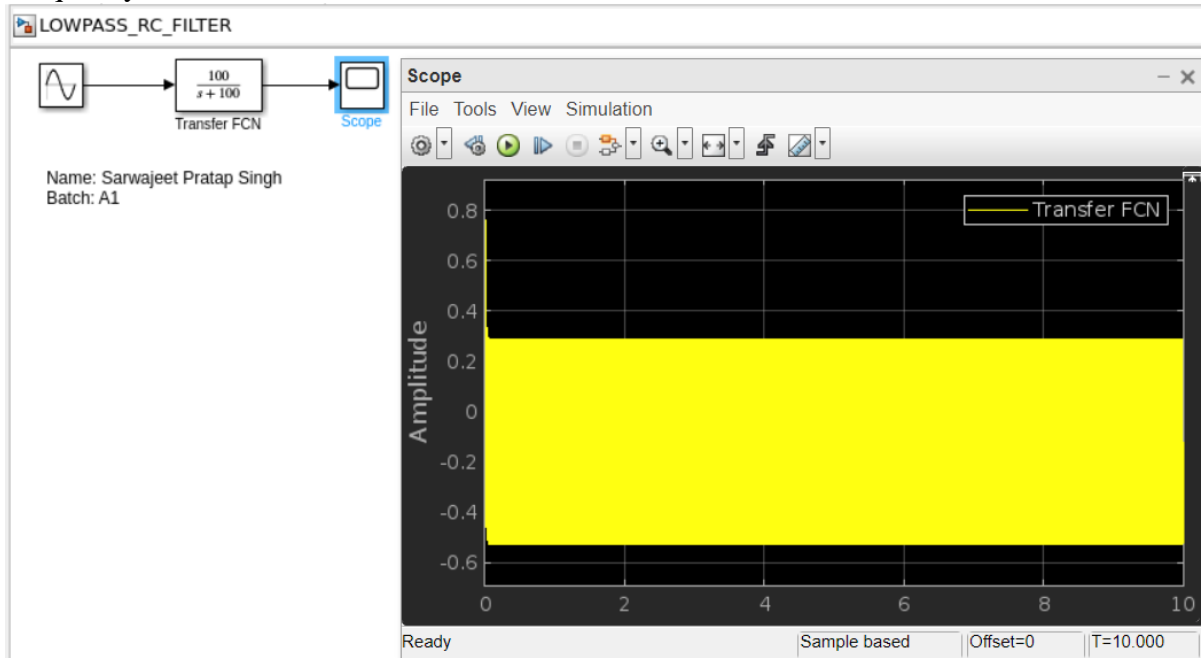**Apparatus:** Matlab Simulink, MyDAQ

Diagram: Passive RC LPF

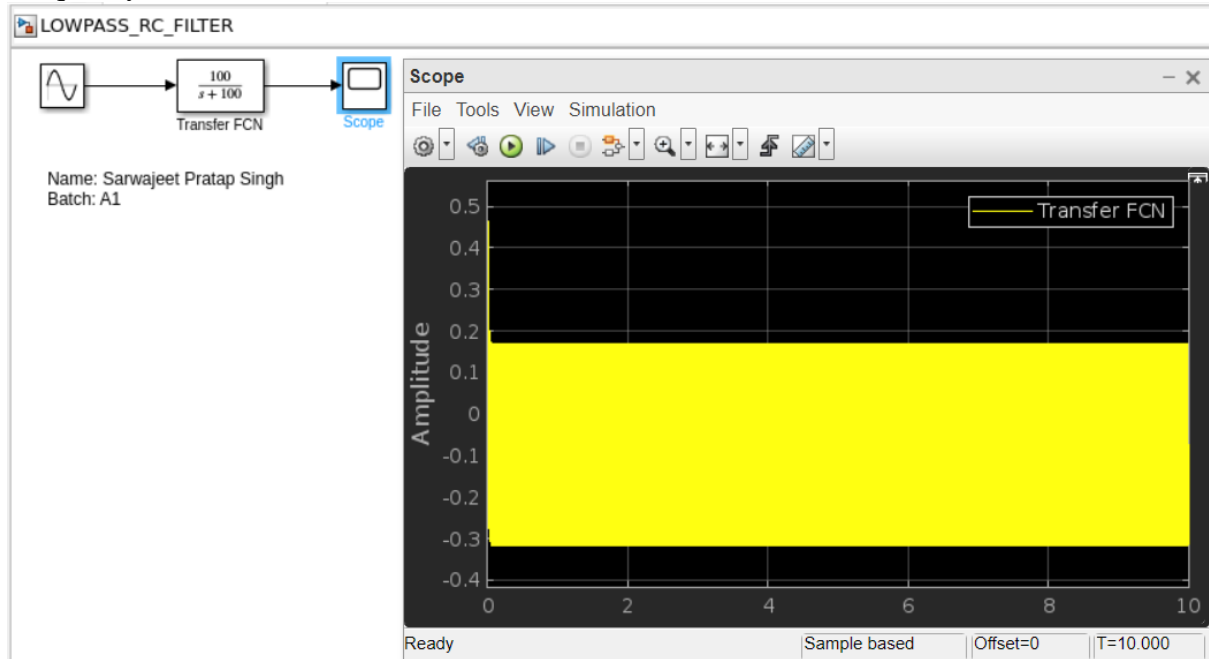**Theory:** MATLAB Simulink model with all selected input/ block parameters and result screenshot:

Frequency: 100Hz

Frequency: 300Hz

Frequency: 500Hz

Frequency: 700Hz

Frequency: 1000Hz

LOWPASS_RC_FILTER

Name: Sarwajeet Pratap Singh
Batch: A1
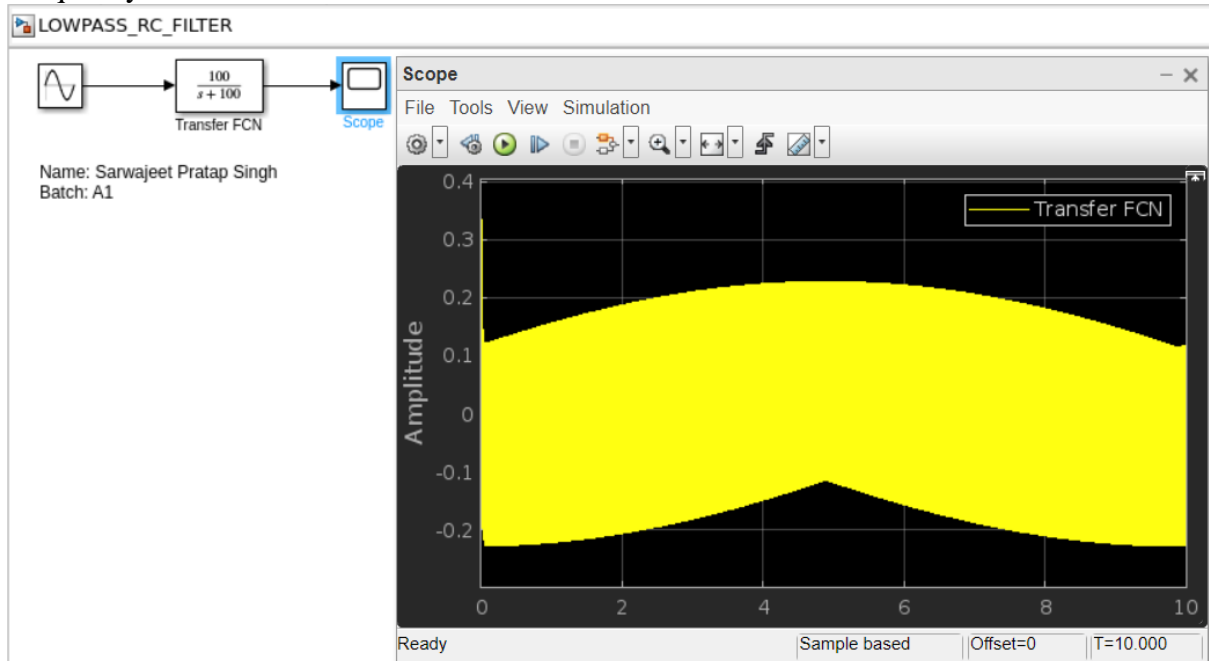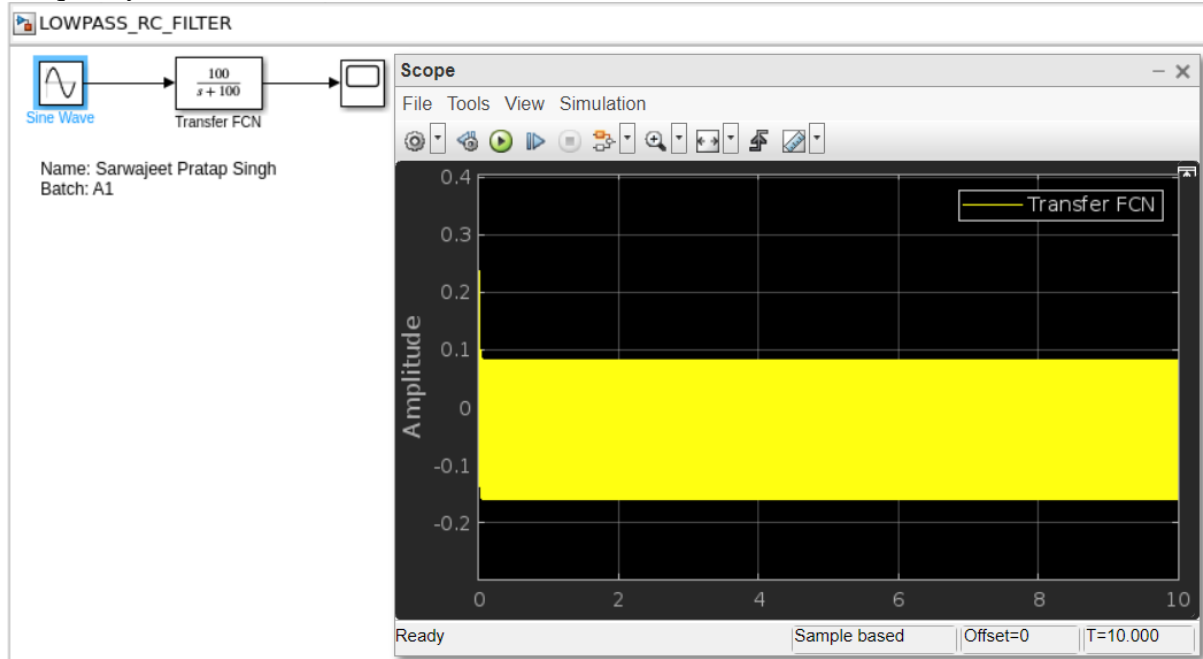
OBSERVATION TABLE:

Frequency(in Hz)	Output(in Volts)
100	2.2
300	0.78
500	0.47
700	0.33
1000	0.23

Frequency Response Graph:
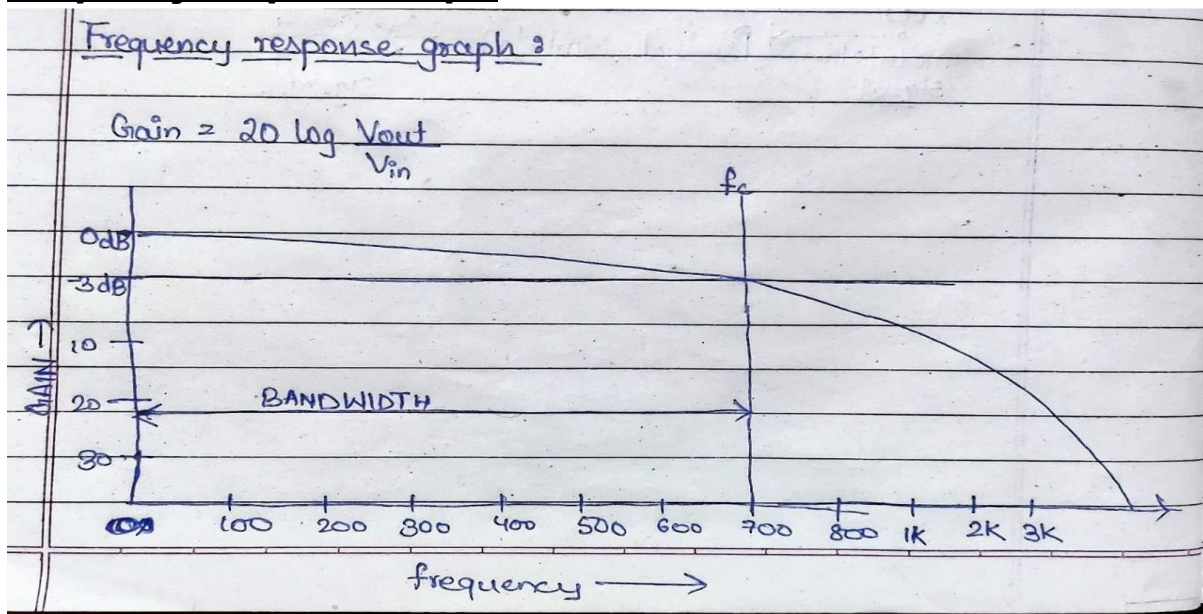
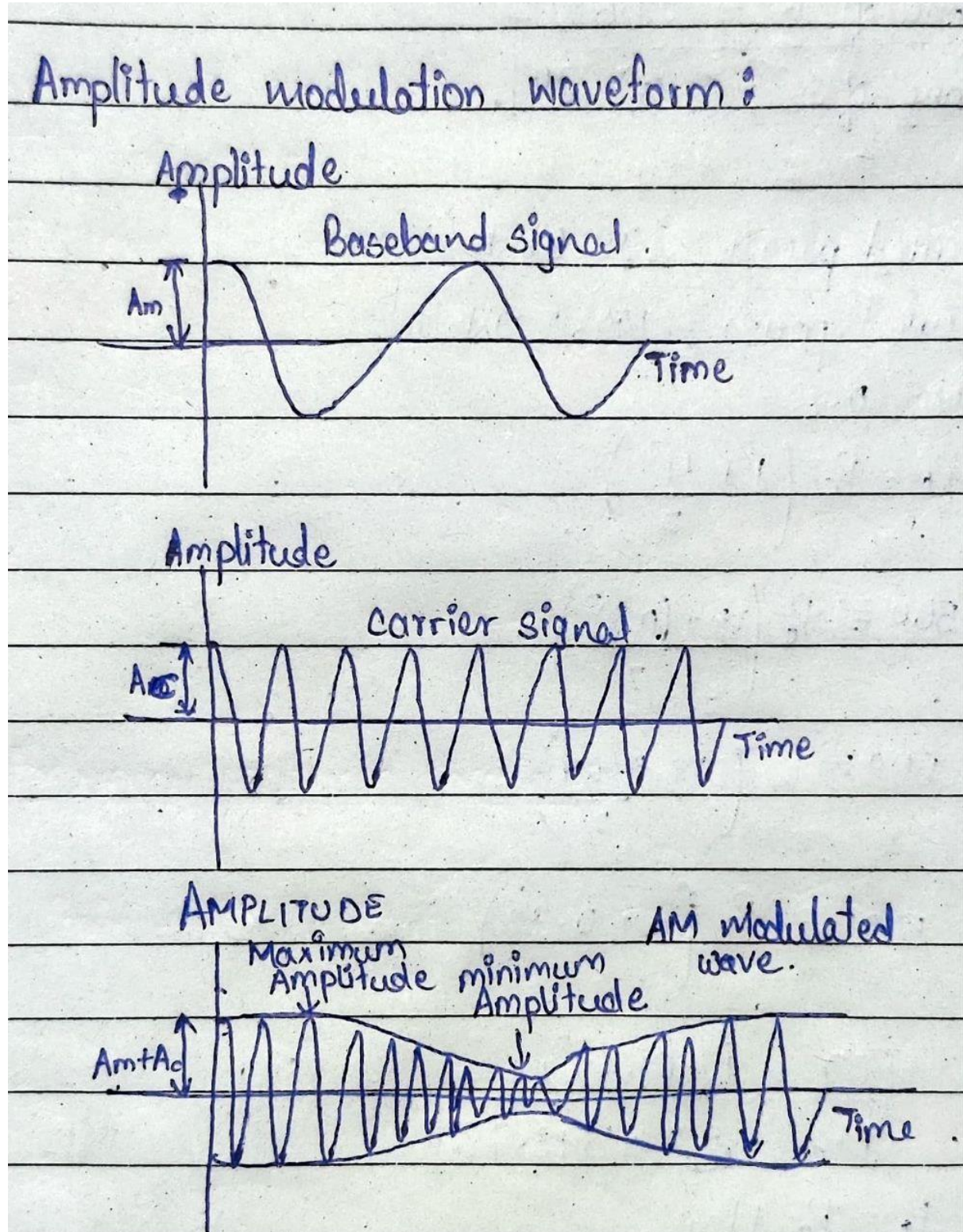**Title:** Amplitude Modulation and Demodulation

Apparatus: Matlab Simulink, Matlab Code

Diagram: Amplitude Modulation and Demodulation

Theory:

Matlab Code Amplitude Modulation and Demodulation:

MATLAB CODE: Modulation Index: M<1

```
clc;
close all;
Am= 1; %amplitude of Modulating Signal
Ac= 2; %amplitude of Carrier Signal
fm= 1; %fm<fc Modulating frequency
fc=10; %Carrier Frequency
fs=100*fc;

m=0.5; %Modulation Index(M<1)
t= 0:0.001:2; %time axis
x= Am*sin(2*pi*fm*t); %message signal
subplot(3,2,1);
plot(t,x);
xlabel('Time');
ylabel('Amplitude');
title('Message Signal');
grid on;

y= Ac*cos(2*pi*fc*t); %carrier signal
subplot(3,2,2)
plot(t,y);
xlabel('Time');
ylabel('Amplitude');
title('Carrier Signal');
grid on;

am_modulated= (1+m*x).*y;
subplot(3,2,3);
plot(t,am_modulated);
plot(t,am_modulated,'r');
xlabel('Time');
ylabel('Amplitude');
title('Modulated signal');
grid on;

demodulated= abs(am_modulated);
subplot(3,2,4);
plot(t,demodulated);
plot(t, demodulated,'k');
xlabel('Time');
ylabel('Amplitude');
title('Demodulated Signal');
grid on;

nf= fm/fs;
[a,b]= butter(3,3*nf);
z= filter(a,b,demodulated);
subplot(3,2,5);
plot(t,z);
plot(t,z,'k');
xlabel('Time');
ylabel('Amplitude');
title('Recovered signal');
grid on;
```
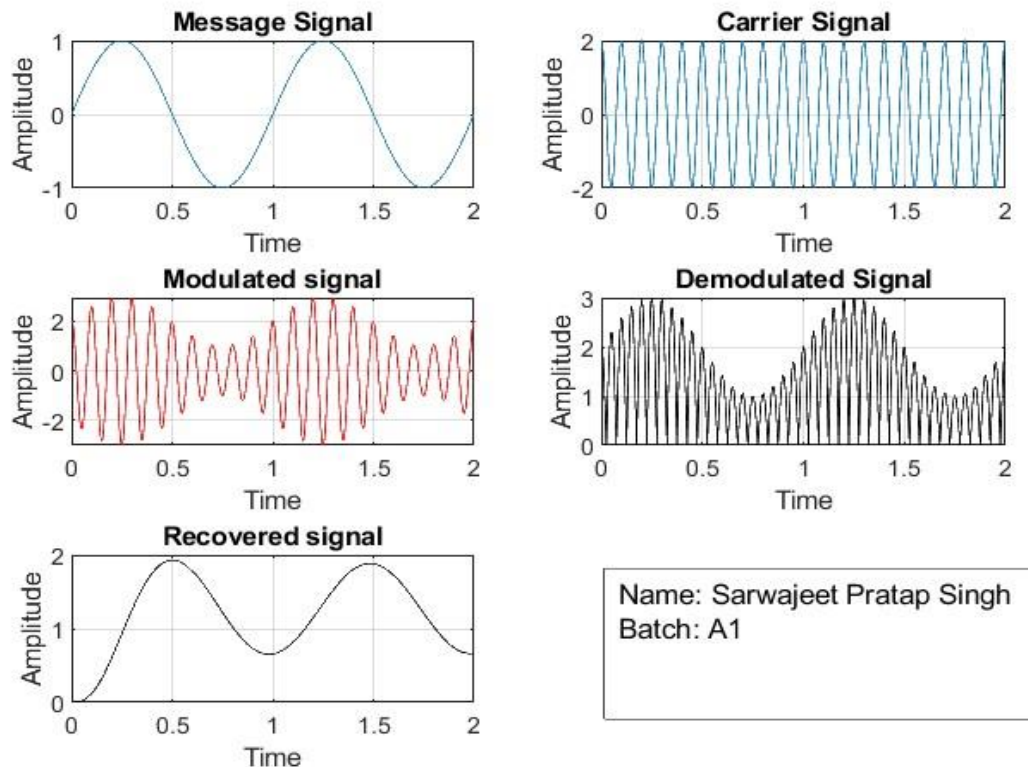
```
fprintf("Sarwajeet Pratap Singh");
fprintf("\nBatch: A1");
grid on;
```

Output:

MATLAB CODE: Modulation Index: M=1
```
clc;
close all;
Am= 1; %amplitude of Modulating Signal
Ac= 2; %amplitude of Carrier Signal
fm= 1; %fm<fc Modulating frequency
fc=10; %Carrier Frequency
fs=100*fc;

m=1; %Modulation Index(M=1)
t= 0:0.001:2; %time axis
x= Am*sin(2*pi*fm*t); %message signal
subplot(3,2,1);
plot(t,x);
xlabel('Time');
ylabel('Amplitude');
title('Message Signal');
grid on;

y= Ac*cos(2*pi*fc*t); %carrier signal
subplot(3,2,2)
plot(t,y);
xlabel('Time');
ylabel('Amplitude');
title('Carrier Signal');
grid on;
```
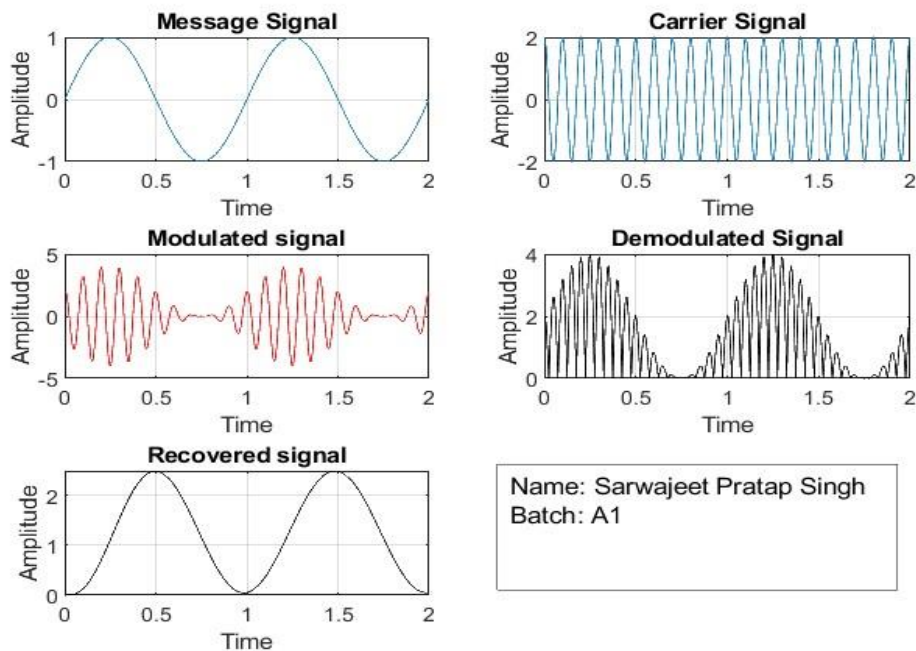
```matlab
am_modulated= (1+m*x).*y;
subplot(3,2,3);
plot(t,am_modulated);
plot(t,am_modulated,'r');
xlabel('Time');
ylabel('Amplitude');
title('Modulated signal');
grid on;

demodulated= abs(am_modulated);
subplot(3,2,4);
plot(t,demodulated);
plot(t, demodulated,'k');
xlabel('Time');
ylabel('Amplitude');
title('Demodulated Signal');
grid on;

nf= fm/fs;
[a,b]= butter(3,3*nf);
z= filter(a,b,demodulated);
subplot(3,2,5);
plot(t,z);
plot(t,z,'k');
xlabel('Time');
ylabel('Amplitude');
title('Recovered signal');
grid on;
fprintf("Sarwajeet Pratap Singh");
fprintf("\nBatch: A1");
grid on;
```

Output:

MATLAB CODE: Modulation Index: M>1

```matlab
clc;
close all;
Am= 1; %amplitude of Modulating Signal
Ac= 2; %amplitude of Carrier Signal
fm= 1; %fm<fc Modulating frequency
fc=10; %Carrier Frequency
fs=100*fc;

m=1.5; %Modulation Index(M=1)
t= 0:0.001:2; %time axis
x= Am*sin(2*pi*fm*t); %message signal
subplot(3,2,1);
plot(t,x);
xlabel('Time');
ylabel('Amplitude');
title('Message Signal');
grid on;

y= Ac*cos(2*pi*fc*t); %carrier signal
subplot(3,2,2)
plot(t,y);
xlabel('Time');
ylabel('Amplitude');
title('Carrier Signal');
grid on;

am_modulated= (1+m*x).*y;
subplot(3,2,3);
plot(t,am_modulated);
plot(t,am_modulated,'r');
xlabel('Time');
ylabel('Amplitude');
title('Modulated signal');
grid on;

demodulated= abs(am_modulated);
subplot(3,2,4);
plot(t,demodulated);
plot(t, demodulated,'k');
xlabel('Time');
ylabel('Amplitude');
title('Demodulated Signal');
grid on;

nf= fm/fs;
[a,b]= butter(3,3*nf);
z= filter(a,b,demodulated);
subplot(3,2,5);
plot(t,z);
plot(t,z,'k');
xlabel('Time');
ylabel('Amplitude');
title('Recovered signal');
grid on;
fprintf("Sarwajeet Pratap Singh");
fprintf("\nBatch: A1");
grid on;
```
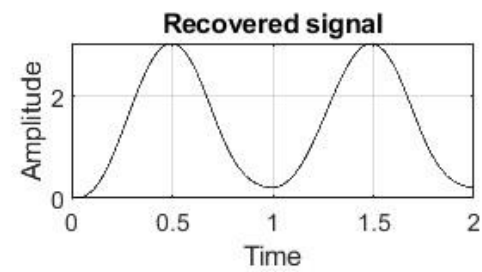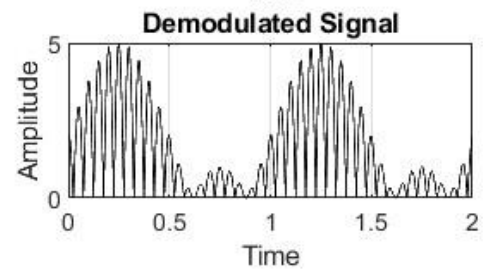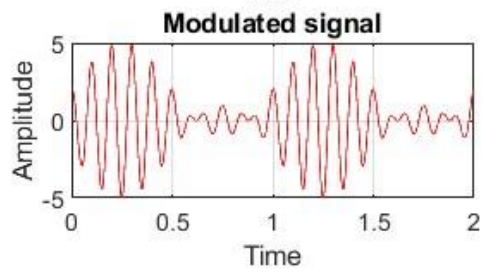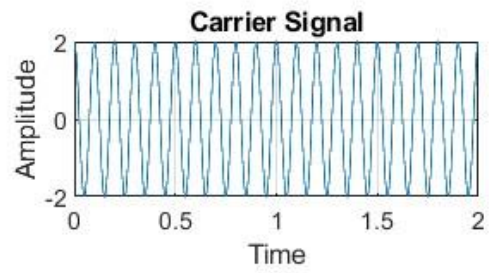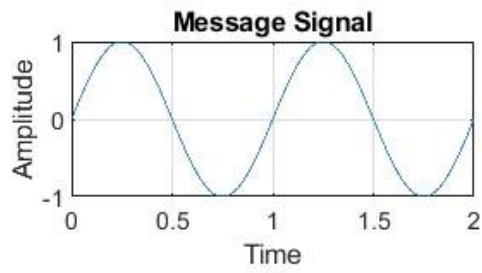
Message Signal

Carrier Signal

Modulated signal

Demodulated Signal

Recovered signal

Name: Sarwajeet Pratap Singh
Batch: A1

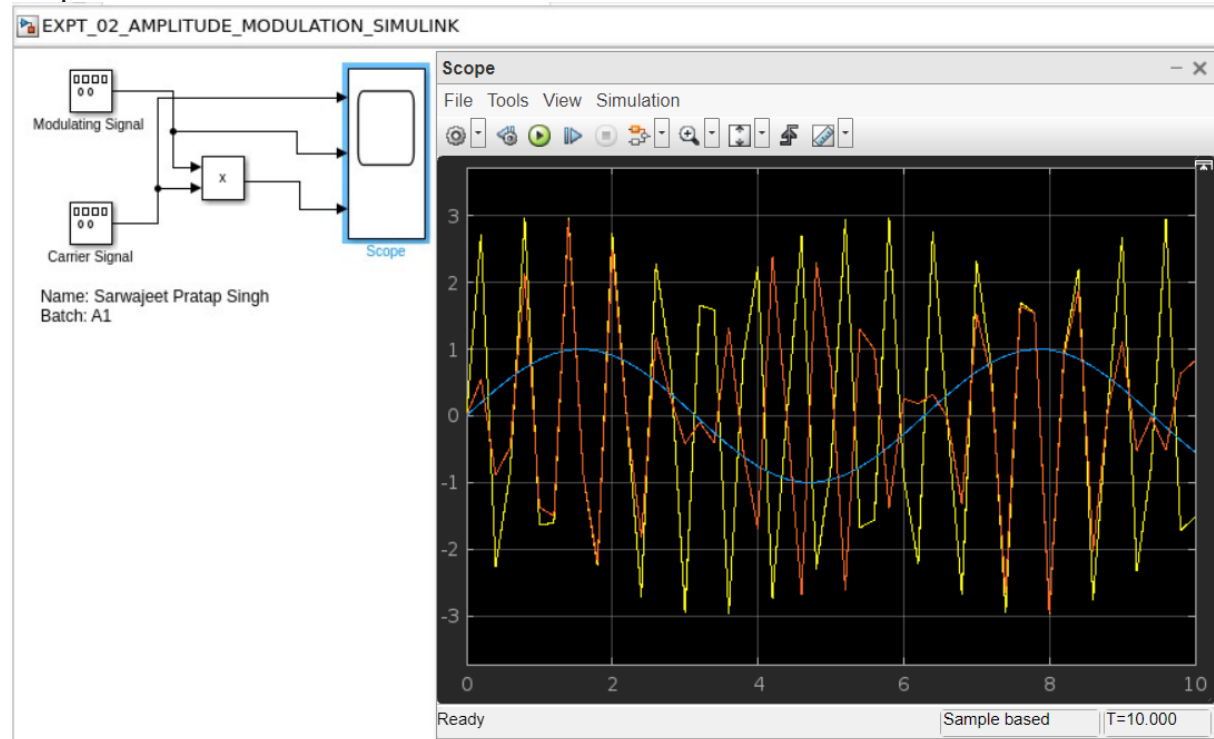# *MATLAB SIMULATION OF AMPLITUDE MODULATION*

Modulating Signal:

Frequency: 1rad/sec

Amplitude: 1

Carrier Signal:

Frequency: 10rad/sec

Amplitude: 3

MATLAB SIMULATION OF AMPLITUDE DEMODULATION

Modulating Signal:

Frequency: 1rad/sec

Amplitude: 1

Carrier Signal:

Frequency: 10rad/sec

Amplitude: 3

Band Pass Filter:

Filter Order: 3

Pass Band Frequency: 4rad/s