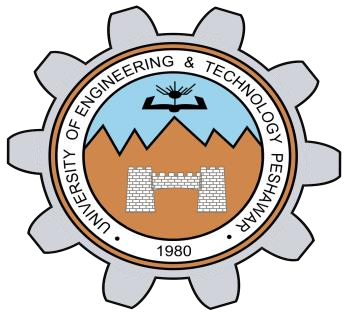
**Lab Report No 5**

*Analysis of Amplitude Modulated and Demodulated Signal using Matlab*



Digital Signal Processing Lab

Submitted By: Naveed Ahmad

Registration No: 22PWCSE2165

Section: B

“*On my honor , as student of University of Engineering and Technology, I have neither given nor received unauthorized assistance on this academic work”*

Student Signature: \_\_\_\_\_\_\_\_\_\_\_\_

Dec. 24, 2024

Department of Computer Systems Engineering

University of Engineering and Technology Peshawar

**Provide .m file with detailed comments Tasks:**

1. **Define Amplitude Modulation:**

If we vary amplitude of a carrier signal in accordance with the instantaneous value of modulating signal, the process is said to be amplitude modulation.

1. **Define Amplitude Demodulation:**

The process of extracting the original message signal from the modulated carrier signal.

1. **List three reasons, why we implement Amplitude Modulation in Communication**

**Systems**

* + Amplitude modulation allows multiple signals to be transmitted in the same frequency band using different carrier frequencies.
  + Amplitude modulation is mostly used for transmitting audio signals because the variation in the amplitude of the carrier signal can effectively transmit the sound.
  + Amplitude modulation allows multiple signals to be sent over different carrier frequencies within the same frequency range.

1. **Define Modulation Index**

The measure of how much the carrier signal’s amplitude is varied by the message signal.

**μ = mp/A**

( where mp is the maximum peak of modulated signal and A is amplitude of carrier signal. )  μ = 0: There is no modulation, and the carrier signal is unchanged (no message signal is transmitted).

* 0 < μ < 1: The carrier amplitude is varied moderately by the message signal. This is the normal range for most AM transmissions and produces a clear, undistorted signal.
* μ = 1: The carrier amplitude is fully modulated by the message signal, meaning the amplitude variation is equal to the carrier amplitude. This is called 100% modulation.
* μ > 1: This leads to overmodulation, where the carrier's amplitude goes below zero, causing distortion and interference.

**5.**

**Input Modulation Index from 0 to 1.4, the increment step should be 0.2.**

**Observe/analyze and comment about the output obse**

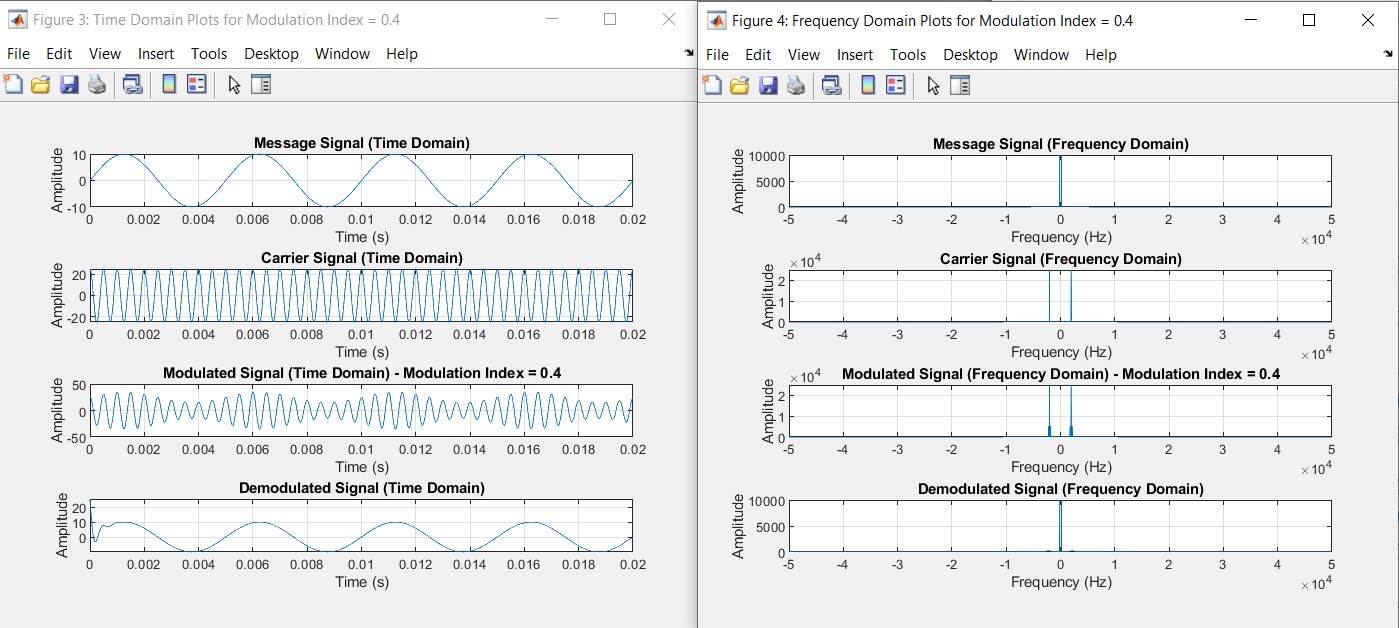
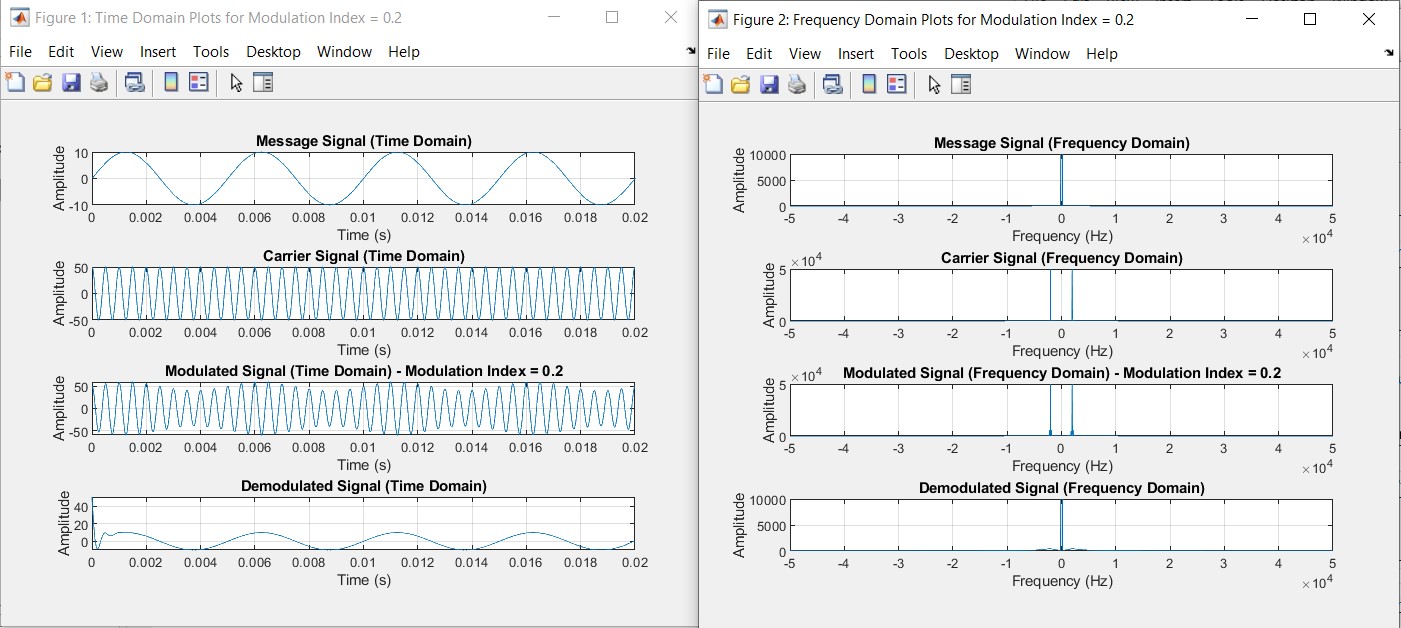
**rved.**



**0.2:**



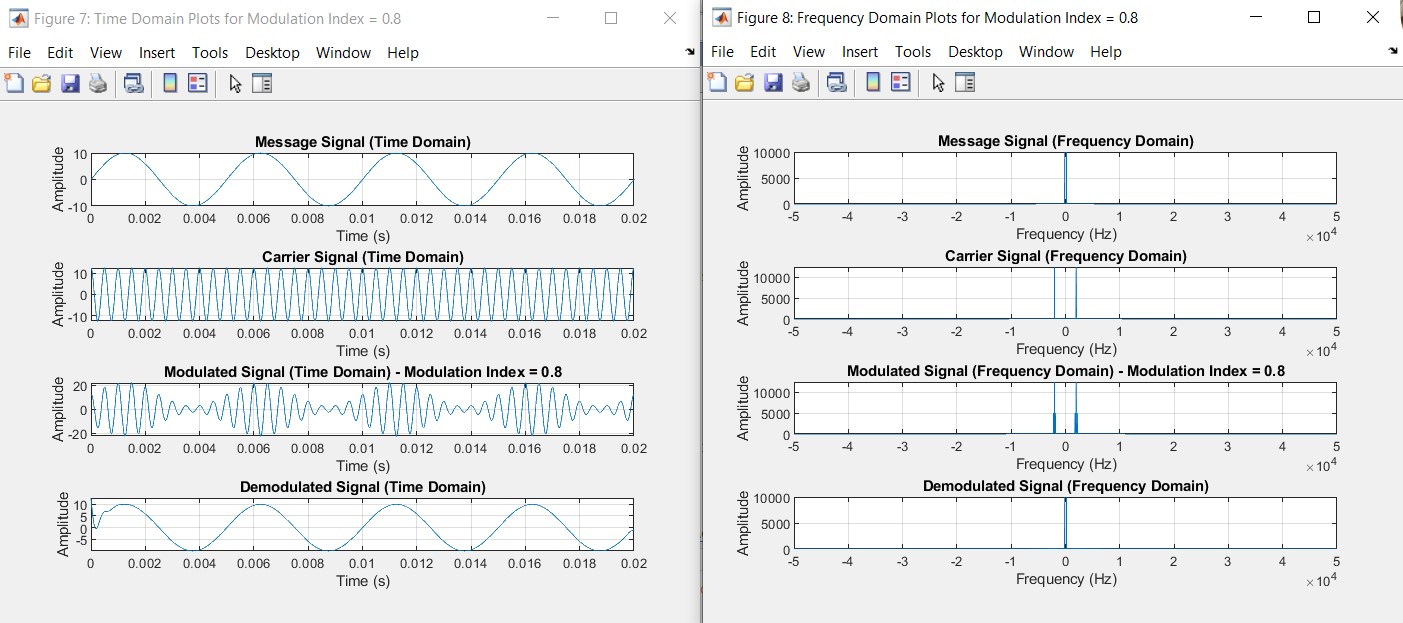
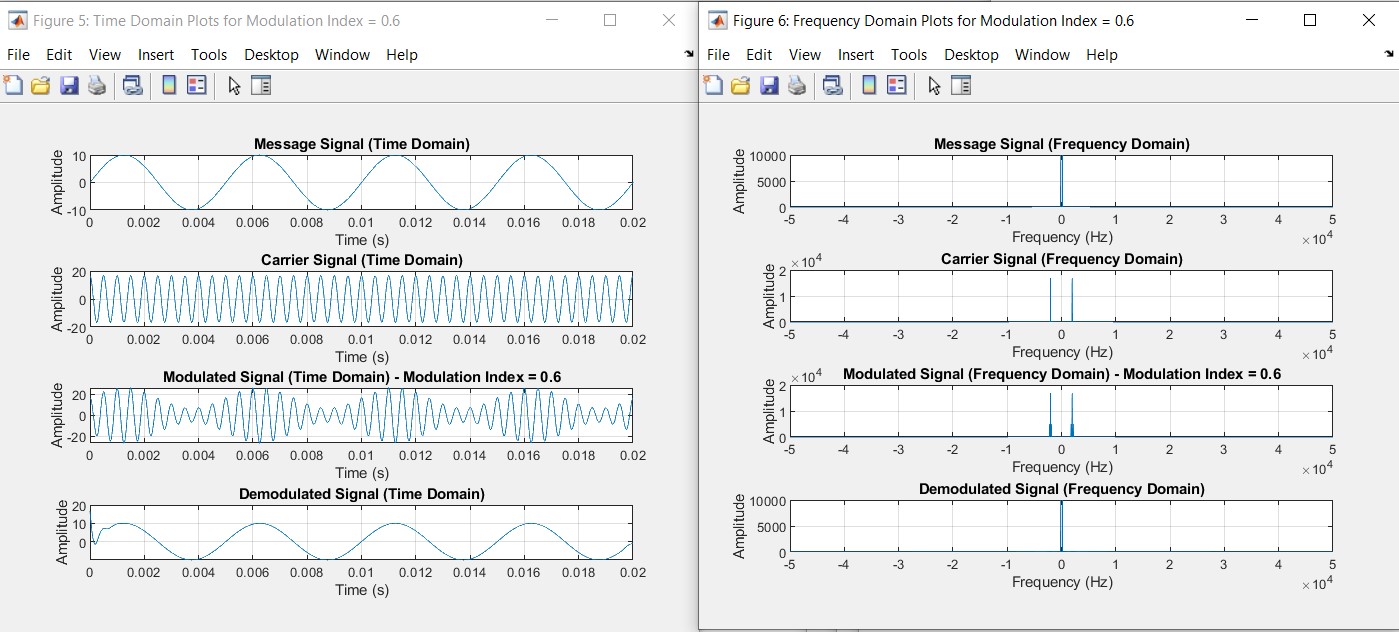
**0.4:**



**0.6:**



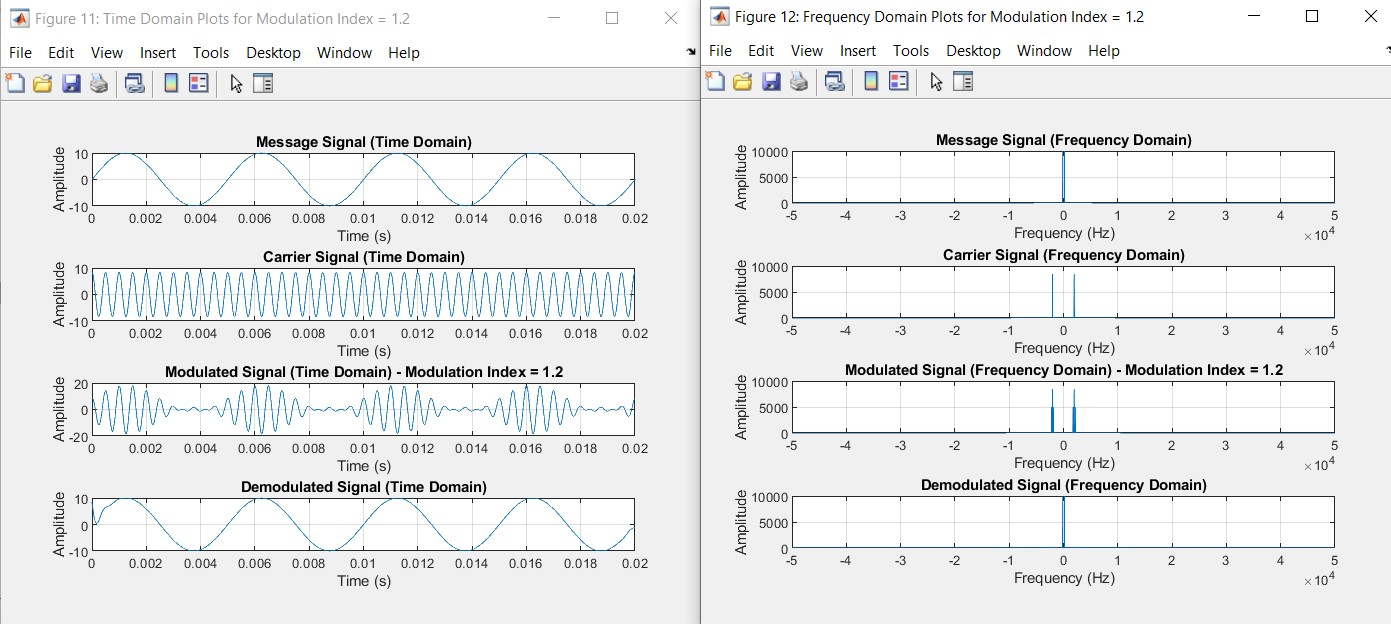
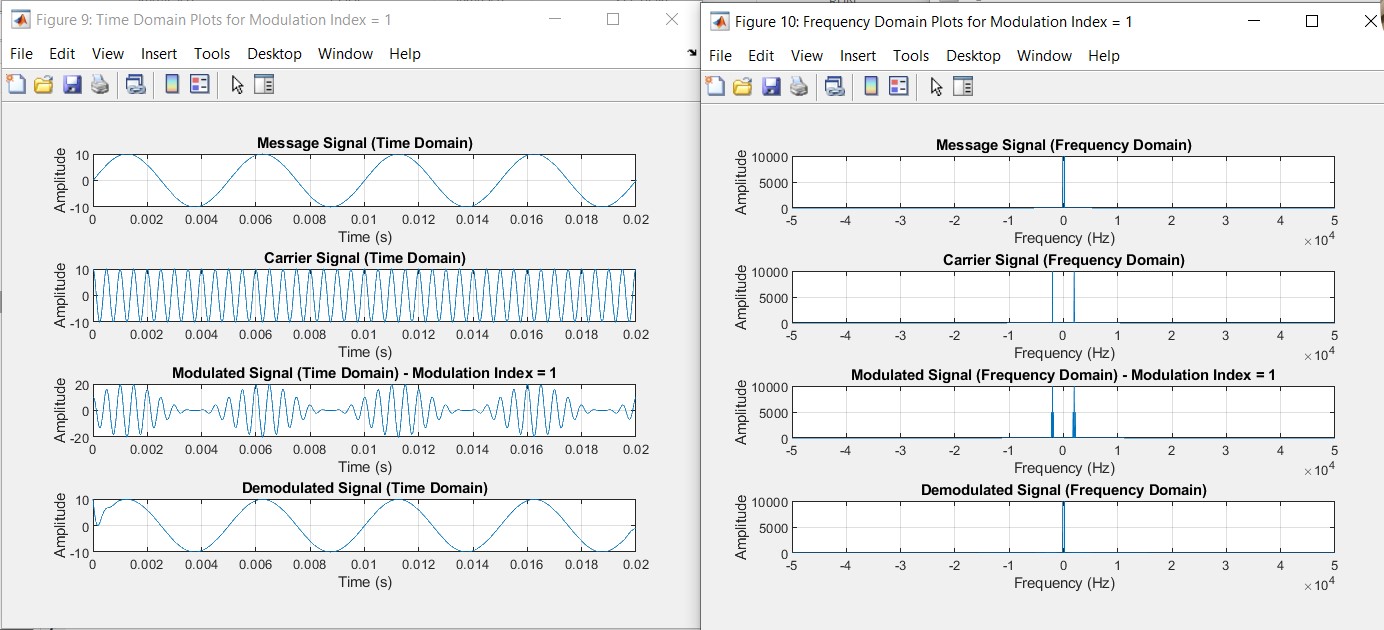
**0.8:**



**1:**



**1.2:**



**1.4:**

**Procedure:**

1.

Create and plot (both time and frequency domain) a message signal with amplitude 10 and frequency

200

Hz

2.

Create and plot (both time and frequency domain) a Carrier signal with

amplitude 10/Modulation Index

and frequency 2000 Hz

3.

Modulate the message signal with the carrier using the desired Modulation Index. Plot modulated signal

in both time and frequency domain. Observe/Analyze the output.

Hint:

y = ammod(ym, fc, 100000, 0,

Ac);

4.

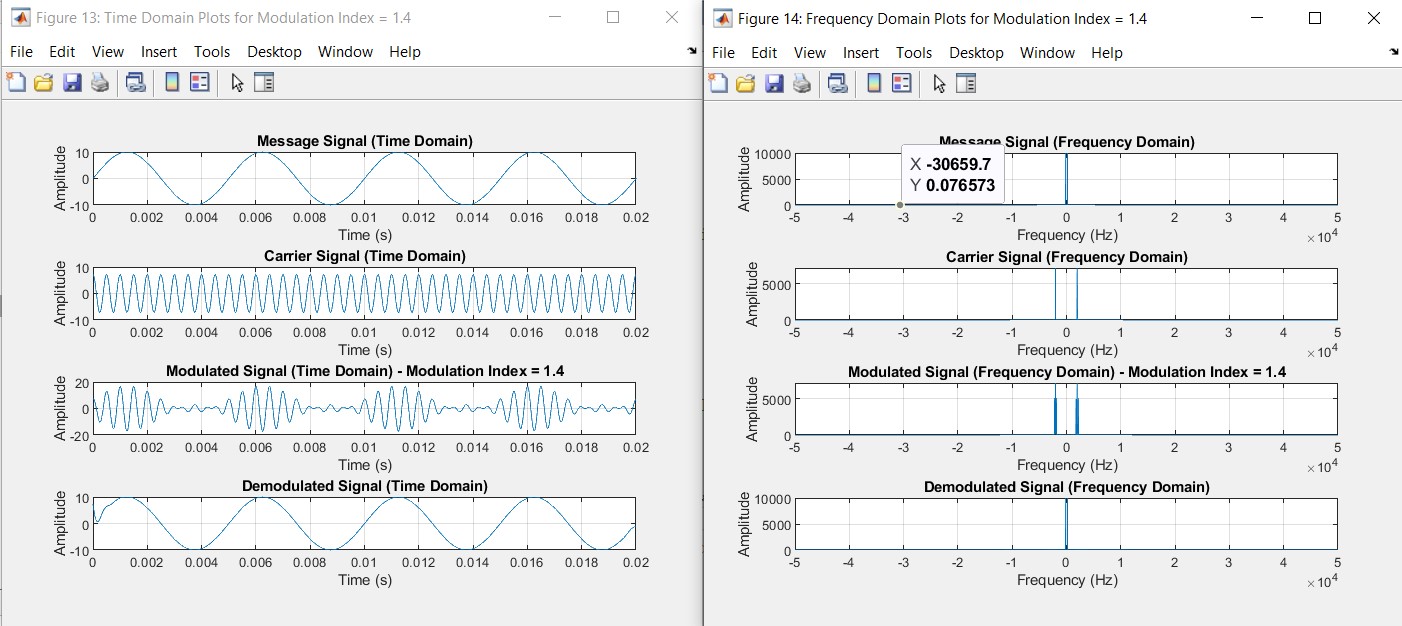
Demodulate the Modulated signal . Observe/Analyze the output.

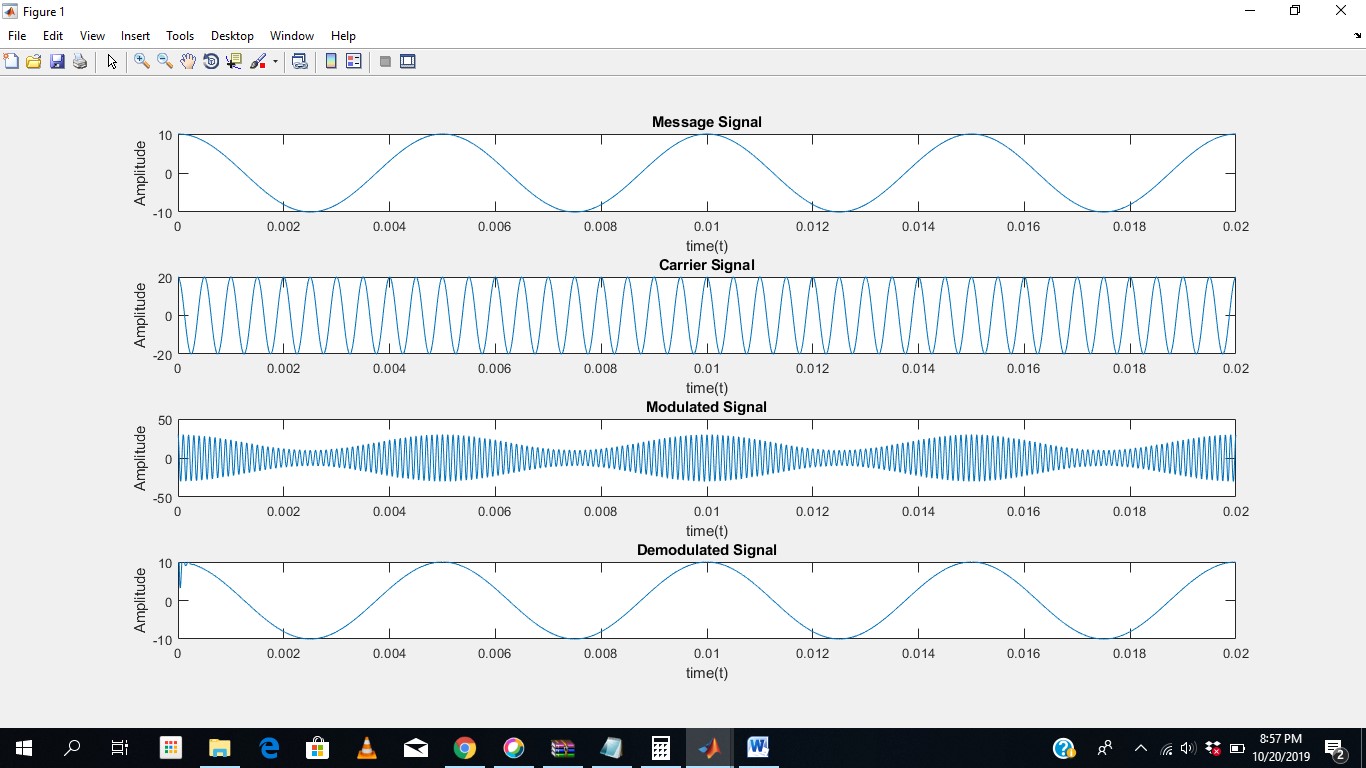
Hint:

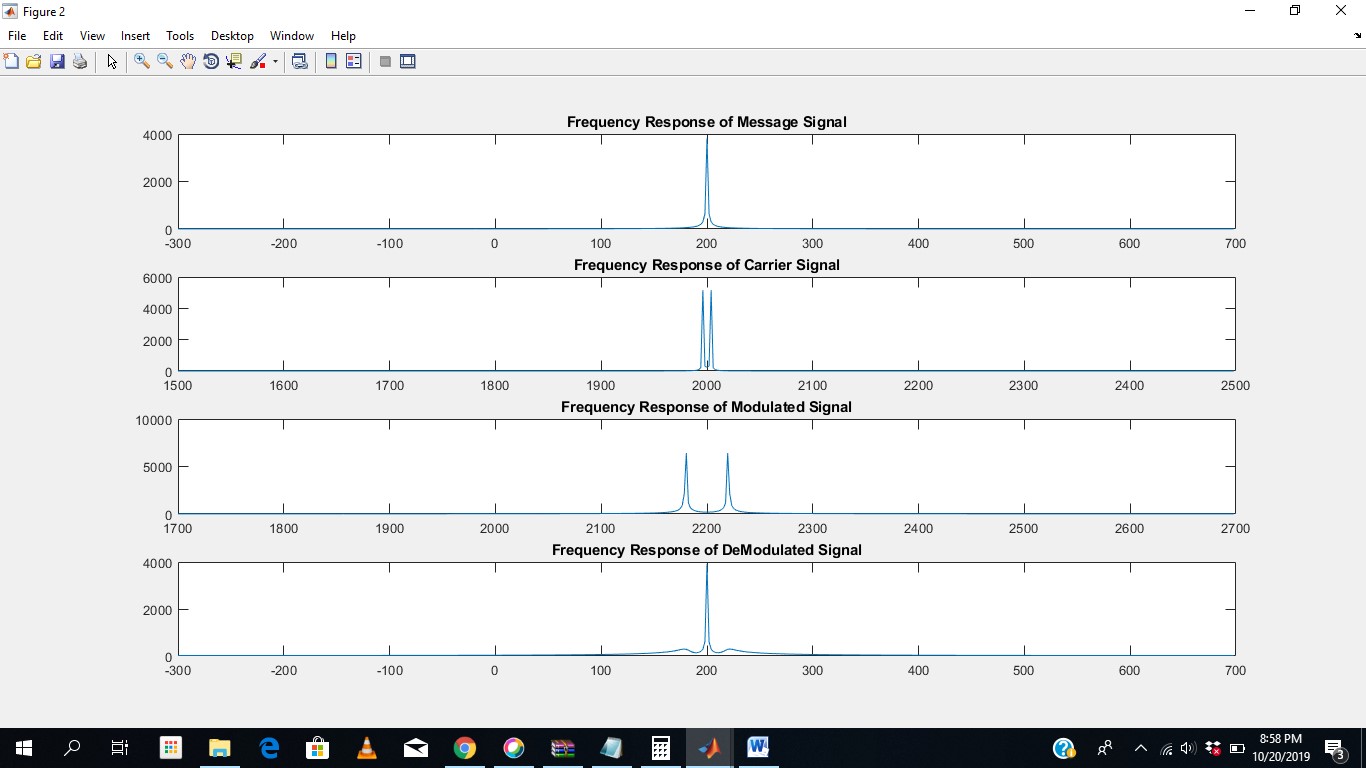
z = amdemod(y, fc, 100000, 0, Ac);

5.

Following are the plots of the desired outputs







**Code:**

Fs = 100000; % Sampling frequency (Hz) t = 0:1/Fs:0.02; % Time vector (20 ms duration) Am = 10; % Message signal amplitude fm = 200; % Message signal frequency (Hz) fc = 2000; % Carrier signal frequency (Hz) mu = 0.8; % Modulation index (0 to 1)

message\_signal = Am \* sin(2 \* pi \* fm \* t);

Ac = Am / mu; % Carrier amplitude (depends on modulation index) carrier\_signal = Ac \* cos(2 \* pi \* fc \* t);

modulated\_signal = ammod(message\_signal, fc, Fs, 0, Ac);

demodulated\_signal = amdemod(modulated\_signal, fc, Fs, 0, Ac);

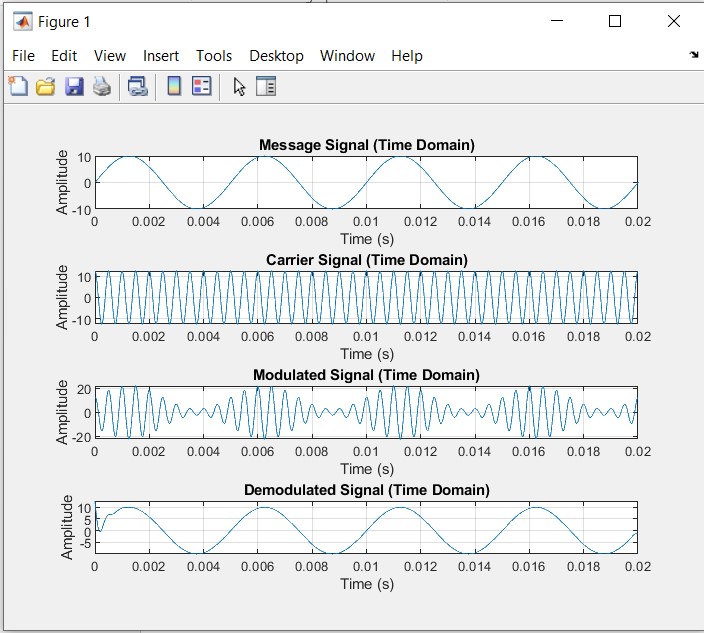
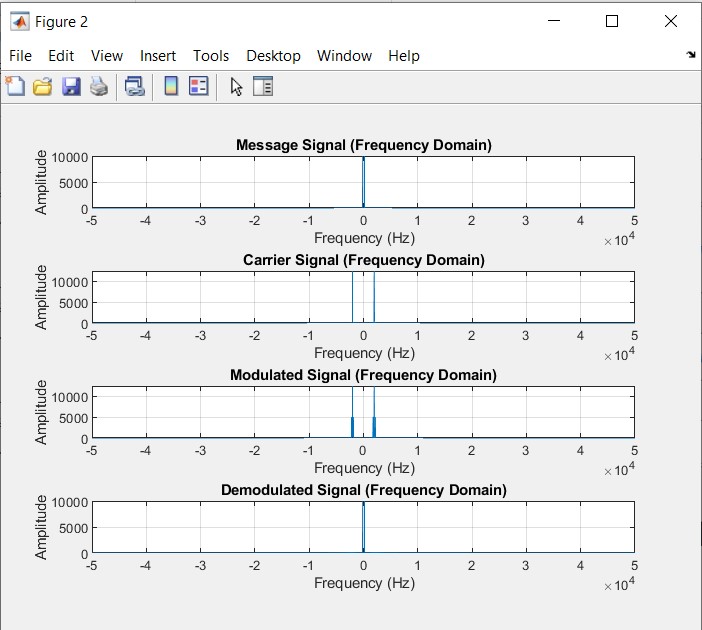
L = length(message\_signal); freq = (-L/2:L/2-1) \* (Fs / L);

message\_fft = abs(fftshift(fft(message\_signal))); carrier\_fft = abs(fftshift(fft(carrier\_signal))); modulated\_fft = abs(fftshift(fft(modulated\_signal))); demodulated\_fft = abs(fftshift(fft(demodulated\_signal)));

% Plot all signals (Time Domain) in one figure figure; subplot(4, 1, 1); plot(t, message\_signal); title('Message Signal (Time Domain)'); xlabel('Time (s)'); ylabel('Amplitude'); grid on; subplot(4, 1, 2); plot(t, carrier\_signal); title('Carrier Signal (Time Domain)'); xlabel('Time (s)'); ylabel('Amplitude'); grid on; subplot(4, 1, 3); plot(t, modulated\_signal); title('Modulated Signal (Time Domain)'); xlabel('Time (s)'); ylabel('Amplitude'); grid on; subplot(4, 1, 4); plot(t, demodulated\_signal); title('Demodulated Signal (Time Domain)'); xlabel('Time (s)'); ylabel('Amplitude'); grid on;

% Plot all signals (Frequency Domain) in another figure figure; subplot(4, 1, 1); plot(freq, message\_fft); title('Message Signal (Frequency Domain)'); xlabel('Frequency (Hz)'); ylabel('Amplitude'); grid on; subplot(4, 1, 2); plot(freq, carrier\_fft); title('Carrier Signal (Frequency Domain)'); xlabel('Frequency (Hz)'); ylabel('Amplitude'); grid on; subplot(4, 1, 3); plot(freq, modulated\_fft); title('Modulated Signal (Frequency Domain)'); xlabel('Frequency (Hz)'); ylabel('Amplitude'); grid on; subplot(4, 1, 4); plot(freq, demodulated\_fft); title('Demodulated Signal (Frequency Domain)'); xlabel('Frequency (Hz)'); ylabel('Amplitude'); grid on;

**OUTPUT:**



|  |  |
| --- | --- |
|  | **ASK:** |
|  | **FSK:** |
|  | **PSK:** |
|  | **QPSK:** |
|  | **QAM:** |