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**AMERICAN INTERNATIONAL UNIVERSITY–BANGLADESH (AIUB)**

FACULTY OF ENGINEERING

Course name: Data Communication

Course code: COE 3201

Section: H

Semester: Spring 2023-24

Group-04

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Experiment No : 07

Experiment name: **Study of Amplitude Modulator and Demodulator using** **MATLAB**

Submission date: April 26th, 2024

**Performance Task for Lab Report:**

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**ANSWER OF QUESTION 1**

Modulation is the process of varying one or more properties of a carrier signal in accordance with the information-bearing signal (also known as the modulating signal), for the purpose of transmitting that signal over a communication channel. The carrier signal typically has a higher frequency compared to the modulating signal, allowing it to carry the modulating signal efficiently.

AM modulation, specifically, refers to Amplitude Modulation, where the amplitude of the carrier signal is varied in proportion to the instantaneous amplitude of the modulating signal. In other words, the strength or power of the carrier signal is modified to encode the information from the modulating signal. AM modulation is commonly used in radio broadcasting.

Modulation is necessary in communication for several reasons:

1. Signal Propagation: Different types of signals propagate through a communication channel more effectively at different frequencies. By modulating a signal onto a carrier wave, we can take advantage of the favorable propagation characteristics of the carrier frequency.

2. Bandwidth Efficiency: Modulation allows us to transmit signals in a more compact form, utilizing a smaller range of frequencies compared to the original signal. This is particularly important for efficient use of the available frequency spectrum, especially in situations where multiple signals need to be transmitted simultaneously without interfering with each other.

3. Noise Immunity: Modulation techniques can enhance the robustness of a signal against noise and interference during transmission. By spreading the signal across a wider frequency range or by using techniques like frequency or phase modulation, it's possible to mitigate the impact of noise and improve the signal-to-noise ratio (SNR) at the receiver.

4. Multiplexing: Modulation enables multiple signals to be combined and transmitted simultaneously over the same channel, a technique known as multiplexing. This allows for more efficient use of the communication medium, enabling several users to share the available bandwidth.

Overall, modulation plays a crucial role in modern communication systems by enabling efficient, reliable, and high-quality transmission of information over various communication channels.

**A screenshot of a computer

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**ANSWER OF QUESTION 03**

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| MATLAB Code | Output Figure |
| clc;  clear;    fs=3000;  t = 0:1/fs:1-1/fs;  fm=5; %frequency of your modulating signal/baseband signal (orginal information signal frequency)  fc=100; % frequency of your carrier signal, we will use for AM modulation    % Baseband Signal (Modulating Signal)  Am=20; % amplitude of your baseband signal  m = Am.\*sin(2\*pi\*fm\*t);    % Carrier Signal  Ac=20; % amplitude of your carrier singal  c= Ac.\*sin(2\*pi\*fc\*t);    % modulation index  mu=Am/Ac; % mu=10/20=0.5    % AM Modulated Signal  cam=(Ac.\*(1+mu\*sin(2\*pi\*fm\*t))).\*sin(2\*pi\*fc\*t);    fftSignal = fft(cam); % This is frequency response of amplitude modulated signal (cam).  fftSignal = fftshift(fftSignal)/(fs/2);  f = fs/2\*linspace(-1,1,fs);    % AM demodulatation part  %am\_demodulated = abs(hilbert(cam))-20;    %multiplying the am modulated signal with carrier signal  am\_demodulated =cam.\*c;  %Applying Low-Pass filter  [k,l] = butter(6,(100).\*2/fs);  filtered\_signal = filtfilt(k,l,(am\_demodulated-200)./10) ;    % Plot the signals  figure;  subplot(4,1,1);  plot(t,m);  ylabel('amplitude');xlabel('time');  title('Modulating/Baseband Signal');  grid on    subplot(4,1,2);  plot(t,c);  ylabel('amplitude');xlabel('time');  title('Carrier Signal');  grid on    subplot(4,1,3);  plot(t,cam);  ylabel('amplitude');xlabel('time');  title('Amplitude Modulated Signal');  xlabel('Time (s)');  grid on    subplot(4,1,4);  %plot(t,am\_demodulated);  plot(t,filtered\_signal);  ylabel('Amplitude');xlabel('time');  title('Demodulated signal');  grid on    figure;  plot(f, abs(fftSignal));  axis([-200 200 0 25]);  title('FFT of AM modulated signal');  xlabel('Frequency (Hz)');  ylabel('Amplitude'); | OUTPUT SCREENSHOT OF QUESTION 1 |