IQRA NATIONAL UNIVERSITY

Department of Computer Science

Data communication & networks

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Assignment: final-term examination

Q1

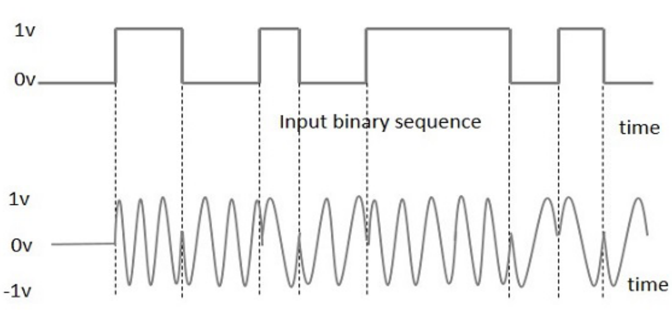
1 A data element is the smallest entity that can represent a piece of information (a bit). A signal element is the shortest unit of a digital signal. Data elements are what we need to send; signal elements are what we can send. Data elements are being carried; signal elements are the carriers.

2 In decoding a digital signal, the incoming signal power is evaluated against the baseline (a running average of the received signal power). A long string of 0s or 1s can cause baseline wandering (a drift in the baseline) and make it difficult for the receiver to decode correctly.

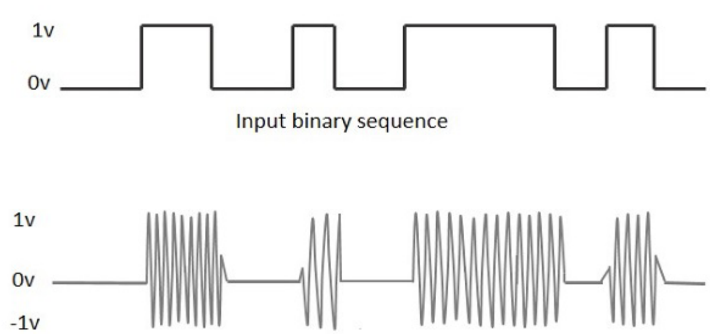
3 We mentioned synchronous, asynchronous, and isochronous. In both synchronous and asynchronous transmissions, a bit stream is divided into independent frames. In synchronous transmission, the bytes inside each frame are synchronized; in asynchronous transmission, the bytes inside each frame are also independent. In isochronous transmission, there is no independency at all. All bits in the whole stream must be synchronized.

4 *S=N x 1/r* N=*S x r* = 2000 x 4 = 8000 bps

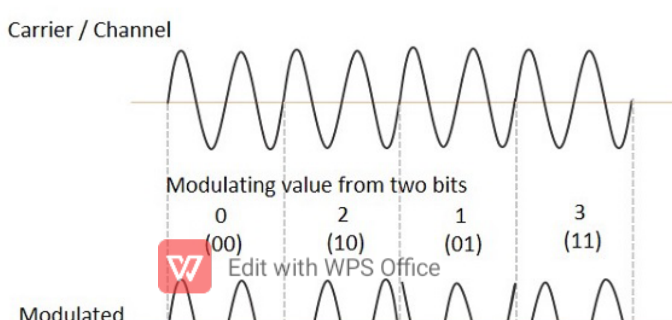
5 Is a graphical representation of a signal components modulated by a digital modulation scheme. It displays the signal as a two-dimensional scatter diagram in the complex plane at symbol sampling instants.



BPSK Modulated output wave



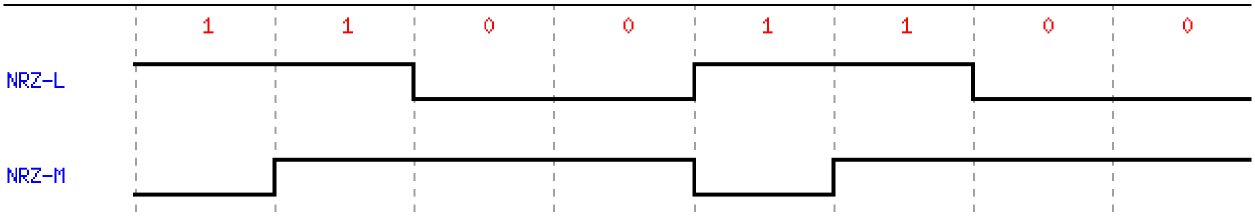
ASK Modulated output wave



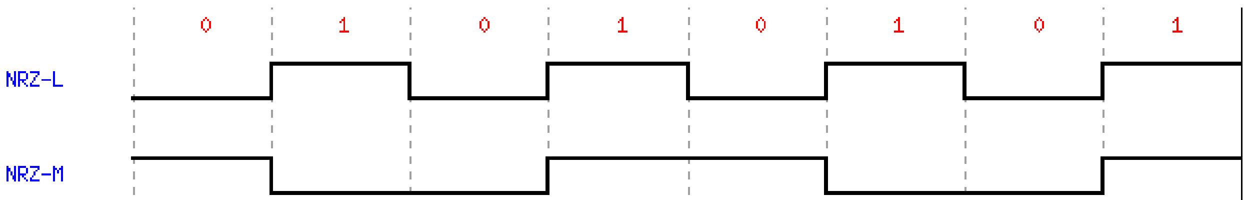
Q2 Sec A The 8-bit data stream for the following case is 110001000

Q2 Sec B

a 11001100

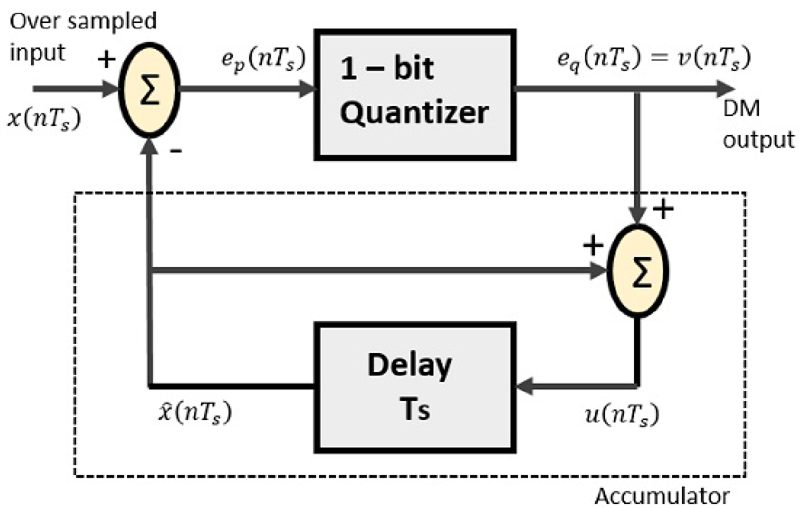


b 01010101



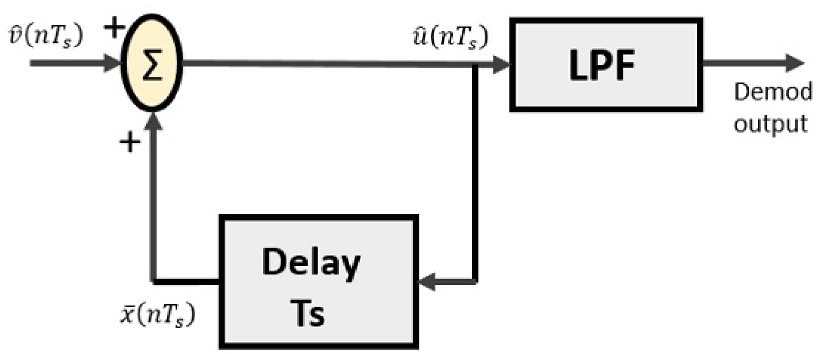
Q2 Sec C Modulator

The Delta Modulator comprises of a 1-bit quantizer and a delay circuit along with two summer circuits. Following is the block diagram of a delta modulator.



Demodulator

The delta demodulator comprises of a low pass filter, a summer, and a delay circuit. The predictor circuit is eliminated here and hence no assumed input is given to the demodulator.



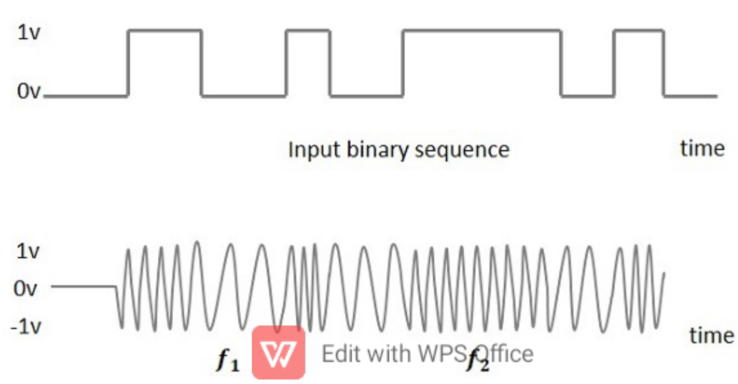
Nyquist sampling rate = 2 x f_{max}
350 x 850 Khz
297500 Khz

Frequency Shift Keying *FSK*

is the digital modulation technique in which the frequency of the carrier signal varies according to the digital signal changes. FSK is a scheme of frequency modulation.

The output of a FSK modulated wave is high in frequency for a binary High input and is low in frequency for a binary Low input. The binary **1s** and **0s** are called Mark and Space frequencies.

The following image is the diagrammatic representation of FSK modulated waveform along with its input.



Q3 Sec A B=(1+d) x S = 2 x N x 1/r = 200Khz N= 100Khz

Amplitude Shift Keying (ASK)

Noise refers to unintentional voltages introduced on to a line by various phenomena such as heat or electromagnetic induction created by other sources.

Q3 Sec B Phase Shift Keying *PSK*

is the digital modulation technique in which the phase of the carrier signal is changed by varying the sine and cosine inputs at a particular time. PSK technique is widely used for wireless LANs, bio-metric, contactless operations, along with RFID and Bluetooth communications.

PSK is of two types, depending upon the phases the signal gets shifted. They are −

Binary Phase Shift Keying *BPSK*

This is also called as 2-phase PSK or Phase Reversal Keying. In this technique, the sine wave carrier takes two phase reversals such as 0° and 180°.

BPSK is basically a Double Side Band Suppressed Carrier *DSBSC*

modulation scheme, for message being the digital information.

Quadrature Phase Shift Keying *QPSK*

This is the phase shift keying technique, in which the sine wave carrier takes four phase reversals such as 0°, 90°, 180°, and 270°.

If this kind of techniques are further extended, PSK can be done by eight or sixteen values also, depending upon the requirement.

BPSK Modulator

The block diagram of Binary Phase Shift Keying consists of the balance modulator which has the carrier sine wave as one input and the binary sequence as the other input. Following is the diagrammatic representation.

Q4)

B)

Analog to Analog Conversion –

Analog-to-analog conversion, or modulation, is the representation of analog information by an analog signal. It is a process by virtue of which a characteristic of carrier wave is varied according to the instantaneous amplitude of the modulating signal. This modulation is generally needed when a **bandpass channel** is required. Bandpass is a range of frequencies which are transmitted through a bandpass filter which is a filter allowing specific frequencies to pass preventing signals at unwanted frequencies.

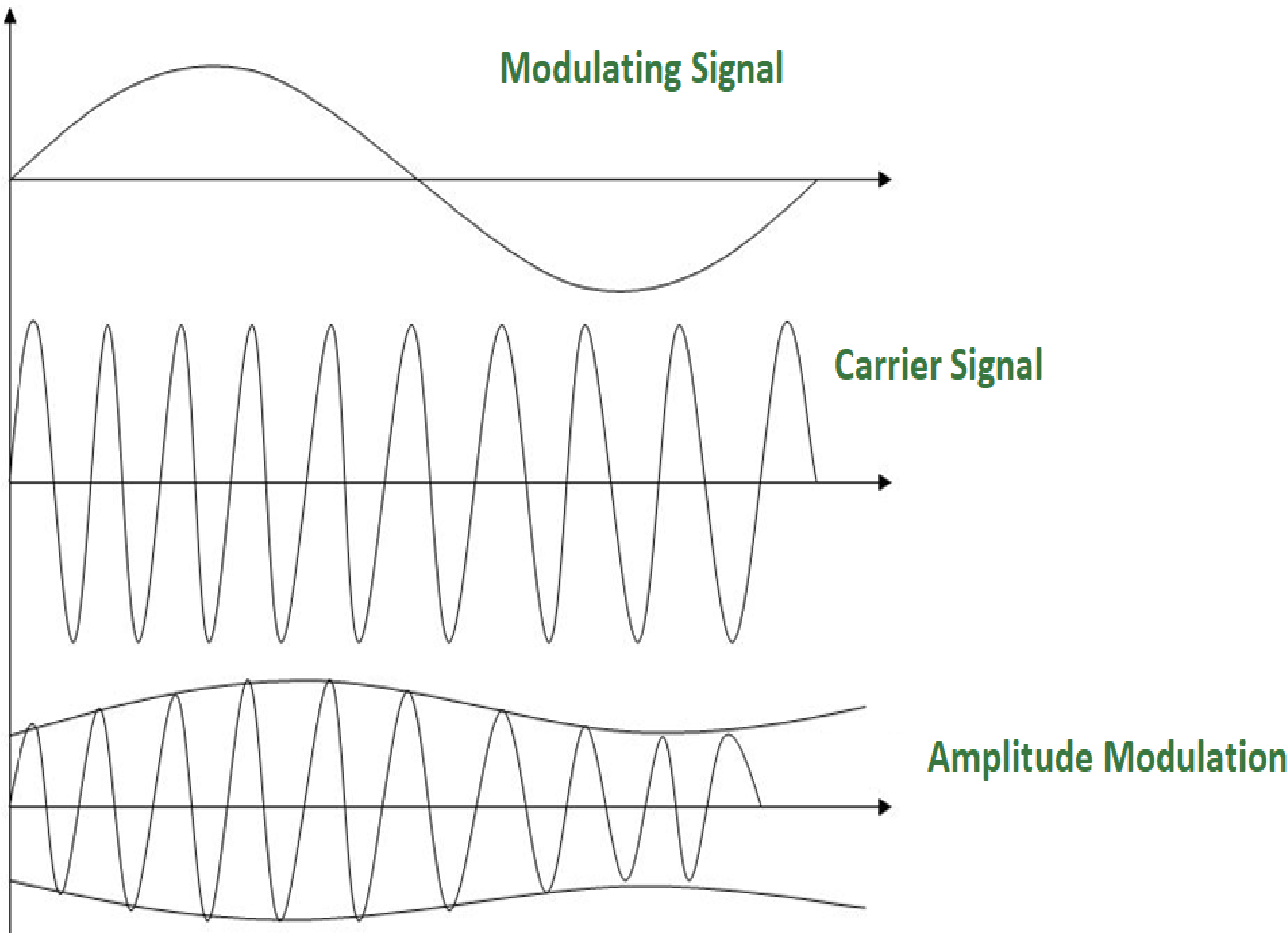
Analog to Analog conversion can be done in three ways:

1. Amplitude Modulation
2. Frequency Modulation
3. Phase Modulation

1. AMPLITUDE MODULATION:

Volume 0%

The modulation in which the amplitude of the carrier wave is varied according to the instantaneous amplitude of the modulating signal keeping phase and frequency as constant. The figure below shows the concept of amplitude modulation:

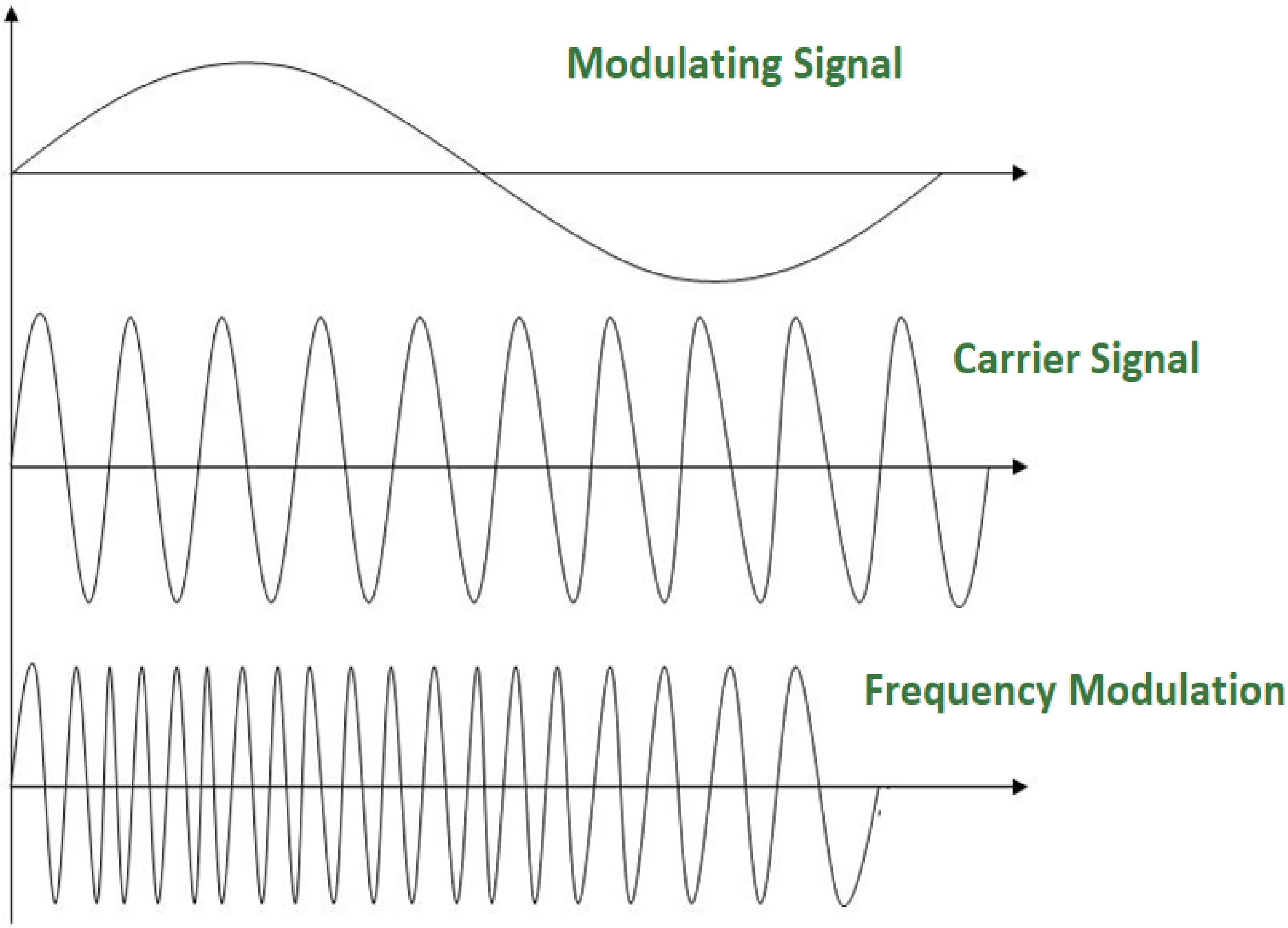


AM is normally implemented by using a simple multiplier because the amplitude of the carrier signal needs to be changed according to the amplitude of the modulating signal.

AM bandwidth:
The modulation creates a bandwidth that is twice the bandwidth of the modulating signal and covers a range centered on the carrier frequency.
Bandwidth= 2fm

2. FREQUENCY MODULATION –

The modulation in which the frequency of the carrier wave is varied according to the instantaneous amplitude of the modulating signal keeping phase and amplitude as constant. The figure below shows the concept of frequency modulation:

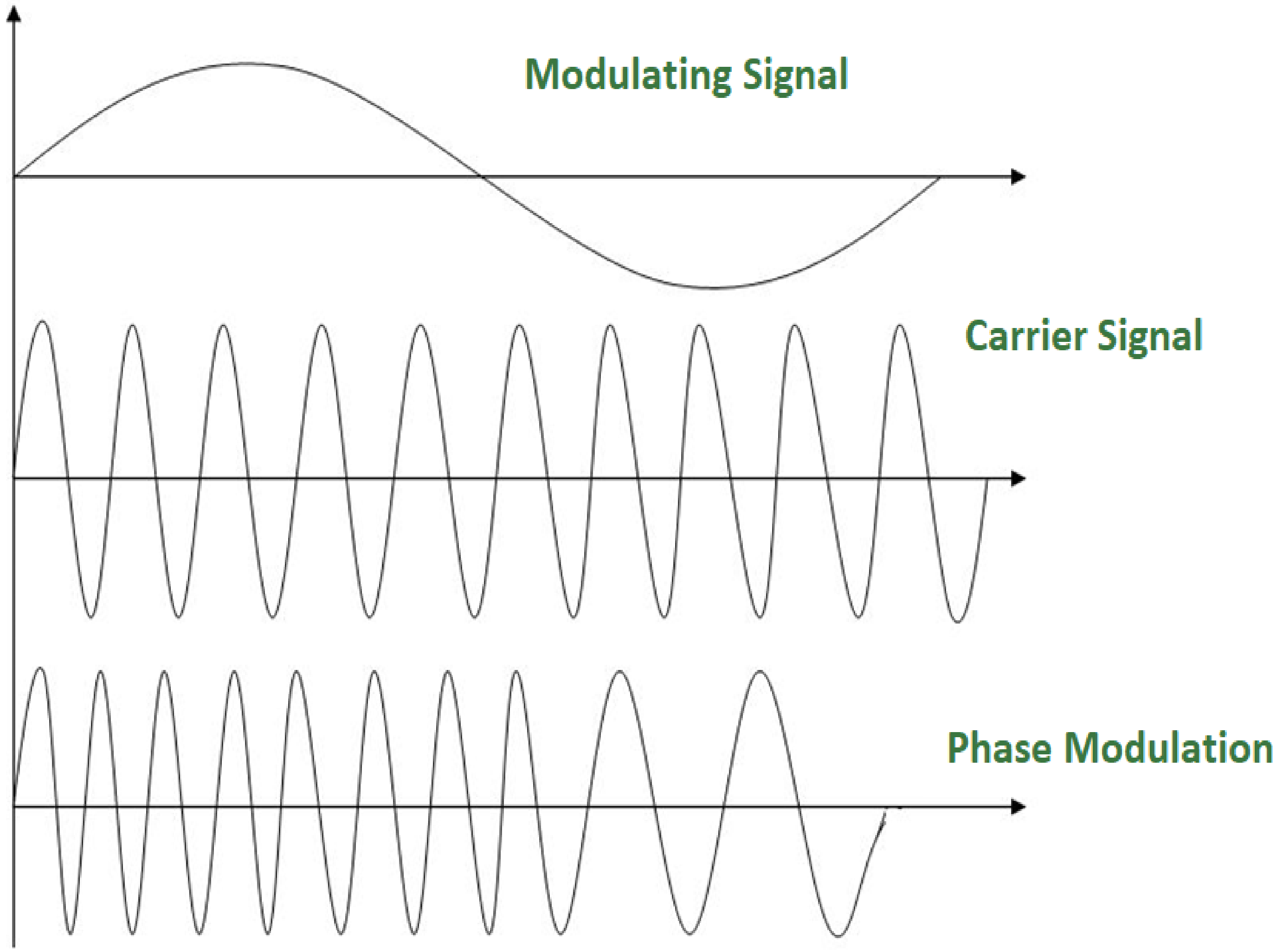


FM is normally implemented by using a voltage-controlled oscillator as with FSK. The frequency of the oscillator changes according to the input voltage which is the amplitude of the modulating signal.

FM bandwidth:

1. The bandwidth of a frequency modulated signal varies with both deviation and modulating frequency. If modulating frequency (Mf) 0.5, wide band Fm signal.
2. For a narrow band Fm signal, bandwidth required is twice the maximum frequency of the modulation, however for a wide band Fm signal the required bandwidth can be very much larger, with detectable sidebands spreading out over large amounts of the frequency spectrum.

3. PHASE MODULATION:
The modulation in which the phase of the carrier wave is varied according to the instantaneous amplitude of the modulating signal keeping amplitude and frequency as constant. The figure below shows the concept of frequency modulation:



Phase modulation is practically similar to Frequency Modulation, but in Phase modulation frequency of the carrier signal is not increased. It is normally implemented by using a voltage-controlled oscillator along with a derivative. The frequency of the oscillator changes according to the derivative of the input voltage which is the amplitude of the modulating signal.