

# CHAPTER – COMPUTER NETWORKS- II

## Communication

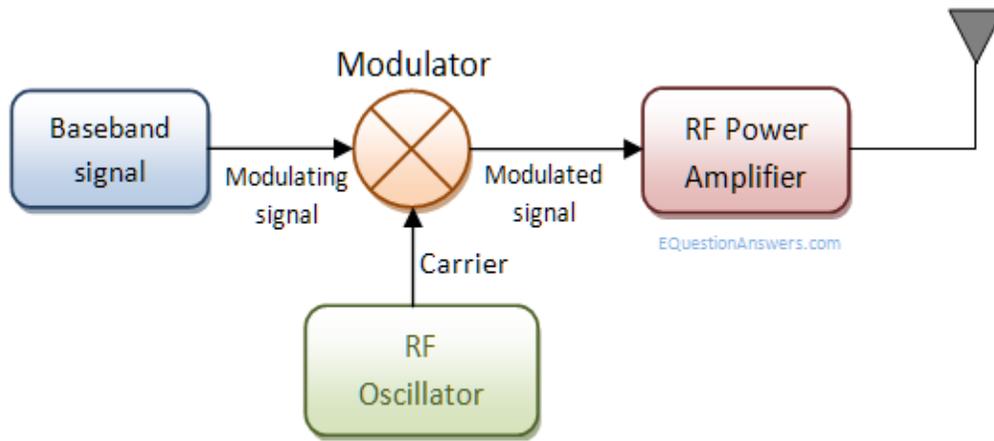
We convey our messages to someone and to the outside world through voice, facial expressions, gestures. These are the communication methods between human beings. However in technological point of view these messages can be base-band audio, video and even digital bits from computer. Telecommunication is the core subject for sending messages from one place to another place. Here we are discussing various types of modulations which are the core mechanisms for any telecommunication devices. Before we start this subject let us go back in the history of telecommunication. Telephone was the first device to send analog audio signals over long distance through copper wire. Telegraph was on the other way to send messages in the forms of dash-dots. Telephone and telegraph remains the base of all modern day's communication. Present days we send audio, video, bitstreams from computers through copper wires, co-axial cable, even through wireless radio waves, microwaves, infrared, and in the form visual lights through optical fibre. Baseband signals can be sent to some distance through copper wire but sending those to a long distance has many challenges. Let us discuss these problems and how modulation came in to picture.

## Modulation needs

Electronic devices produce messages like analog baseband signals in the form of audio, video or even messages can be in the form of digital bits from computer. To send these messages we must have some communication channel like wires, co-axial cable, even wireless radio waves, microwaves or infrared. We can easily transmit messages through wires or cables. Voice, Video, bit streams from computer are having lower frequency band and can travel few distance with wires but cannot be sent through wireless media. Voice signal has lower Bandwidth therefore it will not propagate through space and will be attenuated. To transmit voice signal a large size antenna is required as antenna length is proportional to half of wavelength. The size of the antenna will be more than the distance between transmitter and receiver. Again when more than one transmitter is involved all station will overlap in one frequency band. For those above reasons we choose a carrier, which is a high frequency radio wave, can travel long distance without attenuation and as the frequency is high smaller antenna is required. Selecting different carrier frequency for different transmitting stations can eliminate overlapping of frequency band.

## What is Modulation?

Modulation is an operation of varying amplitude or frequency or phase of carrier signal according to the instantaneous amplitude of the baseband signal/modulating signal.



Modulation Block Diagram

Here baseband signals come from an audio/video or computer. Baseband signals are also called modulating signals as they modulate the carrier signal. Carrier signals are high-frequency radio waves that generally come from radio frequency oscillators. These two signals are combined in the modulator. The modulator takes the instantaneous amplitude of the baseband signal and varies the amplitude/frequency/phase of the carrier signal. The resultant signal is a modulated signal. It goes to an RF amplifier for signal power boosting and then feeds to an antenna or a co-axial cable.

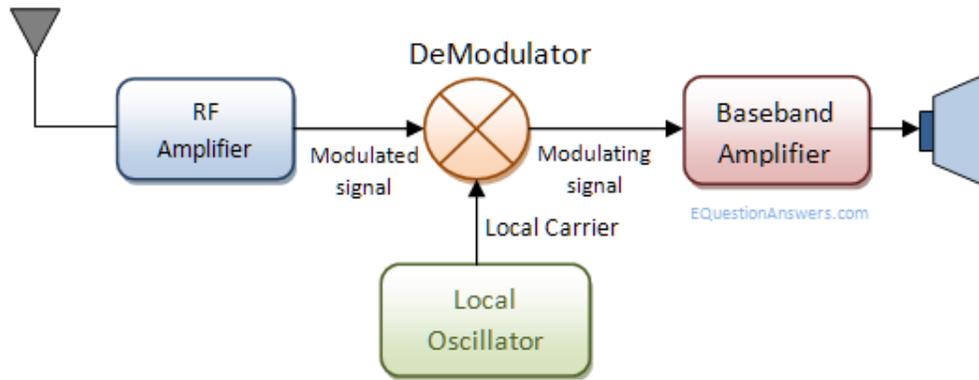
There are two types of modulation: analog and digital. Analog modulation deals with the voice, video, and regular waves of baseband signals. Whereas digital modulations are with bit streams or symbols from computing devices as baseband signals.

## DeModulation:

Demodulation is the opposite process of modulation. The modulator is a part of the signal transmitter, whereas the demodulator is on the receiving side. In a broadcast system, the radio transmitting station does the modulation part. A radio receiver acts as a demodulator. A modem receives signals and also transmits signals; thus, it does both modulation and demodulation at the same time. Hence, the name modem has been given. A radio antenna receives a low-power signal. A co-axial cable end point can also be taken as a signal input. An RF amplifier boosts the signal amplitude. Then the signal goes to a demodulator. The demodulator does the reverse of modulation and extracts the baseband signal from the carrier. Then the baseband signal is amplified to feed an audio speaker or video monitor or TTL/CMOS signal levels to match computer inputs.

## What is De-modulation?

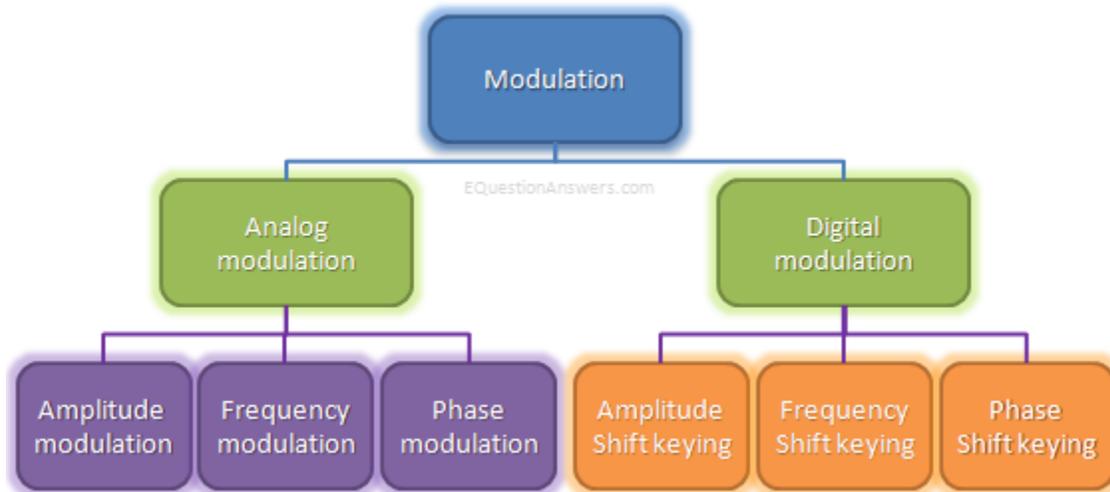
Demodulation is the opposite process of modulation where the varying amplitude, frequency, or phase of the carrier signal is extracted to reconstruct the original message signal.



Demodulation Block Diagram

What are the different types of modulations?

There are mainly two categories of modulations: analog and digital. Here is a diagram showing the types of modulations and further the sub types of analog and digital modulations.



### Analog Modulation:

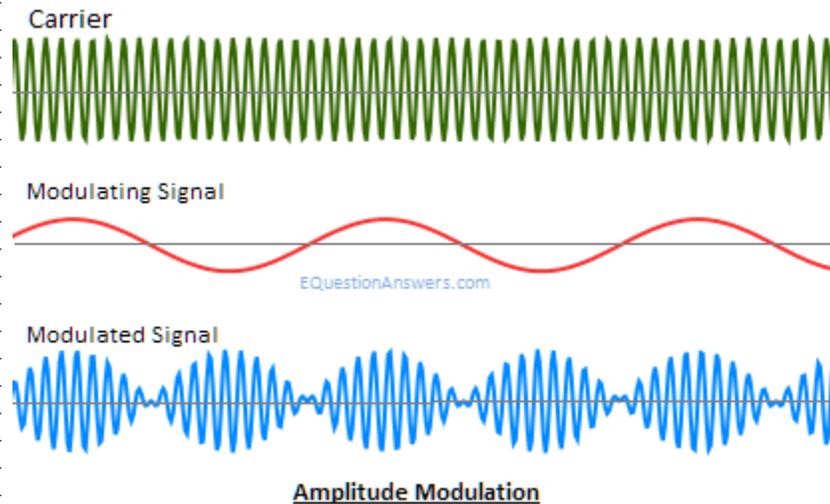
Analog modulation refers to the process of transferring analog low frequency baseband signal, like an audio or TV signal over a higher frequency carrier signal such as a radio frequency band. Baseband signal is always analog for this modulation.

There are three properties of a carrier signal amplitude, frequency and phase thus there are three basic types of analog modulations.

1. **Amplitude Modulation (AM)**
2. **Frequency Modulation (FM)**
3. **Phase modulation (PM)**

## Amplitude Modulation

Amplitude modulation or AM is the process of varying the instantaneous amplitude of carrier signal accordingly with instantaneous amplitude of message signal.



### AM Advantage

AM is the simplest type of modulation. Hardware design of both transmitter and receiver is very simple and less cost effective.

### AM Disadvange:

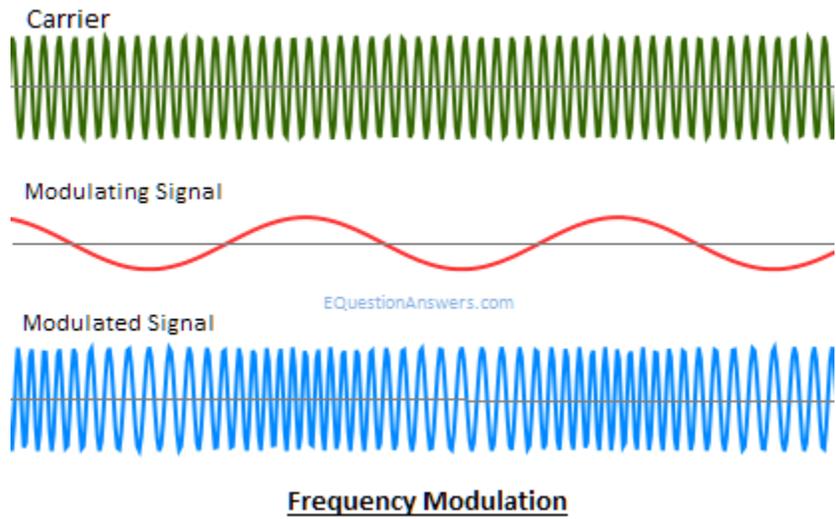
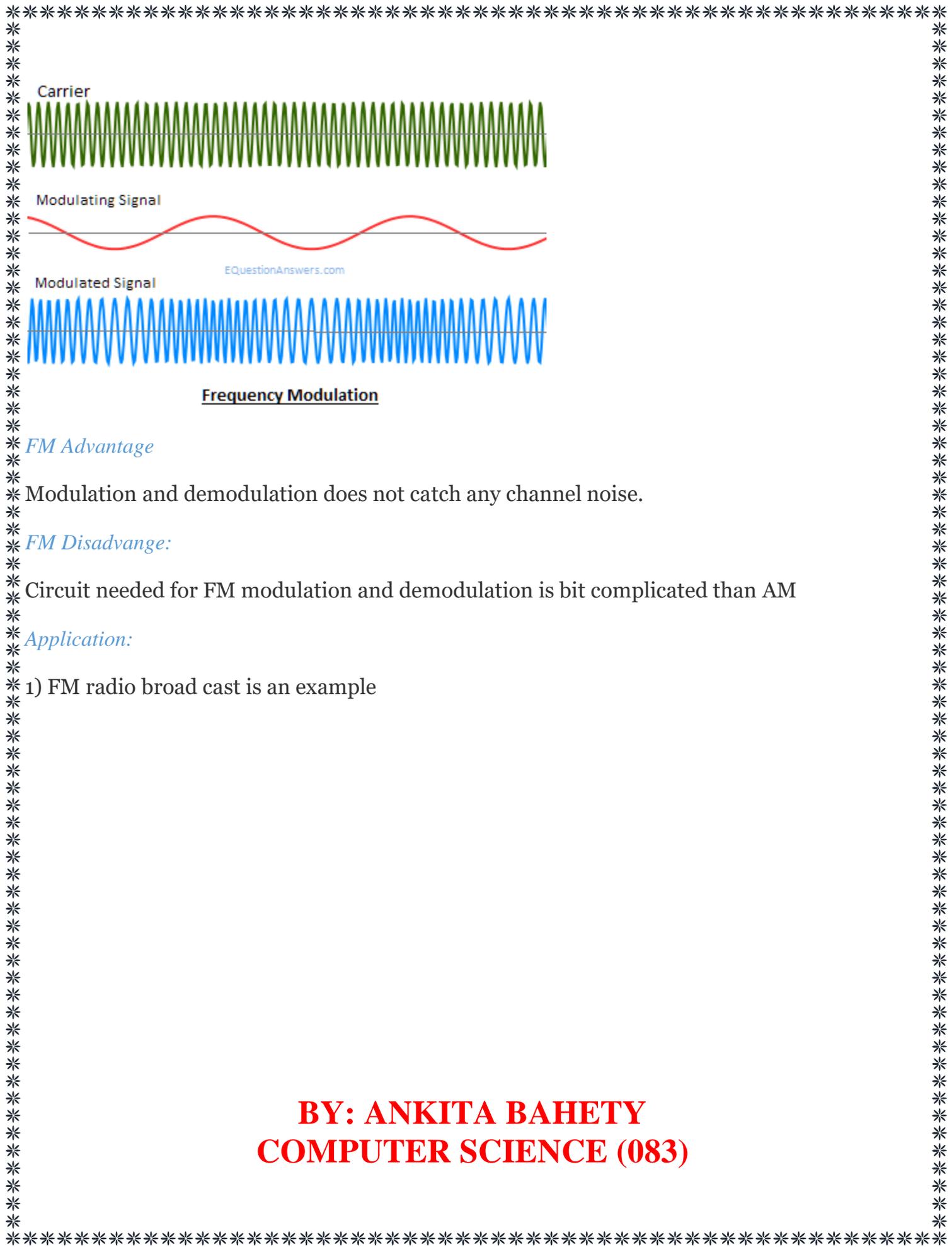
AM is very susceptible to noise.

### Application:

1) AM radio broad cast is an example

## Frequency modulation

FM or Frequency modulation is the process of varying the in instantaneous frequency of Carrier signal accordingly with instantaneous amplitude of message signal.



*FM Advantage*

Modulation and demodulation does not catch any channel noise.

*FM Disadvange:*

Circuit needed for FM modulation and demodulation is bit complicated than AM

*Application:*

- 1) FM radio broad cast is an example

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