Sri SAI RAM ENGINEERING COLLEGE
INSTITUTE OF TECHNOLOGY
West Tambaram, Chennai - 44

SAIRAM DIGITAL RESOURCES

YEAR II SEM III

EC8394

ANALOG AND DIGITAL COMMUNICATION

UNIT NO 1: ANALOG COMMUNICATION

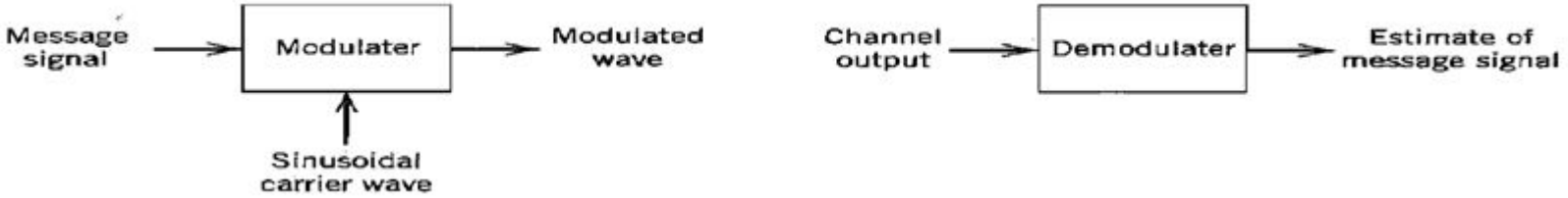
1.2.0 MODULATION , TYPES & NEED FOR MODULATION

ELECTRONICS & COMMUNICATION ENGINEERING

Introduction to communication

What is modulation?

- Modulation is performed at the transmitting end of the communication system.
- At the receiving end of the system we usually require the original baseband signal to be restored, this is usually accomplished by using a process known as demodulation



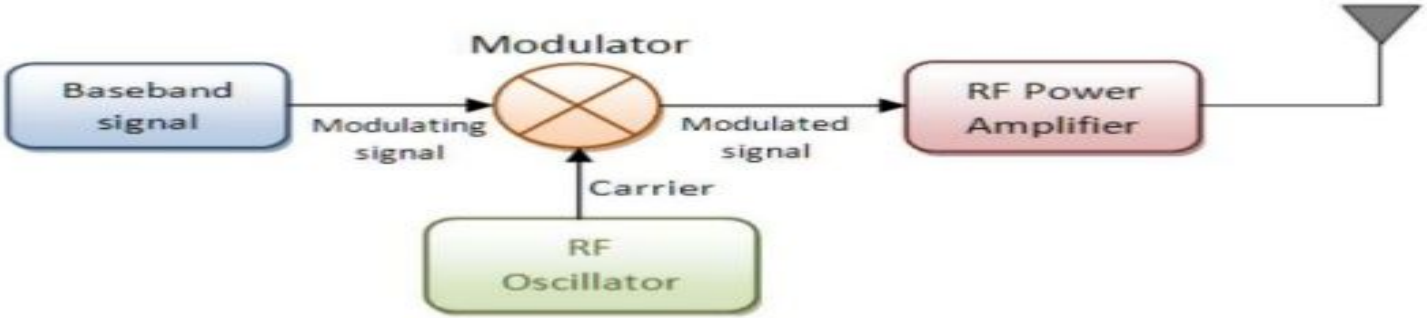
- In basic signal processing terms, we thus find that the transmitter of an analog communication system consists of a modulator and the receiver consists of a demodulator.
- Message signal
- Carrier signal-modulated to convey information

WHAT IS MODULATION

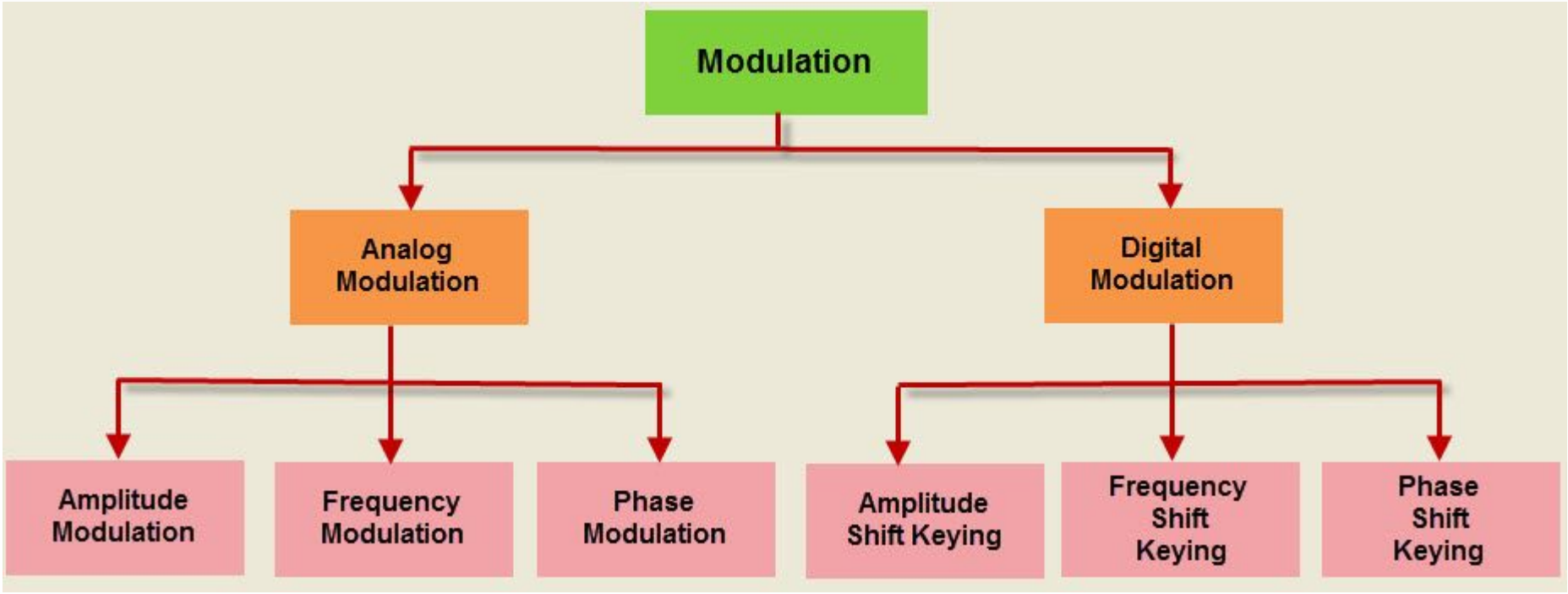
- MODULATION is the basic requirement for transmitting the message signal through free space
- It is the process of transmission of information signal (low frequency audio signal) using a high frequency **carrier signal**

MODULATION

- Operation of varying amplitude, frequency or phase of carrier signal accordingly with the instantaneous amplitude of the message signal is called modulation
- Modulation = Adding information to a carrier signal



TYPES OF MODULATION



Another way

- ANALOG MODULATION:

If the variation in the parameter of the carrier is continuous in accordance to the input analog signal the modulation technique is termed as analog modulation scheme. It is classified as:

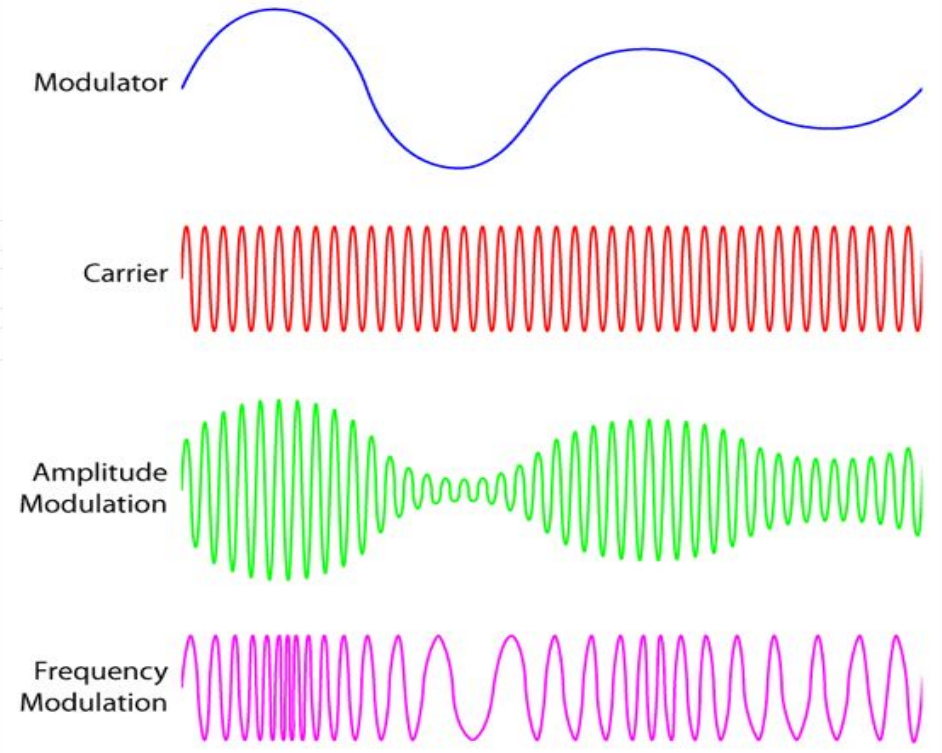
1. Amplitude Modulation
2. Frequency Modulation
3. Phase Modulation

- DIGITAL MODULATION:

If the variation in the parameter of the carrier is discrete then it is termed as digital modulation technique. It is classified as:

1. Amplitude Shift Keying
2. Frequency Shift Keying
3. Phase Shift Keying

SIGNAL REPRESENTATION



AM	Similarities of AM and FM	FM
AM means 'Amplitude Modulation'.	Both are ways for broadcasting radio signals.	FM means 'Frequency Modulation'
It has frequencies that range from 540 kilohertz to about 1600 kilohertz	You could select what carrier or channel you would like on AM and FM.	It has frequencies that range from 88 to 108 MHz.
It has longer range than FM and is able to travel around different obstacles but FM's quality is better.	Both have their own carrier and wave frequency.	FM provides higher quality because it's not that affected by electrical interference.

Feature	AM	FM	PM
Function	amplitude of carrier wave varies as per amplitude or voltage of modulating signal input.	Frequency of carrier wave varies as per voltage of modulating signal input.	Phase of carrier wave varies as per voltage of modulating signal input.
Carrier parameter	frequency of carrier wave is kept constant	amplitude of carrier wave is kept constant	amplitude of carrier wave is kept constant
Types	AM types include DSB-SC, SSB, VSB etc. Refer DSB-SC	Digital FM types include FSK, GFSK, Offset FSK	Digital PM types include BPSK, QPSK, QAM(combination of amplitude and phase modulation

Need for Modulation

If modulation is not employed however, the system designer could confront the following problems:

- Antenna Height
- Narrow Banding
- Poor radiation and penetration
- Diffraction angle
- Multiplexing
- To overcome equipment limitations
- To reduce noise and interferences

Need for modulation

- The main reason is the disturbance of noise.
- After transmitting, our message signal can be attacked by unwanted signals in the channel.
- Message signal can be modified into unwanted signal by noise.
- Because of noise, modulation must be done before transmitting.

Need for modulation Cont...

Factors that suggest need of modulation

1. **Practicable Size of Antenna**

- Speech and music signal(20Hz – 20kHz) can only travel for a few distance.
- To receive the transmitted signal, the length of antenna should be a quarter-wavelength of the frequency used.
- If frequency is 20kHz, wavelength will be 15km and the height of antenna will become 3.75km which is impossible to install.

Need for modulation Cont...

- When we add high frequency signal(10MHz) with our message signal, frequency becomes high(10.02MHz).
- Then the wavelength will low(30m) and the height of antenna will become practicable(7.5m).

Need for modulation Cont...

2. **Power Radiation**

- Radiated power $\propto (\frac{1}{\lambda})^2$
- Without modulation, the frequency of signal is low, wavelength will large and Power will low
- If Power is very low, it will not reach destination and noise can also be added in the channel
- If we used modulation, the frequency of modulating signal is high and radiated power will become high.

Need for modulation Cont...

3. **Narrow banding**

- Narrow banding does not mean that reducing the bandwidth.
- Bandwidth will remain same
- It means that making wavelength same
- Example: We calculated the height of antenna based on wavelength. Without modulation, each frequency will need antenna to communicate.

Need for modulation Cont...

- If we use modulation, the wavelengths of many signals will be the same(not exactly)
- By using modulation, antenna size requirement becomes same

4. **Common Processing**

- How if we have only one transmitter to control or use various signal transmitting

Need for modulation Cont...

5. **Multiplexing**

- Multiplexing is the process of sending several signals through a common channel.
- Most of the television channels use the same frequency range(bandwidth).
- How multiple signals go without overlapping each other?

What is the minimum length of antenna required to transmit a radio signal of frequency 20 MHz ?

Given, the frequency of radio signal
f =20MHz
=20×106Hz
The wavelength of the antenna is
λ=c/f
λ=3×108/ (20 x 10 6)
or λ=15m
∴ For efficient radiation and reception, the height of transmitting and receiving antennas should be comparable to a quater wavelength of the frequency used.
∵ The minimum length of antenna
λ/4
=15/4 =3.75m

VIDEO LINK OF MODULATION

https://www.youtube.com/watch?v=dvGcCk1vbjk
https://youtu.be/00ZbuhPruJw
https://youtu.be/I0jdIvwkiDI
https://youtu.be/ANN1bvPV7y0 AM derivation
https://youtu.be/wqTv6jdUPL4 AM derivation

QUIZ LINK OF MODULATION

https://forms.gle/MicYdG9TZCxgeQ6z7