Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills.
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q.1.

a) Attempt any three of the following:

i. Define modulation index of AM and FM.(2M each)

The modulation index (m_a) of AM can be defined as the ratio of amplitude of modulating signal to the amplitude of carrier signal.

$$m_a = \frac{V_m}{V_c}$$

Practically it can be written as

$$m_a = \frac{V_{max} - V_{min}}{V_{max} + V_{min}}$$

The modulation index of FM can be define as the ratio of frequency deviation (δ) to the maximum modulating signal frequency(f_m).

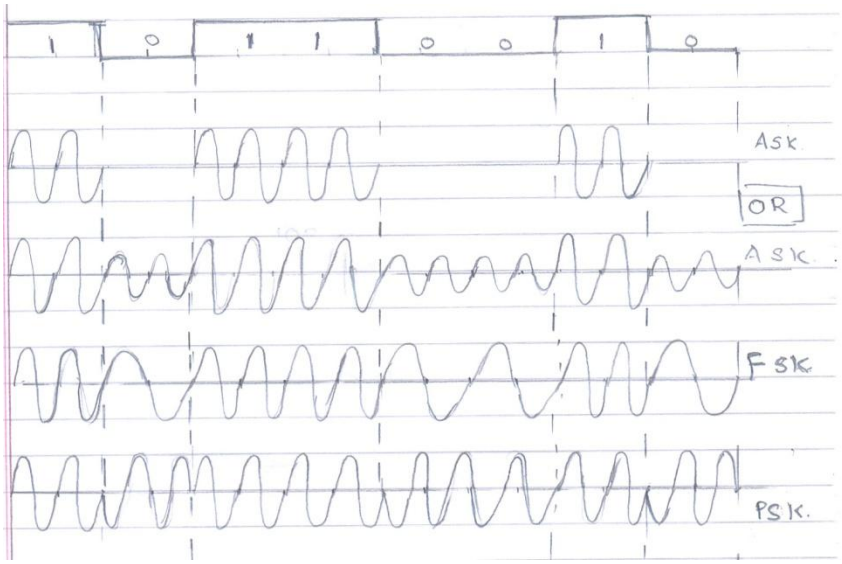
$$m_f = \frac{frequency\ Deviation}{Max.Modulating\ frequency}$$

$$m_f = \frac{\delta}{f_m}$$

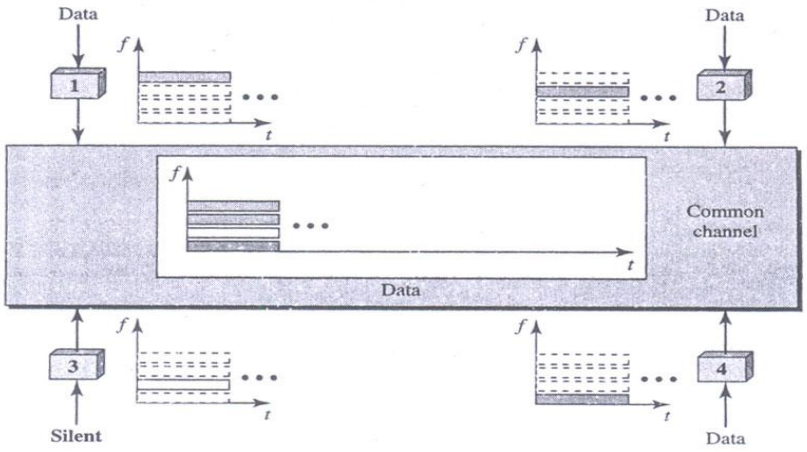
ii. List different types of digital modulation techniques. Draw waveforms for ASK, FSK, PSK technique for binary digits 10110010.(list 1M, Diagram 1M each)

1. Amplitude shift keying(ASK)
2. Frequency Shift keying (FSK)
3. Phase shift keying(PSK)
   a. Binary phase shift keying(BPSK)
   b. Quadrature phase shift keying(QPSK)
4. Quadrature Amplitude Modulation/QAM
5. Differential phase shift keying(DPSK)
6. The digital pulse Modulation Techniques are

i. Pulse code modulation(PCM)
ii. Delta Modulation(DM)
iii. Adaptive Deltamodulation(ADM)



iv. Draw the block diagram of FDMA and describe it's working.
(Diagram 2M, Working 2 M)

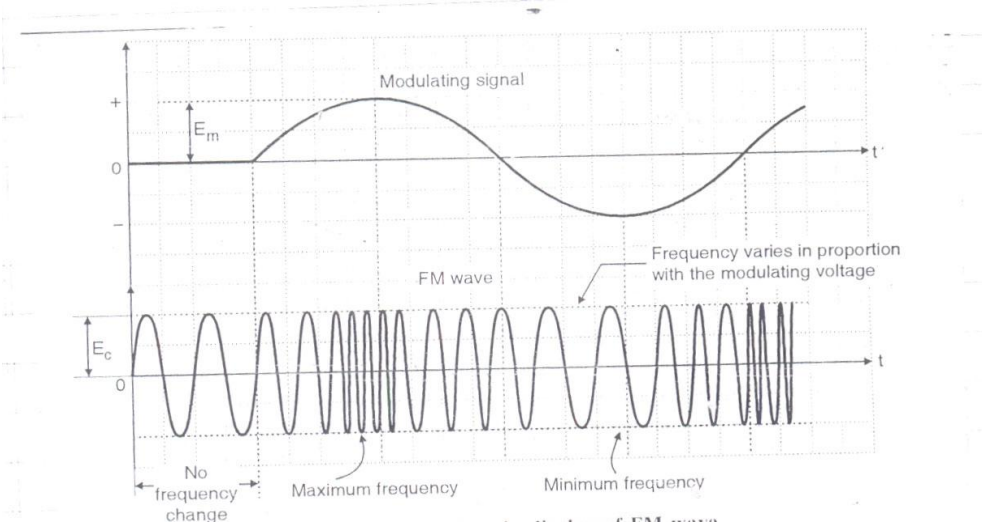


In frequency-division multiple access (FDMA) the available bandwidth is divided into frequency bands. Each station is allocated a band to send its data. In other word each band is reserved for a specific station, and it belongs to the station all the time. Each station also uses a bandpass filter to confine the transmitter frequencies. To prevent station interferences, the allocated bands are separated from one another by small guard bands.

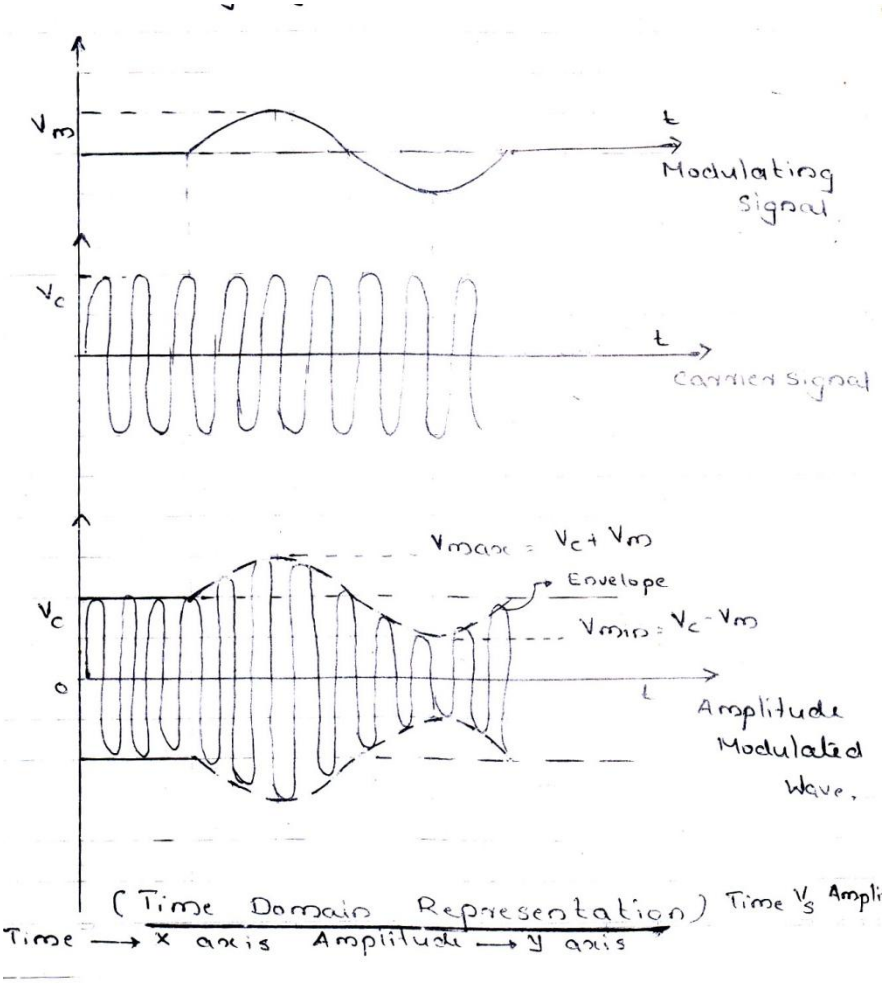
FDMA specifies a predetermined frequency band for the entire period of communication. This means that stream data) a continuous flow of data that may not be packetized) can easily be used with FDMA.

FDMA is an access method in the data link layer of OSI layer. The data link layer in each station tells its physical layer to make a bandpass signal from the data passed to it. The signal must be created in the allocated band. There is no physical multiplexer at the physical layer. The signals created at each station are automatically bandpass-filtered. They are mixed when they are sent to the common channel.

v. Draw AM and FM waveform in time domain.(each 2M)



FM waveform in time domain



AM waveform in time domain

b) Attempt any One of the following:

i. Find percentage modulation when Vmax=132 Vpp and Vmin=28 Vpp.(4M)

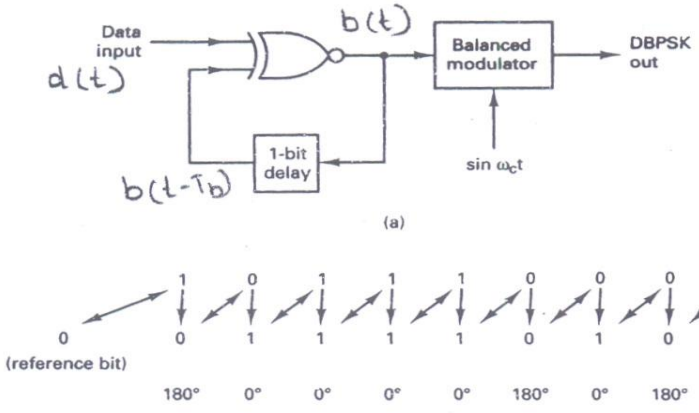
$$\textbf{Percentage of modulation} = \frac{V_{max} - V_{min}}{V_{max} + V_{min}} \times 100$$

$$V_{max} = 132Vpp$$

$$V_{min} = 28Vpp$$

$$\textbf{Percentage of modulation} = \frac{132 - 28}{132 + 28} \times 100 = \frac{104}{160} \times 100 = \frac{52}{80} \times 100 = 65\%$$

ii. Draw the block diagram of DBPSK transmitter. State the function of each block. (Diagram 1 M, Explanation 3M)



DPSK transmitter:

1. D(t) represents the data stream which is to be transmitted. It is applied to one input of as EX-NOR logic gate.
2. The incoming information bit is XNORed with the preceding bit prior to entering for the first data bit there is no preceding bit with which to compare. Therefore an initial reference bit is assumed.
3. The Ex-NORed output b(t) is delayed by one bit period I_s and applied to the other input of EX-NOR gate. The delayed output is represented by $b(t-T_b)$.
4. Depending on the value of d(t) and $b(t-T_b)$ the Ex-NOR gate provides the output sequence b(t).
5. If the first data bit and reference bit are same the XNORed output is logic 1, if they are different XNORed output is logic 0. Logic 1 produces $+\sin w_c t$ as the output of balanced modulator which gives 0^0 phase shift, logic '0' produces $-\sin w_c t$ at the output which gives 180^0 phase shift.

Q.2. Attempt any four of the following:

a) Draw the block diagram of Delta modulation transmitter. Describe its operation with waveform. (2M Diagram, 2 M explanation)

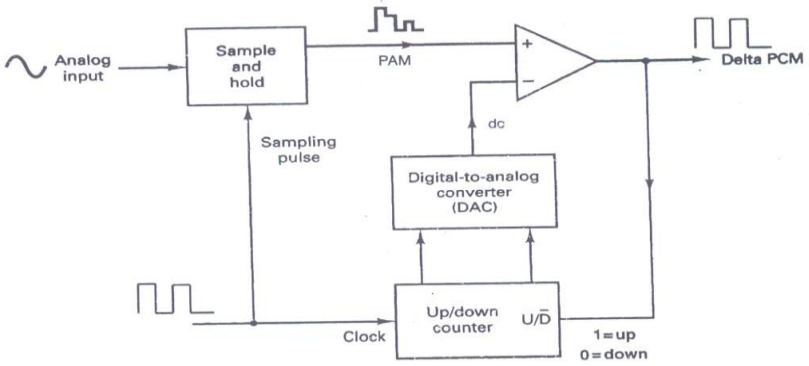
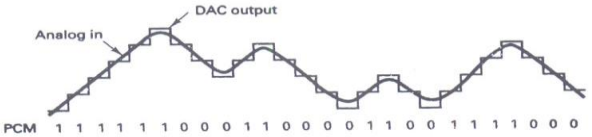


FIGURE 10-20 Delta modulation transmitter



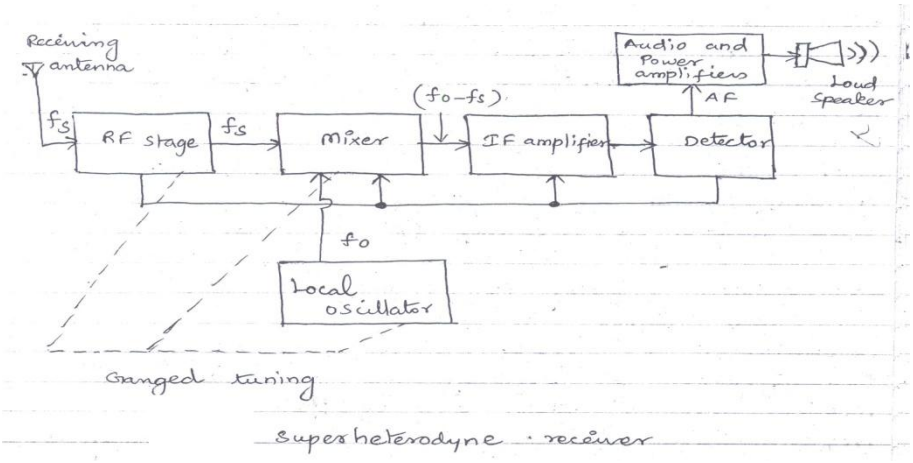
Ideal operation of a delta modulation encoder

The above diagram shows a block diagram of a delta modulation transmitter. The analog input is sampled and converted to a PAM signal, which is compared with the output of the DAC. The output of DAC is a voltage equal to the regenerated magnitude of the previous sample, which was stored in the up-down counter as a binary number. The up-down counter is incremented or decremented depending on whether the previous sample is larger or smaller than the current sample. The up-down counter is clocked at a rate equal to sample rate. Therefore, the up-down counter is updated after each comparison.

Initially, the up-down counter is zeroed, and the DAC is outputting 0V. The first sample is taken, converted to PAM signal, and compare with zero volts. The output of the comparator is a logic 1 condition (+V), indicating that the current sample is larger in amplitude than the previous sample. On the next clock pulse, the up-down counter is incremented to a count of 1. The DAC now outputs a voltage equal to the magnitude of the minimum step size (resolution). The steps change value at a rate equal to the clock frequency (sample rate).

Consequently, with the input signal shown, the up-down counter follows the input analog signal up until the output of the DAC exceeds the analog sample; then the up-down counter will begin counting down until the output of the DAC drop below the sample amplitude. In the idealized situation, The DAC output follows the input signal. Each time the up-down counter is incremented, logic 1 is transmitted, and each time the up-down counter is decremented, logic 0 is transmitted.

b) Draw the block diagram of superheterodyne AM radio receiver. State the function of each block.(diagram 1 M, explanation 3M)



Operation:

The Double Side Band Full Carrier or AM signal transmitted by the transmitter travels through the air and reaches the receiving antenna. This signal is in the form of electromagnetic waves. It induces a very small voltage into the receiving antenna.

RF stage: The RF stage is amplifier which is used to select the wanted signal and reject other out of many, present at the antenna. It also reduces the effect of noise. The desired signal frequency fs is the output of the RF amplifier.

Mixer: The mixer receives signals from the RF amplifier at frequency fs and from the local oscillator at frequency fo such that fo>fs.

Intermediate frequency(IF): The mixer will mix these signals to produce signals having frequency fs, fo,(fo+fs) and (fo-fs).out of these the difference of frequency component i.e.(fo-fs) is selected and all others are rejected. This frequencies called as the Intermediate frequency (IF).

IF=(fo-fs)

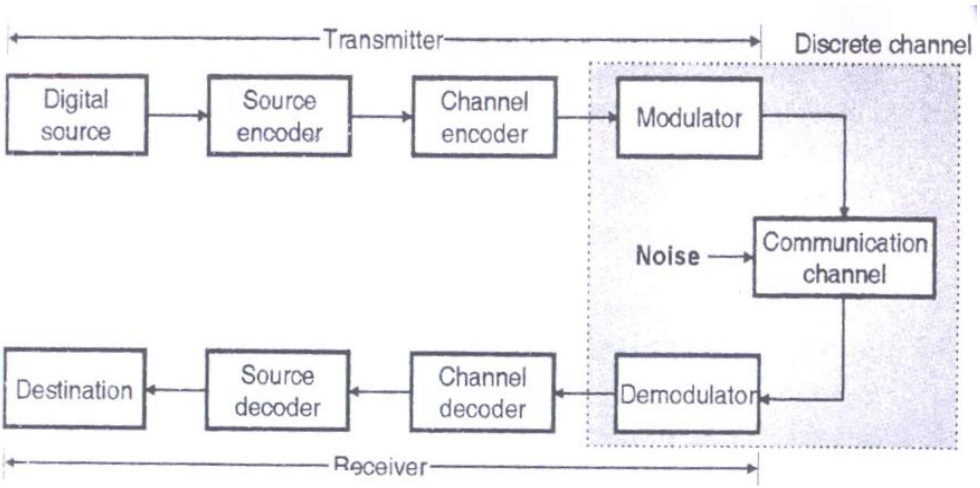
This frequency contains the same modulation as the original signal fs. In order to maintain a constant difference between the local oscillator frequency and the incoming frequency ganged tuning is used. This is simultaneous tuning of RF amplifier, mixer and local oscillator and it is achieved by using ganged tuning capacitor.

Detector:

This intermediate frequency signal is then amplified by one or more IF amplifier signal is detected by the detector to remove the original modulating signal. This is then amplifies and applied to the loudspeaker.

AGC means automatic gain control. This circuit controls the gain of the RF and IF amplifiers to maintain a constant output voltage level even when the signal level at the receiver input is fluctuating. This is done by feeding a controlling dc voltages to the RF and IF amplifiers. The amplitude of this dc voltage is proportional to the detector output.

c) Draw the block diagram of digital communication system. state the function of each block.



Digital communication system

In a block diagram of digital communication system three basic signal processing operations have been included. They are;

1. Source coding
2. Channel codlings and
3. Modulation

The source information is assumed to be digital. If it is analog then it must be converted first to digital.

Source encoder: The source encoder converts the digital signal generated at the source output into another signal in digital form. Source encoding is used to reduce or eliminate redundancy for ensuring an efficient representation of the source output. Different source coding techniques are PCM, DM, ADM etc.

Due to source encoding BW requirement for transmission is reduced.

Channel encoder:

Channel encoding is done to minimize the effect of channel noise.

This will reduce the number of errors in the received data and will make the system more reliable. Channel coding technique introduces some redundancy.

The output of the channel encoder is a series of code words which include the message and some parity bits. These additional parity bits introduce redundancy.

Modulator: Modulation is used for providing an efficient transmission of the single over the channel. The modulator can use any of the CW digital modulation techniques such as ASK. FSK or PSK.

Discrete channel: The discrete channel consists of modulator, channel and detector. It is called as discrete channel because its inputs as well as output are in then discrete form.

Demodulator: the demodulator is used for demodulation**.**

Channel decoder:

The channel decoder is at the receiver and it maps the channel output into a digital signal in such a way that effect of channel noise is reduced to a minimum.

The channel decoder converts these code words into digital messages.

Source decoder:

Source decoder is at the receiver and it behaves exactly in an inverse way to the source decoder.

It delivers the destination (user) the original digital source output.

d) Define bit rate and baud rate.

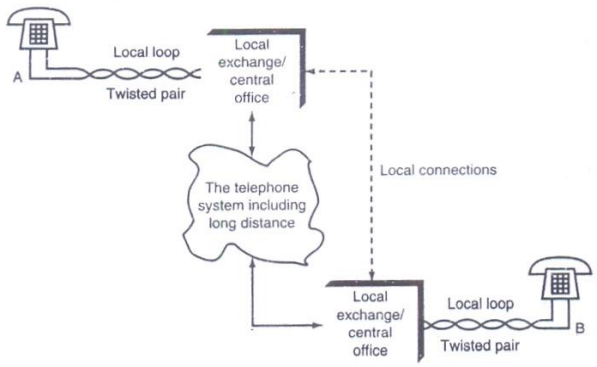
Bit rate:

Bit rate is the number of bits transmitted during one second in the data communication system and it is expressed in bits per second.

Baud rate:

It is the rate of change of a signal on the transmission medium after the encoding and modulation in a data communication system.

e) Draw the block diagram of telephone system. State function of each block. (1M diagram, 3M explanation)



The basic telephone system.

The telephone system permits any telephone to connect with any other telephone in the world. This means that each telephone must have a unique identification code- the 10 digit telephone number assigned to each telephone, the telephone system provides a means of recognizing each individual number and switching system that can connect any switching systems that can connect any two telephones.

The local loop

Standard telephones are connected to then telephone system by way of a two-wire, twisted pair cable that terminates at the local exchange or central office. As many as 10000 telephone line can be connected to single central office. Then connections from then central office go to then "telephone system'.

A call originating at telephone A will pass through the central office and the into the main system where it is transmitted via one of many different routes to the central office connected to the desired location designated as B.

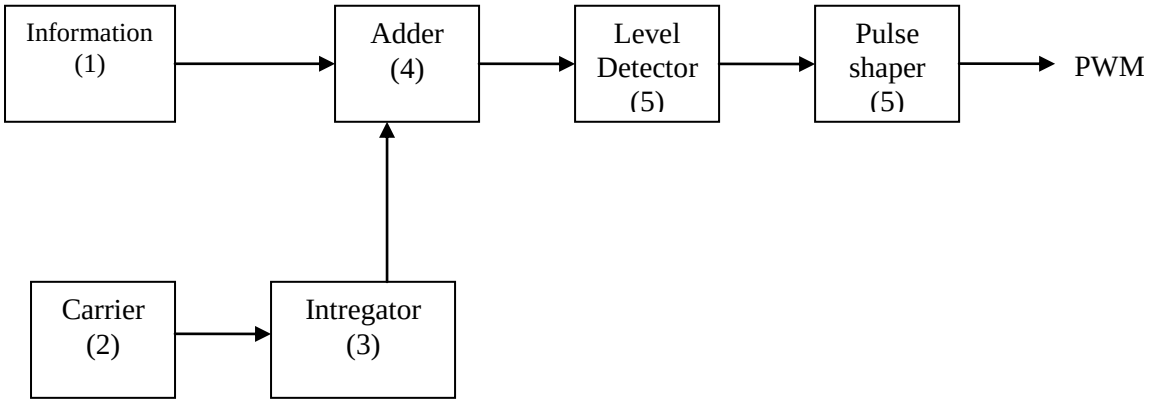
The connection between nearby local exchange is direct rather than long distance. The two wire twisted pair connection between the telephones and the central office is referred to as the local loop or subscriber loop.
All dialing and signaling operations are also carried on this shingle twisted pair.
A basic telephones or telephone set is an analog baseband transceiver. It has a handset which contains a microphone and a speaker, better known as a transmitter and a receiver. It also contains a ringer and a dialing mechanism.

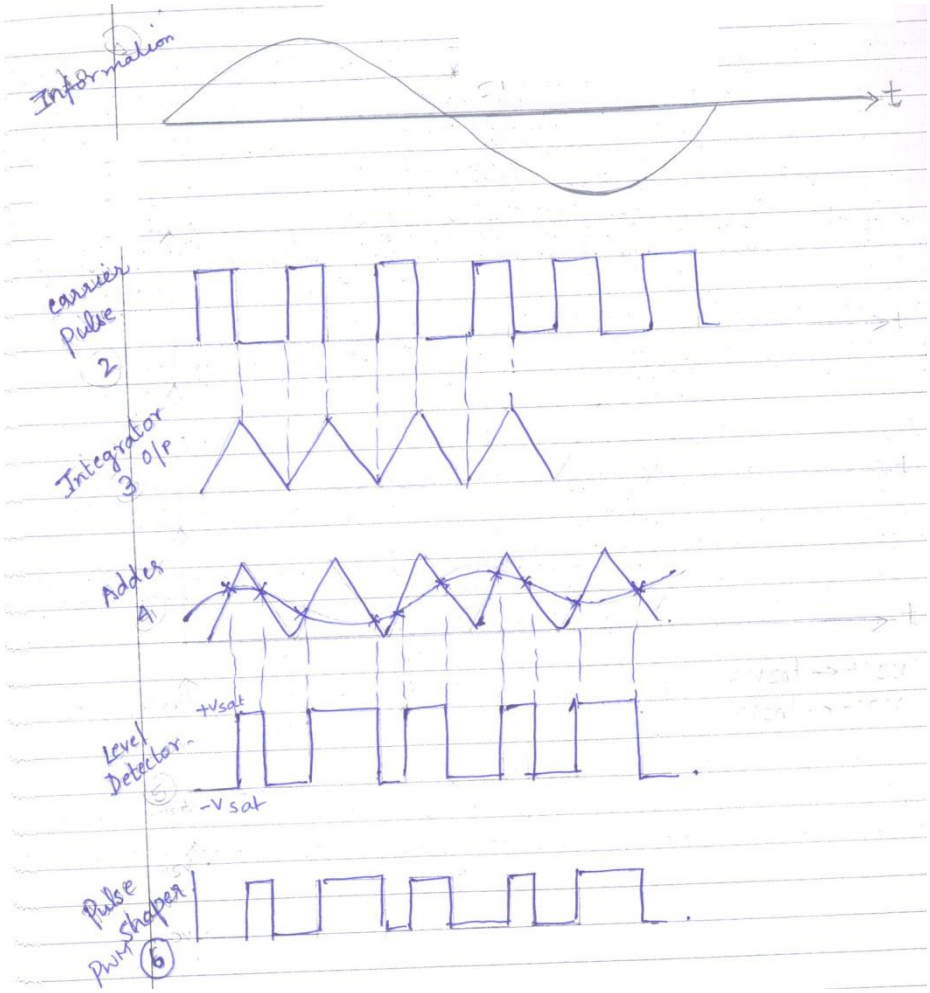
f) State the applications of satellite communication systems(any four)

1. The main application of satellite is communication. Satellites are used as relay station in sky.
2. The main application of satellite is surveillance or observation.
   Eg:
   a. Military satellites are used for reconnaissance.
   b. Intelligence satellite collects information about enemies and potential enemies.
   c. Observation satellites are used as Metrological satellites and weather satellites.
   d. Satellites can spot diseased crop area mineral resources source of pollution etc.
3. TV signals can be transmitted through satellites for redistribution.
4. Satellite can be used in navigation eg: Global positioning system(GPS)
5. Telephone system uses satellites for long distance calls.

Q.3. Attempt any four of the following: (16M)

a) Draw the block diagram of generation of PWM. Describe working with waveforms. (Block diagram -1 M, Waveforms -1M, Explanation -1M)





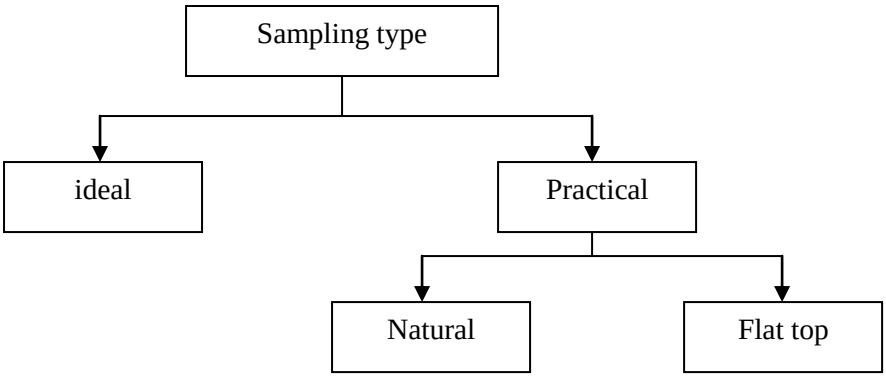
The sample pulses are given to the integrator to generate RAM. The information along with the integrated sample pulse (RAM) is given to the adder circuit. The adder circuit uses operational amplifier. It is a mixer stage. The o/p of adder is fed to the comparator which continuously detects the amplitude of two waveforms (level detector or comparator). It generates a pulse whose width varies according to instantaneous voltage of the modulating signal. The pulse shaper adjusts the height of the pulse required for transmission.

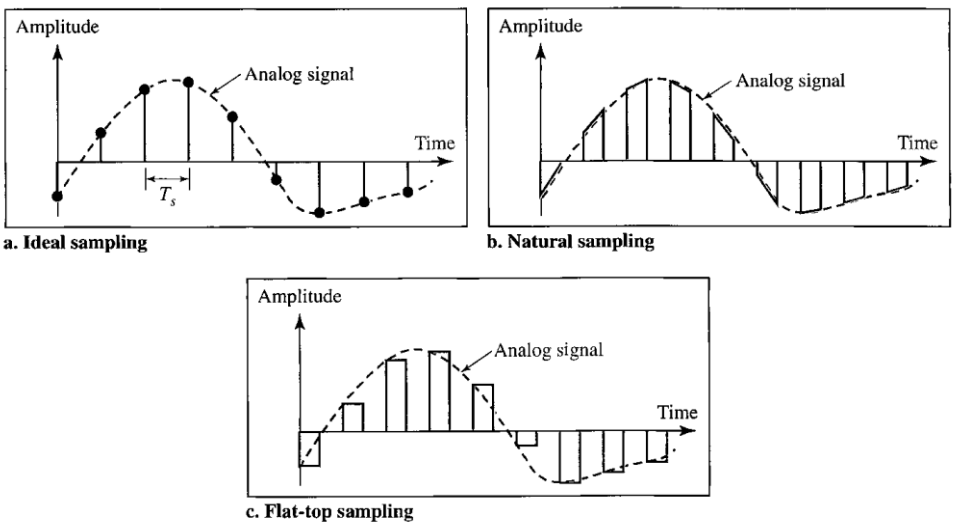
b) State sampling theorem. State natural and flat top sampling.
(Definition sampling theorem -1M, Natural Sampling -1M, Flat top Sampling – 1M, Waveforms- 1M)

Sampling Theorem:

In any pulse modulation technique, the sampling frequency should be greater than or equal to twice the maximum frequency of the modulating signal to reconstruct the original information at the receiver with minimum distortion.

Types of sampling:





Ideal Sampling

Ideal sampling is the process of sampling by which pulses of infinitesimally small (o width) are used. However, in practice it is impossible hence pulses with zero width. And hence practical sampling is used.

Natural sampling:

It follows the natural waveforms of modulating signal during pulse interval. It uses chopper circuits**.**

Flat top sampling:

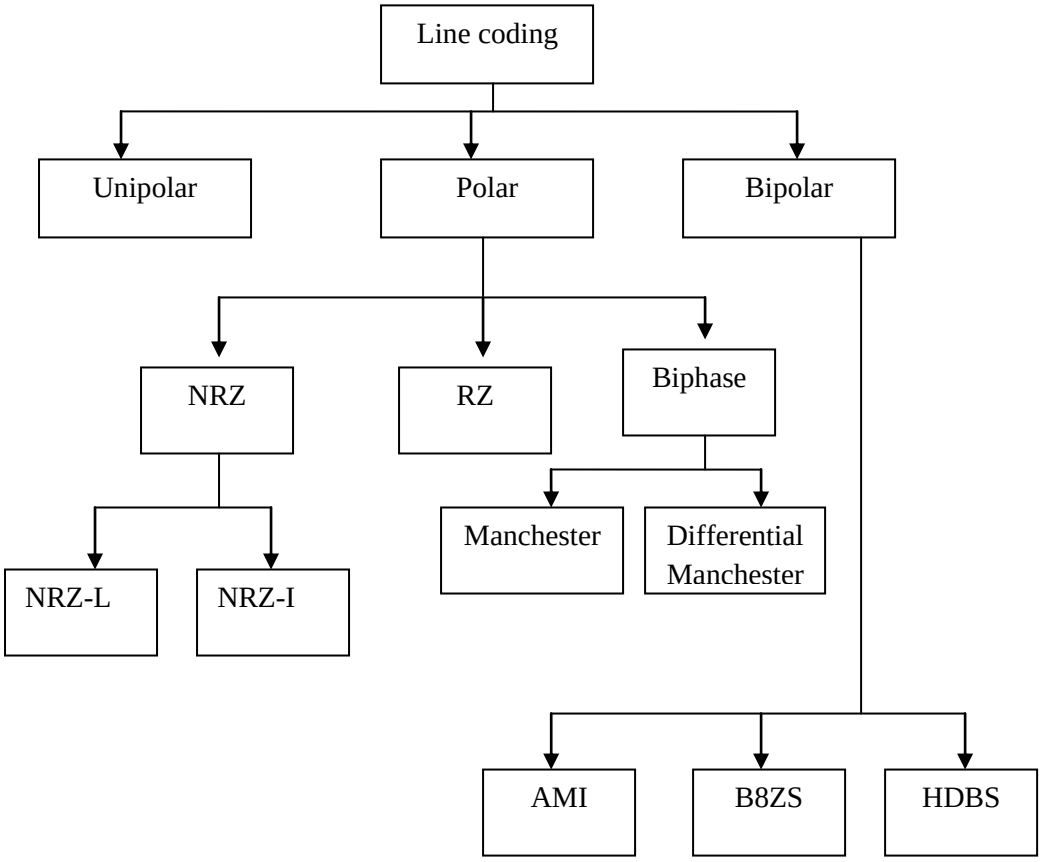
Flat top sampling has constant amplitude within the pulse interval. It uses sample hold circuits it is more towards ideal sampling

c) State the bandwidth requirement of: (1M-each)

i. ASK
ii. FSK
iii. DPSK
iv. QPSK

F_b = input bit rate, $\Delta F = frequency\ duration$
$ASK = F_b$
$FSK = 2(\Delta F + 2F_b)$
$DPSK = F_b$
$QPSK = F_b/2$

d) Give the classification of Encoding techniques.(classification -4 M)



e) Differentiate FDM and TEM(four point- !M for each point))

TDM	**FDM**
TDM is preferred for digital signals	FDM is preferred for analog signals
TDM divides & allocates certain time period for each channel.	FDM divides the channel into two or more frequencies ranges that do not overlap.
Each signal uses all between for some time	Each signal uses a small portion of between all the times.
Problem of cross talk is not secure	It suffers from the problem of cross talk due to imperfect band pass filtering.
Synchronization is required.	Synchronization is not required.

Q.4.

a) Attempt any three of the following: (12M)

i. List the features of ground wave propagation.(4 points-Each point 1M)

The ground waves are surface wave.. They follow the curvature of the earth and can therefore, travel distance beyond the horizon.

Features:

- Ground waves leave the transmitting antenna and remain close to the earth
- It is strong at LF & MF (30 KHz to 3MHz)
- Signals can propagate for hundreds of Kms at these low frequencies.
- AM broadcast are propagated by ground waves.

ii. State advantages and disadvantages of encoding techniques.

(Give 2 advantages and 2 disadvantages of any one of the encoding techniques1 M for each point)

Advantages of unipolar:

1. Simple mechanism to generate signal

Disadvantages of unipolar:

1. DC component.

The average amplitude of unipolar encoded signal is not zero. It has a DC component associated with it. This dc component affets the between of the processing circuit and also the power required to transmit the signal through the media.

2. Synchronization:

A series of same kind of bits can cause a problem while decoding. When signal is not varying, the receiver cannot determine the beginning & ending of each bit. Whenever there is no signal change to indicate the start of next bit, the receiver has to depend on time. The lack of synchronization between the transmitter & receiver clock distorts the signal. This disadvantage is overcome by using parallel lines which carry clock pulse and allows receiver to synchronize with transmitter. This increases the cost & hence not used.

Advantages of NR-I:

1. DC component is reduced because two voltage levels are present. Since 1's are represented. As a transition, synchronization is achieved for consecutive 1's.

Disadvantages of NR-I:

2. Synchronization for consecutive 0's is not achieved.

Advantages of Biphase:

1. At least 1 transition in 2 bit period which can be used for synchronization.
2. The waveform doesn't have DC component because every bit is encoded as +ve polarity for half bit period and –ve polarity for half bit period.
3. Error detection is easier because there is at least 1 transition for each bit.

Disadvantages of Biphase:

1. The frequency at which transitions are taking place is high, and hence higher bandwidth requirement.

Advantages of B8ZS:

1. Good synchronization capability.
2. Since alternate polarity of signal is used, DC component is absent.
3. Error detection and correction is easy.

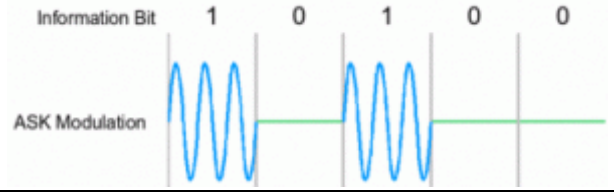
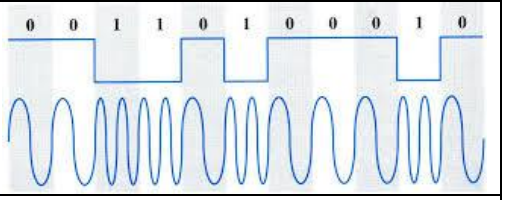
Disadvantages of B8ZS:

1. Because alternating polarity are used, the transmission data rate increases does increasing the band width.

Advantages of HDB3:

1. Scrambling techniques eliminate constant signal level.
2. Transitions are introduced for each 1 bit which provides synchronization.
3. DC component is almost absent.
4. Error detection is improved in a long sequence of 1s and 0s.

iii. Compare ASK and FSK digital modulation system on the following points.(1M for each point)

Points	**ASK**	**FSK**
Definition	In this process a carrier of two different amplitudes is used to transmit digital information. For a 1a carrier of higher amp is transmitted & for a 0 a carrier of lower amp is transmitted	It id the process of mod in which the carrier of certain frequency f_1KHz is transmitted for 0 & carrier of another frequency is transmitted for a 1. At the receivers f_1 is decoded as 0 & f_2 as 1.
Waveform		
Bandwidth	F_b	$2(\Delta F + 2F_b)$
Noise immunity	less	more

iv. Draw the block diagram of satellite communication system and describe its working. (Block diagram 2 M, Explanation 2 M)

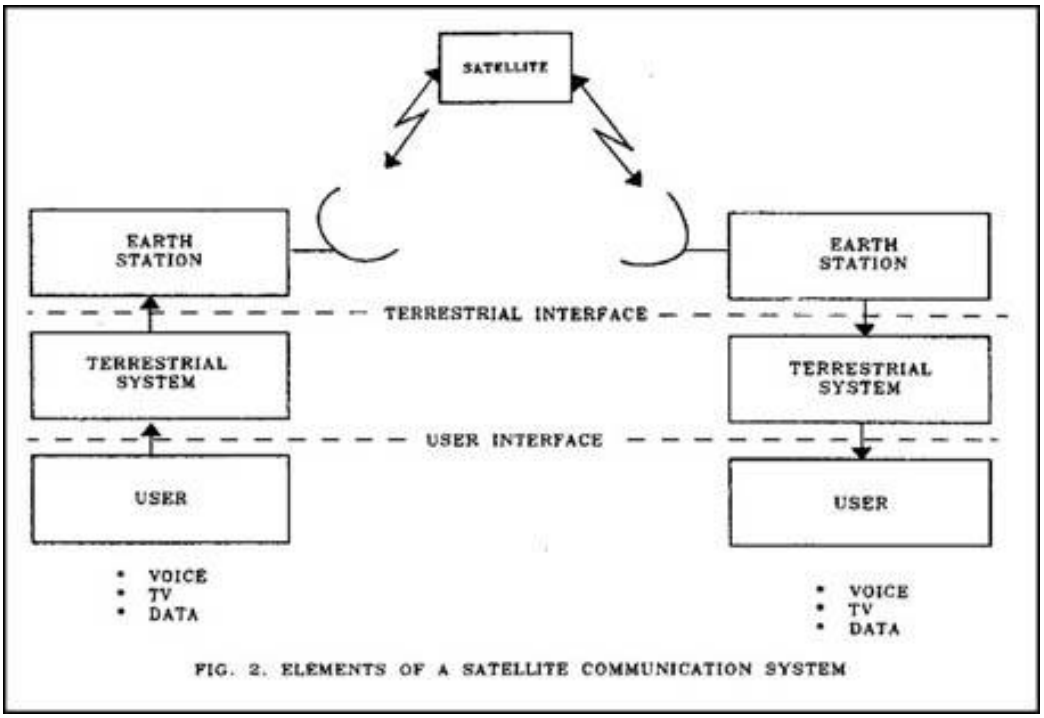


FIG. 2. ELEMENTS OF A SATELLITE COMMUNICATION SYSTEM

A satellite is any natural or artificial object located in space, capable of receiving and retransmitting electromagnetic waves.

Transmitter

The satellite communication system consists of a satellite that links many earth stations on the ground. When the user is connected to earth station through a terrestrial network (telephone or leased line) the user generates baseband s/g, processes & transmits to the satellite at the earth station.

Satellite

It is a large repeater in space. It receives the modulated RF carrier in uplink frequency spectrum from all the earth station in the network. The frequency used for transmission from earth station to space (satellite) is called uplink frequency. The satellite amplifies this carrier & retransmits them to the earth in the down link frequency spectrum. The frequency used for transmission from space to earth (satellite to earth station) is called down link frequency. The uplink & downlink frequency are made different in order to avoid interference of these s/g is space.

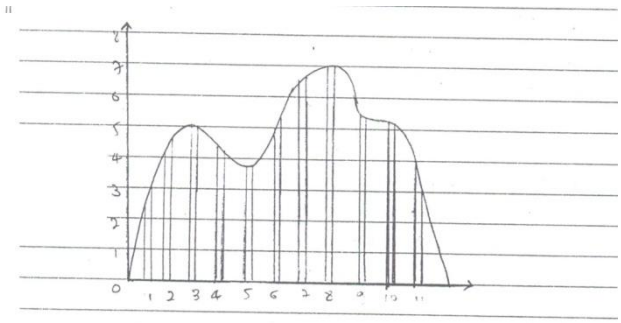
Receiver

The earth station receives s/g from satellite this s/g is processed to get the original baseband s/g which is then send to the user through terrestrial network.

b) Attempt any One of the following

i. Draw the block diagram of PCM transmitter. Describe function of each block along with waveforms.
(Block diagram 2 M, Waveforms-with quantum levels- 2M and explanation – 2M)

PCM is a digital pulse modulation system in which analog information signal is sampled according to sampling theorem, quantized and then encoded the sequence of 0's 1's obtained are transmitted. Thus, the analog signal is transmitted using digital signal and hence PCM is a digital modulation system.
Quantum Level:
The signal amplitude is divided into discrete level called quantum level.



Samp. pulse	1	2	3	4	5	6	7	8	9	10	11
Actual voltage	3V	4.6V	5V	4.2V	3.8V	5.1V	6.5V	7V	5.3V	5.2V	4V
Quantum level	3V	4V	4V	4V	3V	5V	6V	6V	5V	5V	3V
Encode	011	100	100	100	011	101	110	110	101	101	011

Block diagram of PCM:

Modulating s/g

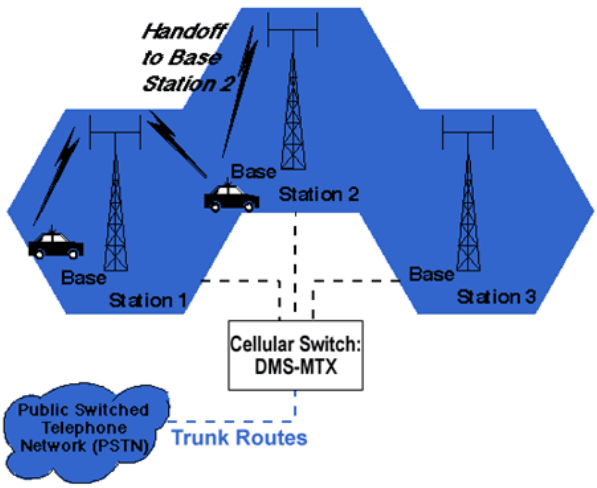
PCM

1. **Low pass filter:**
It is used to limit the bandwidth of the information signal to the desired value. LPF is a frequency selection network that allows a desired frequency range to pass & removes all other unwanted frequency.
2. **Sampling circuit:**
It carries out the process of sampling according to sampling theorem.
3. **Quantization circuit**
Performs the process of quantization. In this, the entire signal is divided into no. of discrete levels called quantum levels. Quantization is the process of approximation of the sampled value to the nearest quantum level.

Quantization noise errors:
The quantized level is transmitted & these are a difference between the actual sampled value & the quantized value. This error is random in nature & it is not uniform. Hence, it is called as a noise & since error is caused due to transmission of quantized levels, it is called as quantization error. Companding circuits can be used for reducing quantization error.

4. **Companding circuit**:
This reduces quantization error without increasing bandwidth. This is a process of artificially boosting low amplitude signal during transmission and to reduce quantization error. This is called compression. The reverse process of enhancing this compressed signal (expansion) is carried out at the receiver to large the signal back to original value.
5. **Encoder**
This counts the quantized value into sequence of 0's & 1's. the sequence depends on number of bits used for each quantum level and the type of encoding mechanism.

ii. Describe the concept of hand off.
(Diagram 3 M, Explanation – 3 M)
Each cell is connected by telephone lines or a microwave radio relay link to a master control centre known as mobile telephone switching Office(MTSO).
The MTSO provides interface between each cell and the main telephone office.
As the vehicle containing the telephone passes through a cell, it is served by the cell transceiver.
The telephone call is routed through the MTSO to the standard telephone system.
As the vehicle moves, the system automatically switches from one cell to the next.
The receiver in each cell station continuously monitors the signal strength of the mobile unit.
When the signal strength drops below a desired level, it automatically seeks a cell where the signal from the mobile unit is stronger.
The computer at the MTSO causes the transmission from the vehicle to be switched from the weaker cell to the stronger cell. This called handoff.



Q.5. Attempt any four of following

a) Compare pulse modulation with continuous modulation with any four points
Any 4 points (1 mark per point)

	Parameter	**Pulse modulation**	**CW modulation**
1	carrier	Train of rectangular pulses	Sinusoidal
2	Type of modulation system	PAM,PWM,PPM,PCM,DM	AM,FM,PM
3	Principle of operation	Amplitude, width or position of the pulse carrier is varied proportional with instantaneous message signal	Amplitude, frequency or phase of the carrier is changed proportional with instantaneous message signal
4	Performance in presence of noise	Better than CW modulation (PWM & PPM well, PCM & DM also perform well but PAM does not perform well)	Not better than pulse modulation (FM & PM perform well but AM does not perform well)
5	Application	Satellite communication, communication between spaceships & earth stations	Broadcasting (radio & TV)
6	Bandwidth requirements	Large	Small
7	Cost & simplicity	Costly & complex	Simpler & less costly

b) A broadcast AM Transmitter radiates 50 KW of carrier power .What will be the radiated power at 85% modulation?
(1mark for formula 3 marks for answer ;if properly solved without writing formula can be considered for full 4 marks)

$P_{total} = P_c(1+(m^2/2))$
$=50(1+(0.85^2/2))$
$=68.06$ KW

c) State the Shannon's theorem to measure channel capacity.
(2 marks for statement, 2 marks for equation)

The capacity of a channel with bandwidth B and additive Gaussian band limited white noise is

$$\mathbf{C=B \log_2 (1+S/N) \quad bits/sec}$$

Where, S & N are the average signal power and noise power respectively at the output of channel

N= ηB (if the two sided power spectral density of the noise is η/2 watts/Hz)
B= channel bandwidth

d) State advantages and disadvantages of digital communication

(Advantages 2 marks /2 points, Disadvantages 2 marks /2 points)

Advantages of digital communication

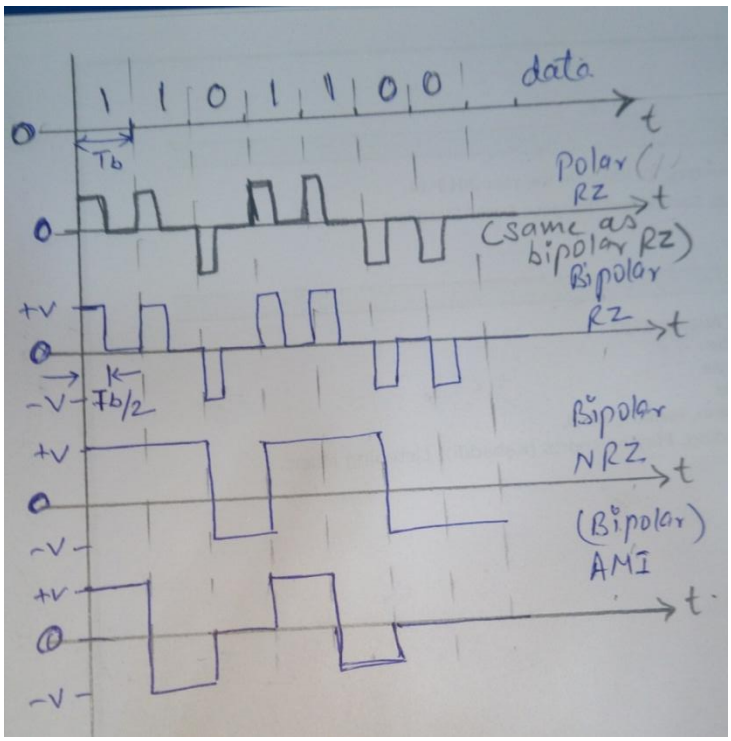
- noise immunity increases as coding is possible
- Multiple data can be send simultaneously using multiplexing
- More immune to additive noise as digital signals are regenerated rather than amplification in long distance transmission
- Data encryption is possible
- Digital signals are simpler to measure and evaluate than analog signals.
- In digital systems transmission errors can be corrected and detected more accurately.

Disadvantages of Digital Communication

- The transmission of digitally encoded analog signals requires significantly more bandwidth.
- Digital transmission requires precise time synchronization between the clocks in the transmitter and receiver.
- Digital transmission systems are incompatible with older analog transmission systems.

e) Draw following data formats for bit stream 1101100 using following encoding technique

i) Polar R2(RZ)
ii) Bipolar R2
iii)Bipolar NRZ
iv) AMI
(1 marks per Encoding)



f) State any two applications of FDMA & TDMA(each 2M)

FDMA Application

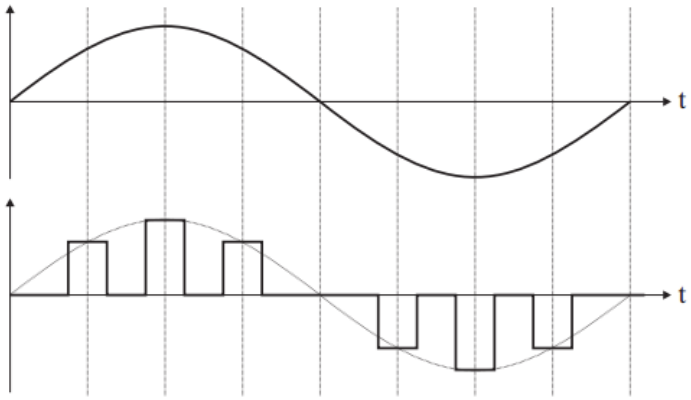
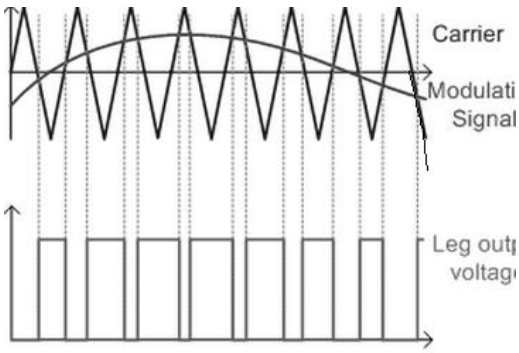
- It is used to transmit data of multiple users using same analog medium
- it is used for satellite communication
- AMPS mobile communication

TDMA Application

- It can be used transmit data of multiple sender on digital medium
- It can be used for satellite communication
- It is used in GSM system
- It is used in Optical fiber communication

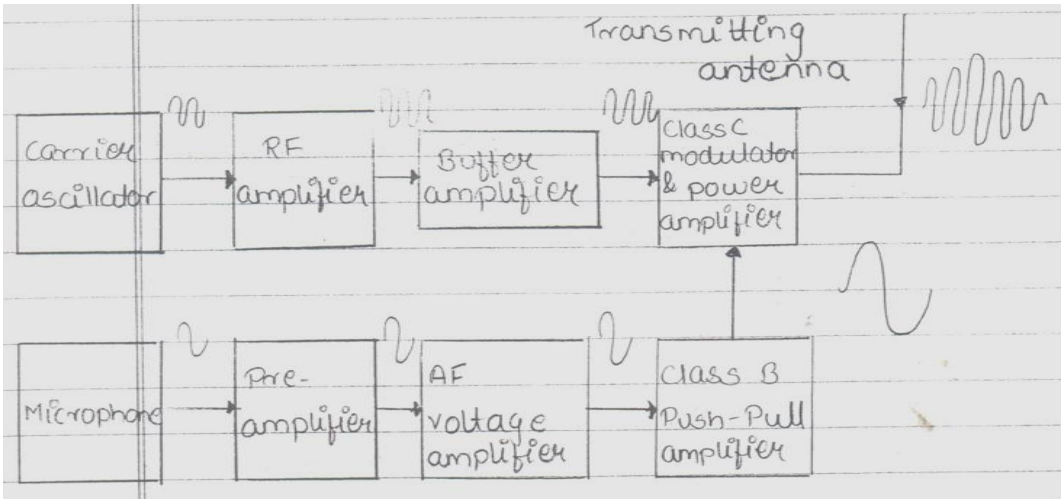
Q.6. Attempt any four of following:

a) Compare PAM & PWM(Any 4 points)(1 mark per point)

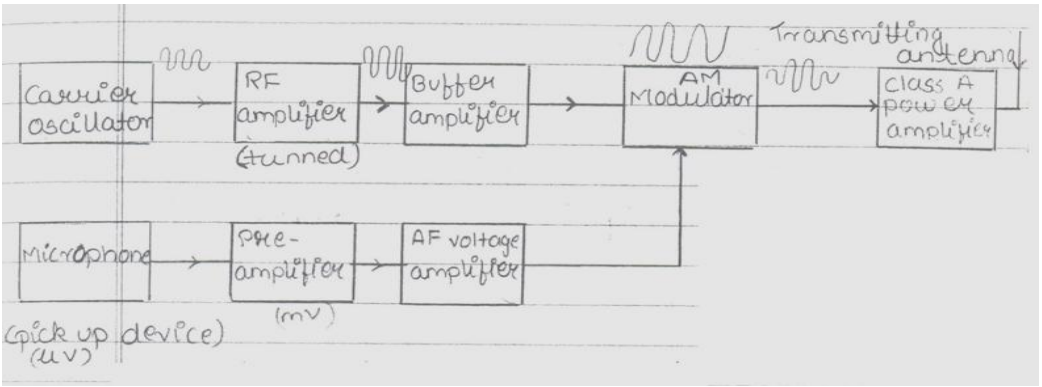
PAM	**PWM**
It is type of Pulse analog modulation in which amplitude of pulse is varied in accordance with amplitude of modulating signal	It is type of Pulse analog modulation in which width of pulse is varied in accordance with amplitude of modulating signal
Transmitted power Varies with variation in amplitude	Transmitted power Varies with variation in width.
Data loss due to noise is high as data is present in amplitude variations	immune to noise
It is easy to generate	Generation of PWM is complex comparing with PAM
Requires very high bandwidth comparing with bandwidth of data	Requires moderate bandwidth comparing with bandwidth of data
 Pulse Amplitude Modulation (PAM)	

b) Draw block Diagram of High level AM transmitter and low level AM Transmitter. (2M for each block diagram)

High level AM transmitter



Low level AM Transmitter



c) State advantages and limitations of DM over PCM
(Advantages 2 marks /2 points, Disadvantages 2 marks /2 points)

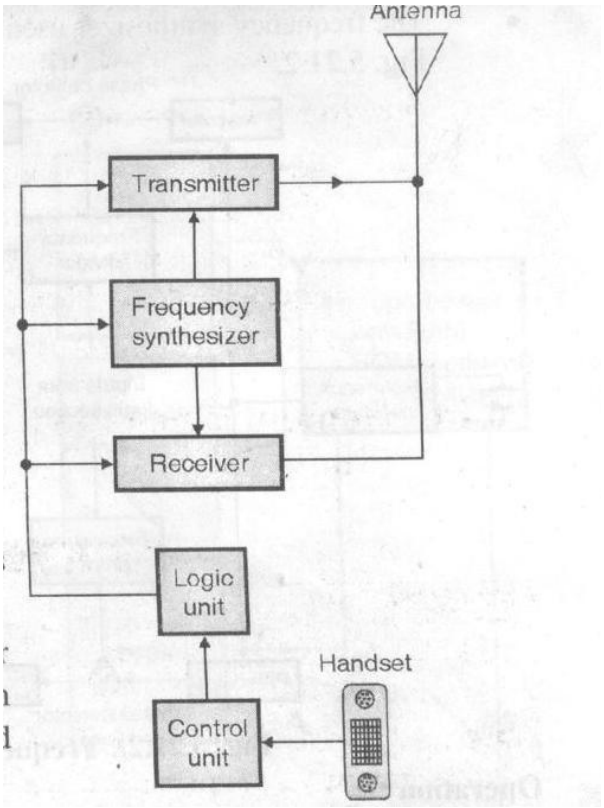
Advantages:-

- Quantization & encoding technique of Delta modulation is simple comparing with PCM
- only one bit I is required per sample
- no word level synchronisation required at input of receiver
- overall complexity is less comparing with PCM

Disadvantages:-

- Slope over load distortion: If the input signal amplitude changes fast, the step by-step accumulation process may not catch up with the rate of change
- Granular noise: If the step-size is made arbitrarily large to avoid slope-overload Distortion, it may lead to 'granular noise'.
- Bit-timing synchronization is, however, necessary if the demodulator in implemented digitally.

d) Draw block diagram of Mobile phone system. Describe its working. (2M diagram, 2M explanation)



The five major parts of this system are:
1. Control Unit
2. Logic unit
3. Transmitter
4. Receiver
5. Frequency synthesizer

This unit operates on dedicated battery.
The transmitter and receiver share the same antenna. This antenna is transreceive antenna.
The important feature of the transmitter is that its output power is controlled by the cell site and MTSO.
Typically the output power is 3 W.
Transmitter is low power FM unit and operates in the frequency range of 825 to 845MHz. there are 666 transmit channels which are spaced 30 KHz apart.
The transmitter uses the unit called duplexer which isolates the transmitter output from the receiver input.
The transmit and receive frequency are spaced 45MHz apart inorder to minimize the interference.
The receiver is dual conversion super heterodyne type receiver. Its frequency range is 870.03 to 889.98 MHz.
There are 666 receiver channels spaced at30 kHz.
The frequency synthesizer develops all signal which are used by transmitter and receiver.

e) State the sequential process for handset to handset call procedure.(4 Marks for step by step procedure for call origination, call in progress and call termination)

i) After receiving dial tone caller enters mobile no of receiver(or fetches from phone memory) and depresses call button after this no is transmitted through reverse control channel to base station along with callers unique identification

ii) Base station forwards the callers identification no & destination no to MTSO

iii) MTSO sends page command to all cell sites controller to locate destination party .

iv) Once the destination mobile is located destination cell site controller sends page request trough control channel to destination p[arty to determine if the unit is on or off hook .

v) After receiving positive response to the page ,ideal user channel are assigned to both mobile units

vi) Call progress tones are applied to both direction (ring & ring back)

vii) When system receives notice that the called party has answered the call switches terminates call progress tone and conversation begins .

viii) If all user channels are busy sends directed retry command instructing caller unit to retry call through neighboring cell

ix) If system cannot allocate user channel through neighboring cell then switch transmits intercept message to calling mobile unit over control channel

x) If called party is off hook calling party gets busy signal
if called no. is invalid then caller will get re