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 tryto 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 constantvalues 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.1A) Attempt any three: **12M**

a) Define Modulation. Why it is necessary?

(Definition 1Mark, Need of Modulation 3Marks)

Ans:

Modulation:

It is a process in which the amplitude, frequency or phase of carrier signal is varied in accordance with the instantaneous amplitude of the modulating signal.

or

It is a process in which the low frequency information signal is superimposed on a high frequency carrier signal.

Need of Modulation:

1. Reduction in height of antenna: For transmission of radio signals ,antenna height must be multiple of (λ/4). Minimum height required to transmit a baseband signal of **f=10 KHz** is calculated as

Minimum height of antenna = λ/4=c/4f=7.5Km. The antenna of this height is practically impossible to install

Minimum height required to transmit a baseband signal of **f=1MHz** is calculated as **Minimum height of antenna = λ/4=c/4f=75m.**

Thus modulation is necessary to reduce the height of antenna.

2. Avoids mixing of signals: If the baseband sound signals are transmitted without using the modulation through more than one transmitter, then all signals will be in frequency 0 to 20 KHz. Therefore all the signals get mixed together and a receiver cannot separate them from each other. So if the baseband signal is used to modulate different carrier then they will occupy different slots in frequency domain. **Thus modulation is necessary to avoid mixing of signals.**

3. Increases range of communication: The frequency of baseband signal is low and thus the low frequency signal cannot travel a long distance when they are transmitted they get heavily attenuated. The attenuation reduces with increase in frequency of the transmitted signal and they can travel longer distance.

4. Makes multiplexing possible: Multiplexing is the process in which two or more signals can be transmitted over same communication channel simultaneously. This is possible only with modulation. Therefore many TV channel can use same frequency range without getting mixed with each other.

5. **Improves quality of reception:** With FM and digital communication technique like PCM, the effect of noise is reduced to a great extent.

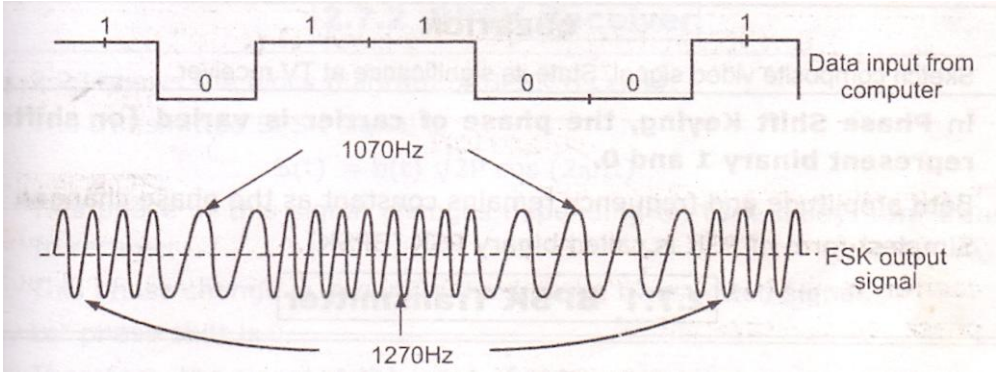
b) Draw the waveform for FSK and PSK modulation.

(FSK Waveform 2Marks, PSK Waveform 2 Marks)

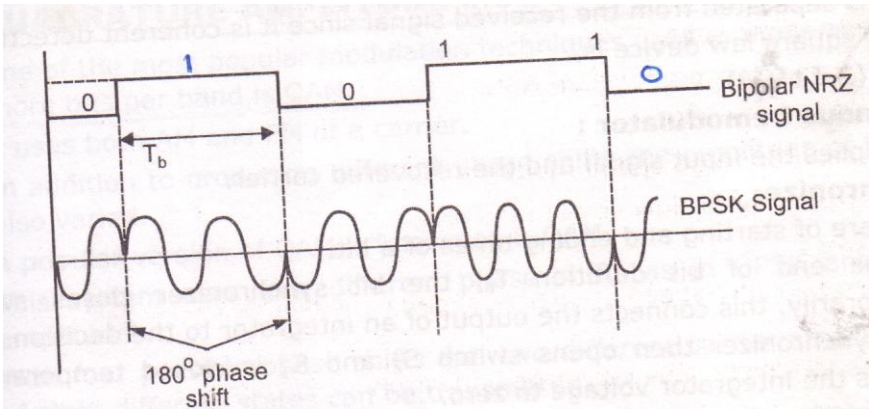
Note: Any other relevant data shall be considered for drawing waveform.

Ans:

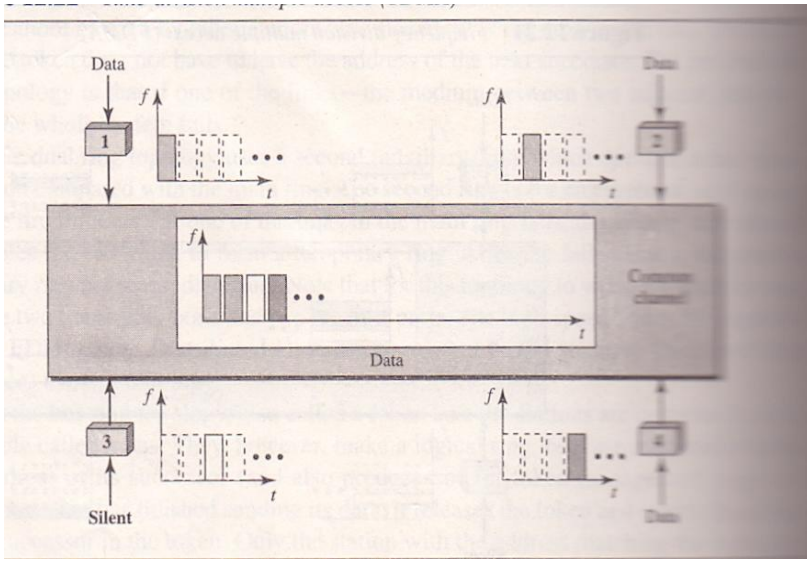
FSK Modulation



PSK Modulation

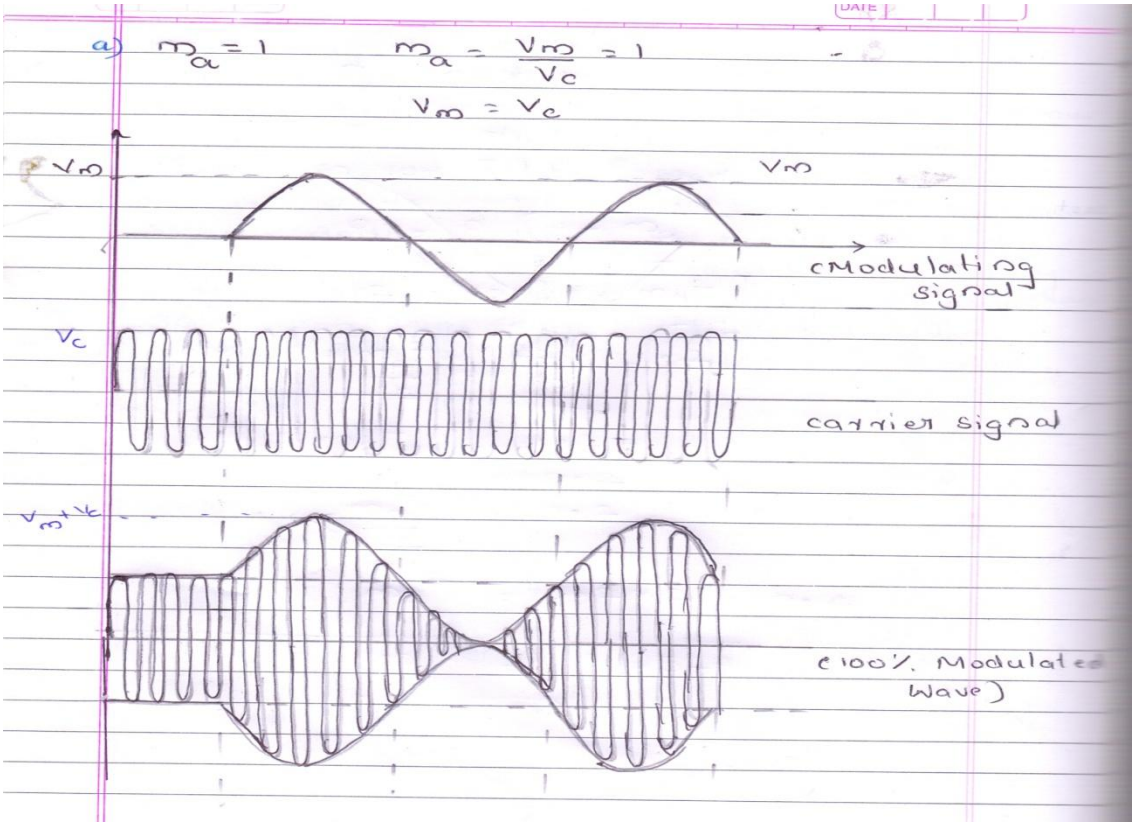


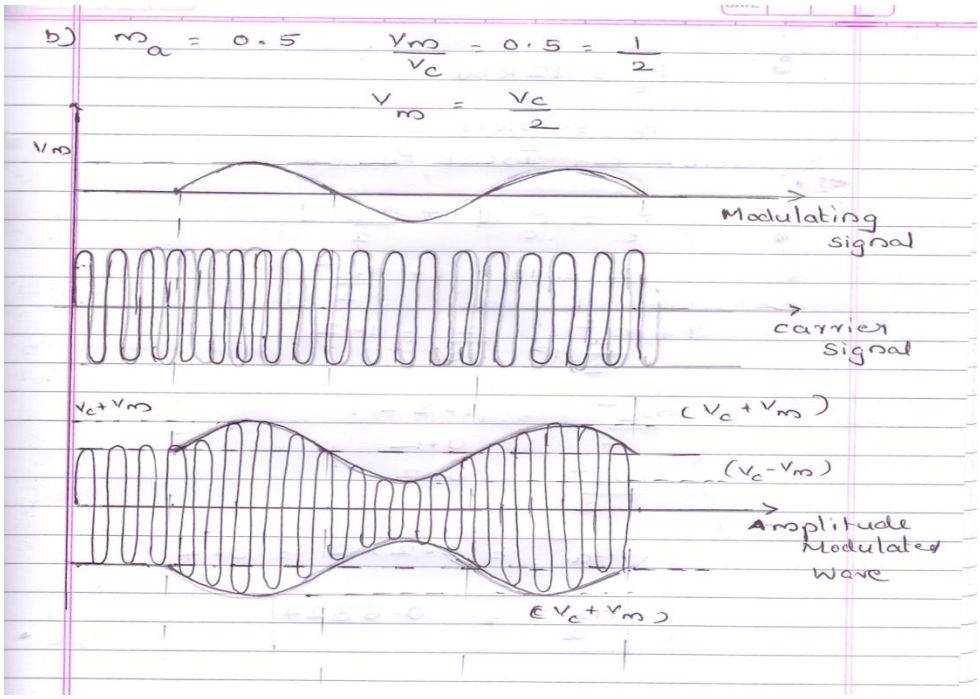
c) Draw block diagram of TDMA. Describe its working.
(Diagram 2 Marks, Working 2Marks)
Ans:



In TDMA the stations share the bandwidth of the channel in time. Each station is allocated a time slot during which it can send data. Each station transmits its data in the assigned time slots. In TDMA the bandwidth is just one channel that is time shared between different stations. It is an access method in the data link layer. The data link layer in each station tells its physical layer to use the allocated time slot. There is no physical multiplexer at the physical layer.
The main problem with TDMA lies in achieving synchronization between the different stations. Each station needs to know the beginning of its slot and the location of each slot. This may be difficult because of propagation delays introduced in the system if the stations are spread over a large area. To compensate fort the delays we can insert guard times. Synchronization is normally accomplished by having some synchronization bits at the beginning of each slot.

d) Draw AM wave in time domain, when ma=1 and ma=0.5.
(AM Wave for ma=1, 2 Marks, ma=0.5, 2 Marks)
Ans:



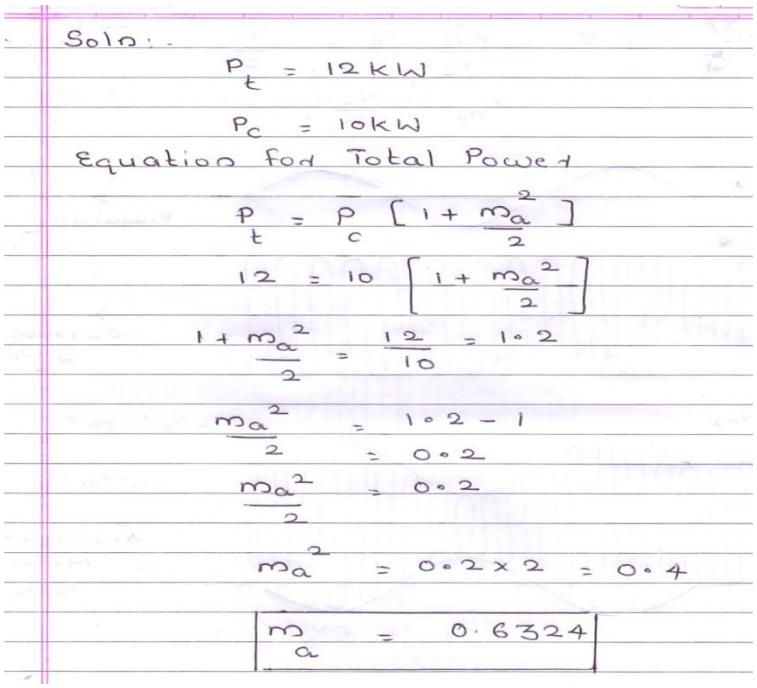

b) $m_a = 0.5$ $\frac{V_m}{V_c} = 0.5 = \frac{1}{2}$
$V_m = \frac{V_c}{2}$
V_m
Modulating signal
carrier signal
$V_c + V_m$
$(V_c + V_m)$
$(V_c - V_m)$
Amplitude Modulated wave
$(V_c + V_m)$

Q.1B) Attempt any one: **6M**

a) A transmitter transmits 10kW of power without modulation and 12kW after amplitude modulation. What is the modulation index?

(Each Correct Step 1 Mark)

Ans:



Soln:-

$P_t = 12\,kW$

$P_c = 10\,kW$

Equation for Total Power

$$P_t = P_c\left[1 + \frac{m_a^2}{2}\right]$$

$$12 = 10\left[1 + \frac{m_a^2}{2}\right]$$

$$1 + \frac{m_a^2}{2} = \frac{12}{10} = 1.2$$

$$\frac{m_a^2}{2} = 1.2 - 1$$

$$\frac{m_a^2}{2} = 0.2$$

$$m_a^2 = 0.2 \times 2 = 0.4$$

$$\boxed{m_a = 0.6324}$$

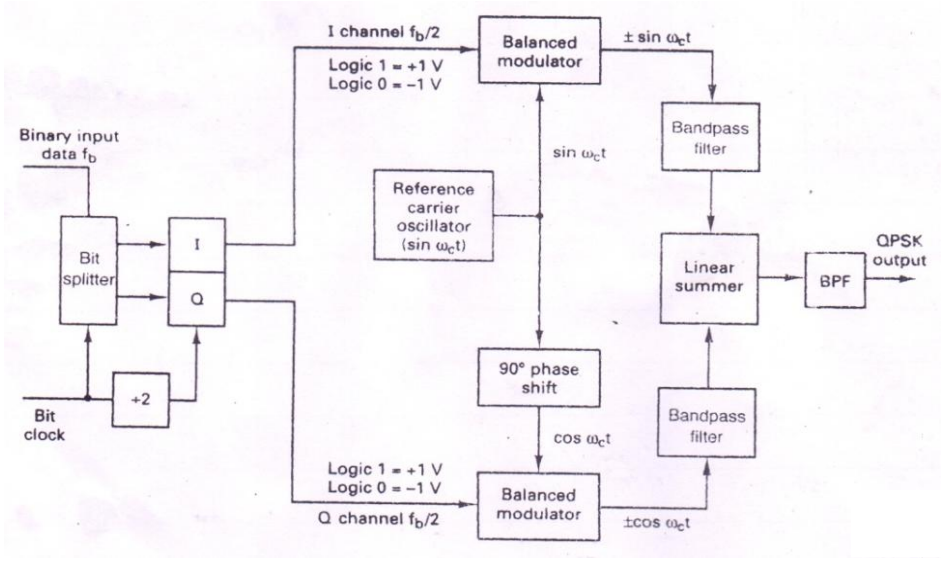
b) Draw and explain QPSK modulator.

(Block Diagram 2 Marks, Explanation 2 Marks, Waveform 2 Marks)

Ans:

Quadrature Phase Shift Keying or Quaternary Phase shift Keying

1. QPSK is an example of multilevel phase modulation.
2. With QPSK four output phases are possible for a single carrier frequency.
3. Since four output phases are present, there must be four different input conditions.
4. With two bits there are four possible conditions. 00, 01, 10, 11 are possible.
5. With QPSK the binary input data are combined into groups of two bits called dibits.
6. Each dibit code generates one of the four possible output phases ($+45^o$, $+135^o$, -45^o, -135^o)



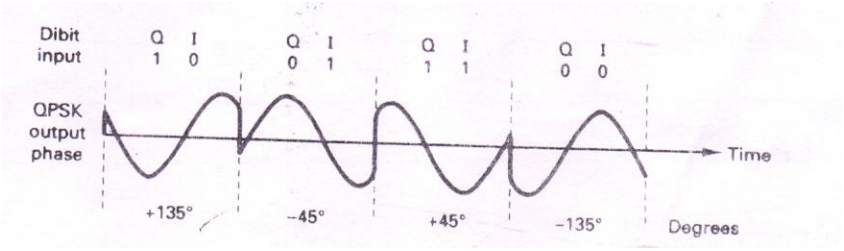
1. Two bits (a, dibit) are clocked into the bit splitter.
2. One bit is directed to the I channel and the other to Q channel.
3. The I bit modulates a carrier that is in phase reference oscillator (hence the name "I" for in phase channel).
4. The Q bit modulates a carrier that is 90^o out of phase OR in quadrature with the reference carrier (hence the name "Q" for "quadrature channel.
5. A QPSK modulator is two BPSK modulators combined in parallel.
6. For a logic 1 = + 1V

   Logic 0 = - 1V

two phases are possible at the output of the I balanced modulator. (+Sin w_c t, Sin w_c t), and two phases are possible at the output of the Q balanced modulator (+Cos w_c t, -Cos w_c t). When the linear summer combines the two quadrature (90^o out of phase signals) there are four possible resultant phases given by these expressions:

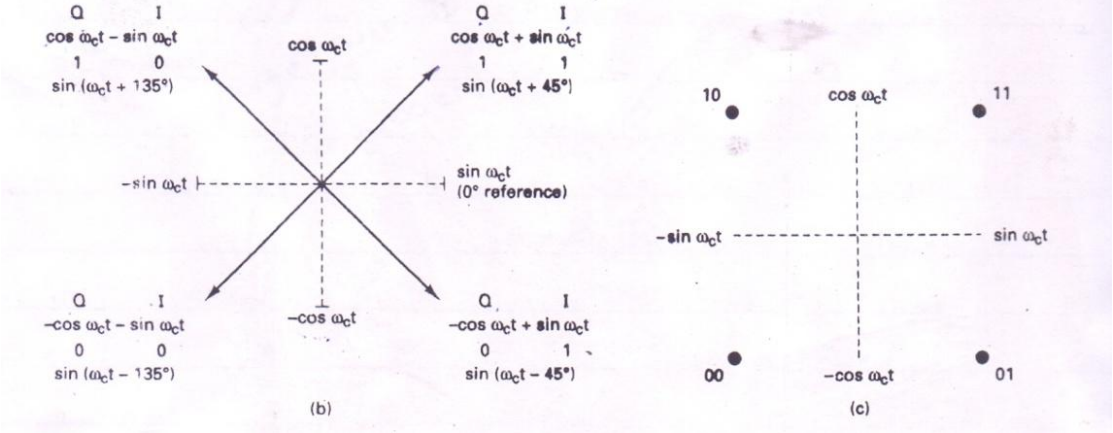
+ Sin w_c t + Cos w_c t
+ Sin w_c t - Cos w_c t
- Sin w_c t + Cos w_c t
+ Sin w_c t - Cos w_c t

Output waveform



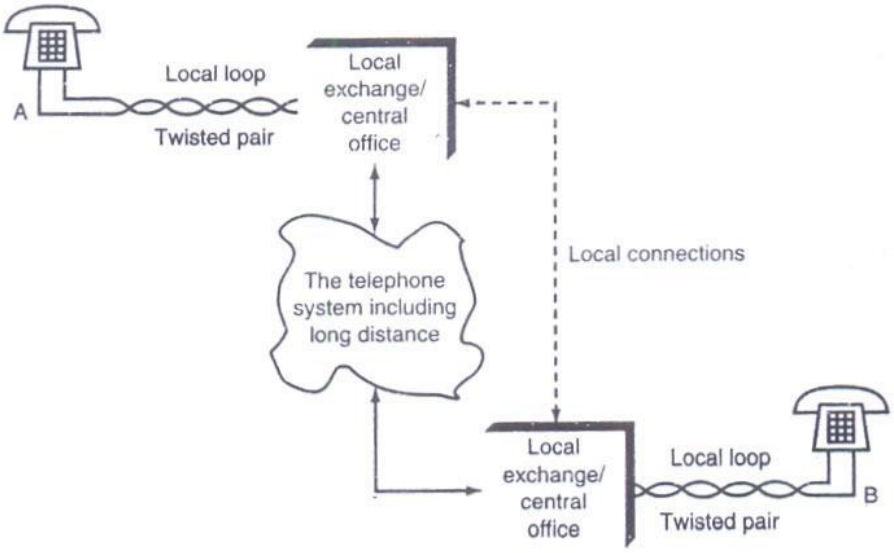
Binary input		QPSK output phase
Q	I	
0	0	−135°
0	1	−45°
1	0	+135°
1	1	+45°

(a)



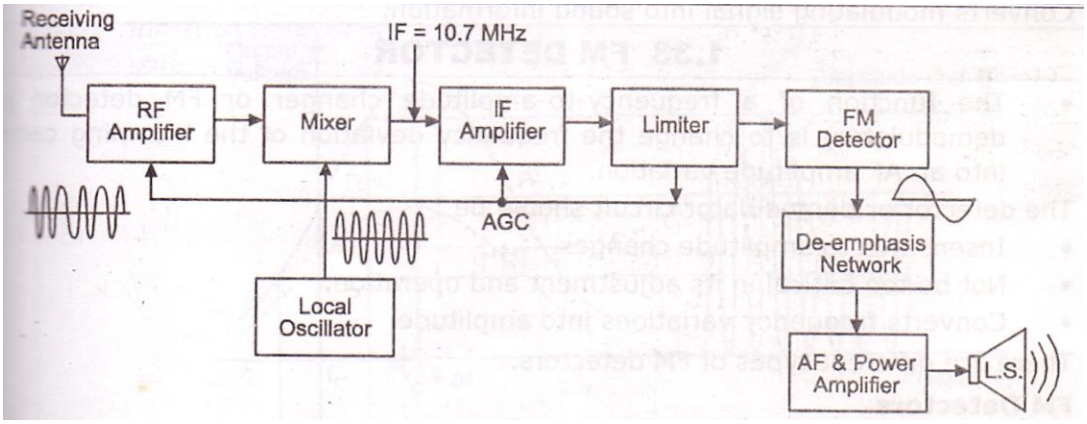
Q.2 Attempt any four: **16M**

a) Draw the block diagram of standard telephone system. Describe its functions.
(Diagram 2 Marks, Functions 2 Marks)
Ans:



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 then 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.

b) Draw the block diagram of FM receiver. State the function and each block.
(Diagram 2 Marks, Functions 2 Marks)
Ans:



Functions:

1. RF Amplifier:

Its function is

To improve the signal to noise ratio.

To march the receiver input impedance to antenna impedance.

To reduce noise figure.

2. Mixer:

It is also known as frequency changer. Input signal frequency f_s and local oscillator frequency f_0 are mixed to down convert the received signal to intermediate frequency (IF).

$IF = f_0 - f_s$

IF = 10.7 MHz

3. IF Amplifiers:

It amplifies the IF of mixer output. Due to large bandwidth gain per stage is low. Therefore two or more stages of IF amplifiers are used.

4. Amplitude Limiter:

It removes the unwanted amplitude that added in original FM signal while travelling in free space. It is removed before demodulation, otherwise distortion appears at the output.

5. FM Detector:
It converts the FM signal into original modulating signal.

6. De-emphasis:
The artificially boosted high frequencies at transmitter are removed by de-emphasis.

7. AF and Power Amplifier:
First the modulating signal is voltage amplified and its power is increased to drive the loudspeaker.

8. AGC:
Automatic gain control is used to ensure that the signal fit to the limiter is within its limiting range and also prevents overloading of last IF amplifier.

9. Loudspeaker:
It converts modulating signal into sound information.

c) Draw neat block diagram of delta modulator. Describe its operation.
(Diagram-2Marks & Explanation-2Marks)
Ans:

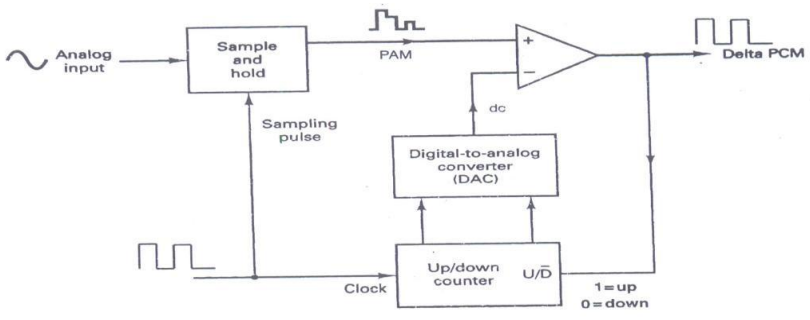
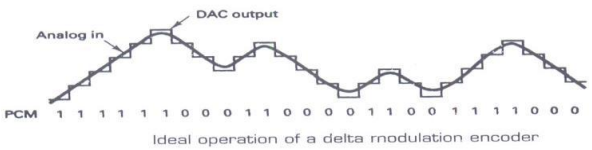


FIGURE 10-20 Delta modulation transmitter



Ideal operation of a delta modulation encoder

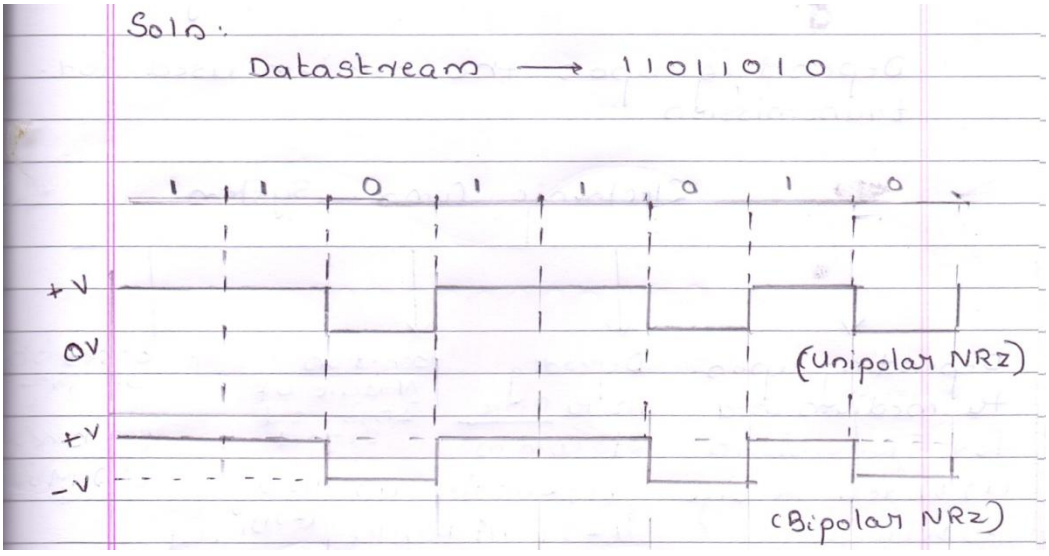
The above diagram shows a block diagram of a delta modulation transmitter. The analog input is sampled and converted to a PAM signal, which is compared with the output of the DAC. The output of DAC is a voltage equal to the regenerated magnitude of the previous sample, which was stored in the up-down 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.

d) Consider the data stream 11011010 and encode using,

i) Unipolar NRZ **ii) Bipolar NRZ**

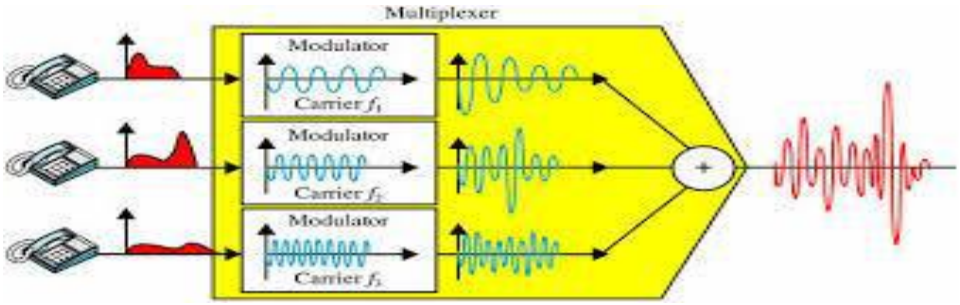
(Correct encoding for Unipolar NRZ 2 Marks, Bipolar NRZ 2Marks)

Ans:

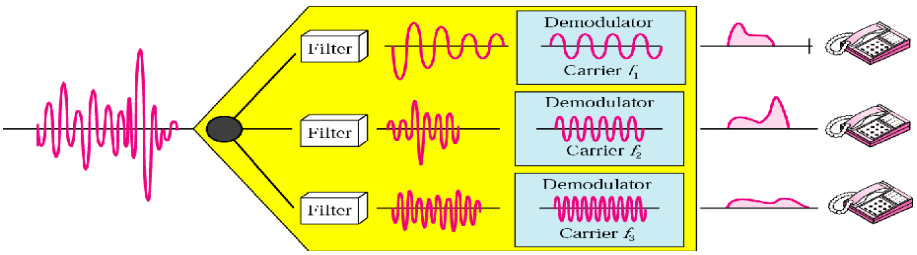


e) Draw the block diagram and explain the working of FDM.
(Diagram 2Marks, Working 2 Marks)
Ans:

Modulation:



Demodulation:

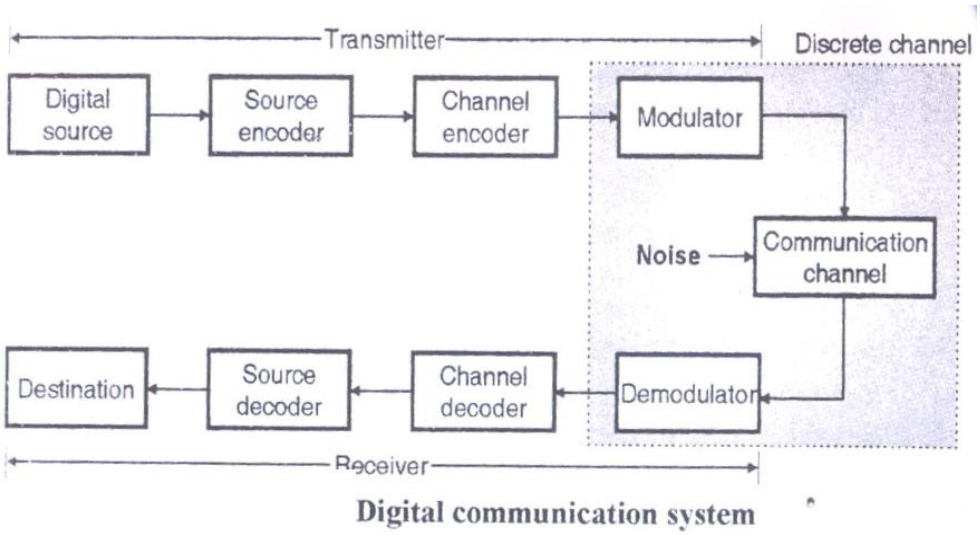


In FDM, signal generated by each sending device modulate different carrier frequencies. These modulated signals are combined into a single composite signal that can be transported by the link. Carrier frequencies are separated by guard bands to prevent over- lapping of signal. Though it is an analog multiplexing system, digital signals can also be sending by converting them into analog signals.
The demux uses a series of filters to decompose the multiplexed signal into its constituent carrier signals. These modulated carrier signals are passed through demodulators to separate them from their carrier and then are passed to their output lines**.**

f) Draw the block diagram of digital communication system.

(Correct Diagram 4Marks)

Ans:



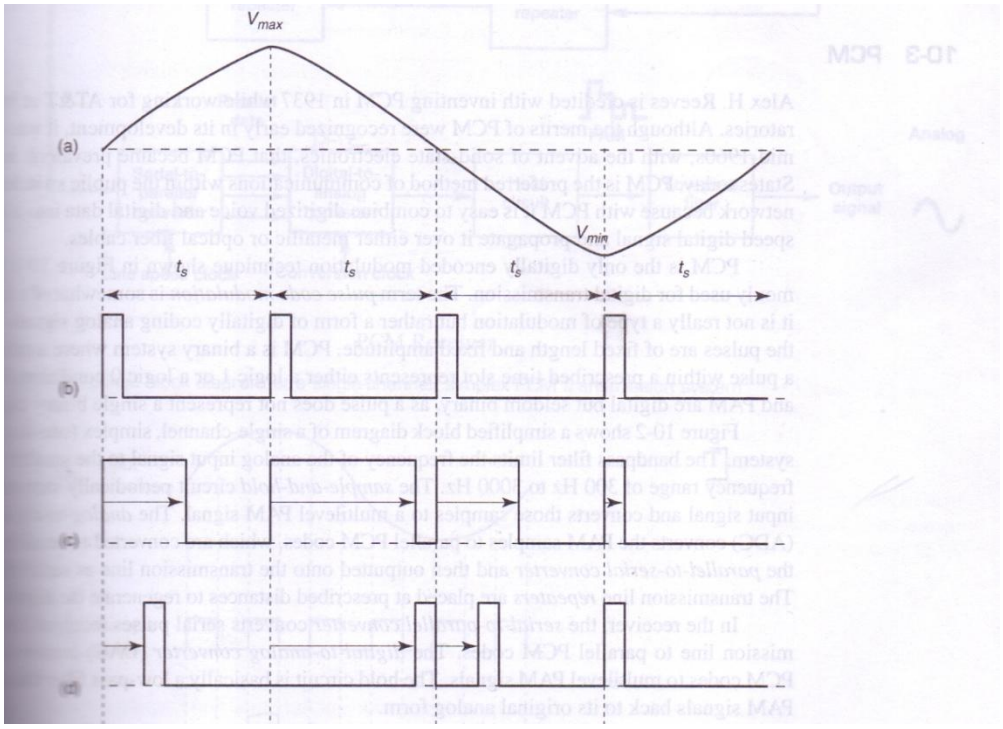
Digital communication system

Q.3 Attempt any four: **16M**

a) Draw waveform of PWM and PPM.

(Relevant waveform 2Marks each)

Ans:



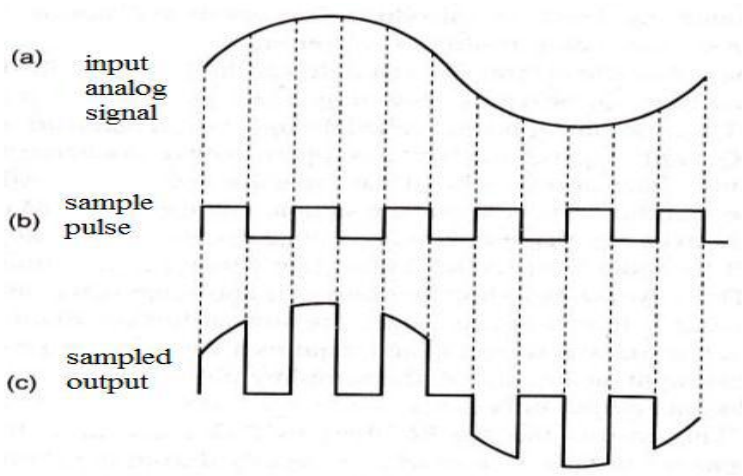
b) Define sampling theorem and draw waveform for natural sampling.

(Theorem 2Marks, Relevant waveform 2Marks)

Ans:

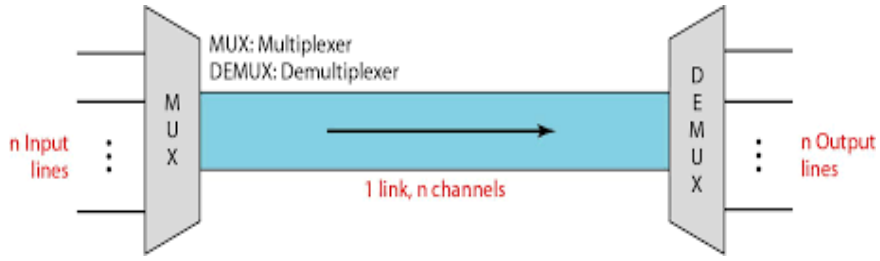
Sampling theorem: In any pulse modulation technique, the sampling frequency should be greater than or equal to twice the maximum frequency of the modulating signal to reconstruct the original information at the receiver with minimum distortion.

Waveform for Natural sampling



c) What is multiplexing? State different types of multiplexing techniques used.
(Definition-2Marks & Any two types–2Marks)
Ans:

Multiplexing: It is process of simultaneously transmitting two or more individual signals over single communication channel.



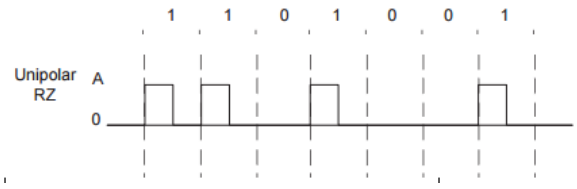
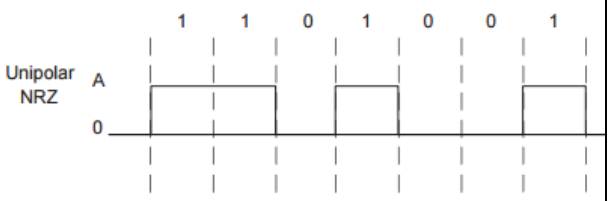
Types of multiplexing:

1. Frequency Division Multiplexing (FDM)
2. Time Division Multiplexing (TDM)
3. Wavelength Division Multiplexing (WDM)

d) Compare unipolar RZ and NRZ encoding methods?

(Any four relevant points 1Mark each)

Ans:

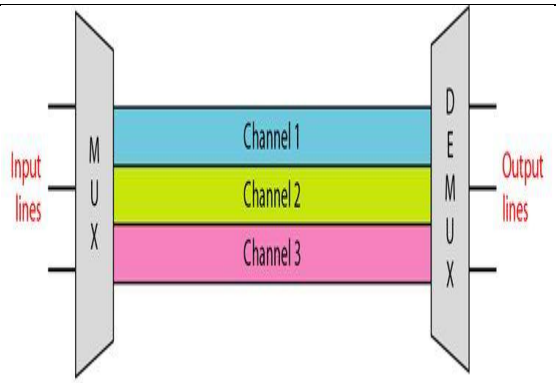
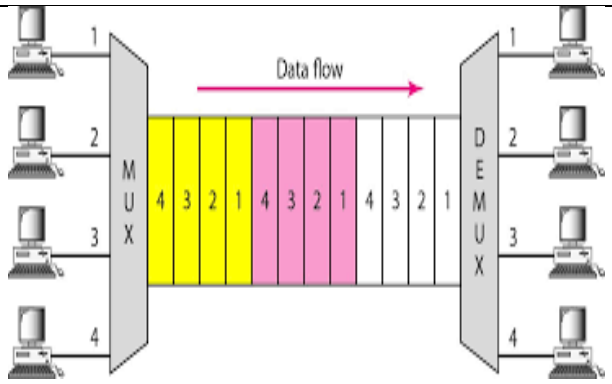
Unipolar RZ	Unipolar NRZ
In this format each "0" is represented by an off pulse(0)& each "1" by an on pulse With amplitude A & duration $T_b/2$..	In this format each "0" is represented by an off pulse(0)& each "1" by an on pulse With amplitude A & duration T_b
During the on time, the pulse return to zero after half bit period.	During the on time, the pulse does not return to zero after half bit period.
Unipolar RZ pulses carry less energy.	Unipolar NRZ pulses carry more energy.
Clock recovery is Poor.	Clock recovery is Good.
Synchronization is not essential	Synchronization is not essential.
	

e) Compare FDM and TDM w.r.to.

i) Definition ii) Schematic dig. iii) Principle

(Definition 2Marks, Relevant Diagram 1Mark, Principle 1Mark)

Ans:

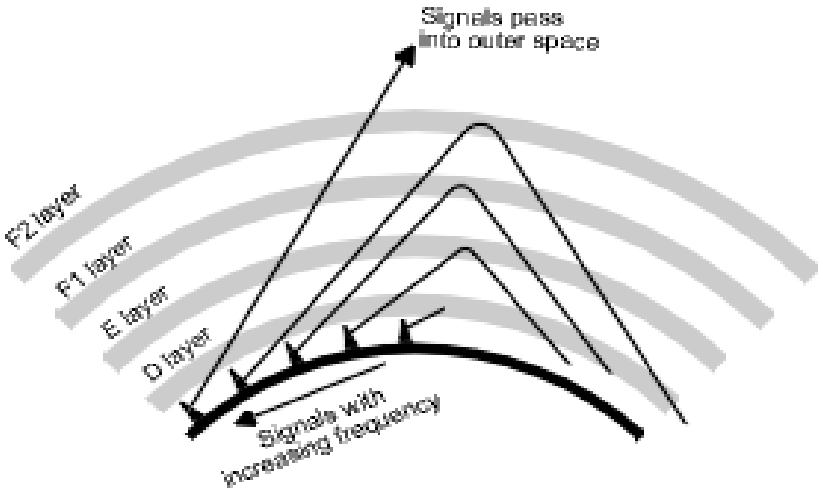
	FDM	**TDM**
Definition	Frequency-division multiplexing (FDM) is an analog technique where total range of frequency is divided into number of frequency slots. Each slot of frequency is allotted to each channel.	Time-division multiplexing (TDM) is digital technique to combine data where time is shared.
Schematic Diagram		
Principle	• Various channels of different frequencies combined, transmitted through single wire & separated at receiver with help of demultiplexer. • FDM is applied when bandwidth of a link is greater than combined bandwidth of signals to be transmitted. • These modulated signals are then combined into single composite signal that can be transported by the link. • Carrier frequencies are separated by sufficient bandwidth to accommodate modulated signal. • These bandwidth ranges are channels through which various signals travels. • Channels must be separated by guard bands to prevent signals from overlapping.	• Various channels of different frequencies combined, transmitted through single wire & separated at receiver with help of demultiplexer. • Transmission time is divided into number of time slices. • Then each time slice is allocated to different source node, each of which wants to send data. • Data flow of each connection is divided into units & link combines one unit of each connection to make a frame. • Data rate of link that carries data from 'n' connections must be 'n' times data rate of a connection to guarantee the flow of data.

Q.4 A) Attempt any three: **12M**

a) Describe ionosphere propagation with the help of neat diagram.

(Relevant Diagram 2Marks; Relevant Explanation 2Marks)

Ans:



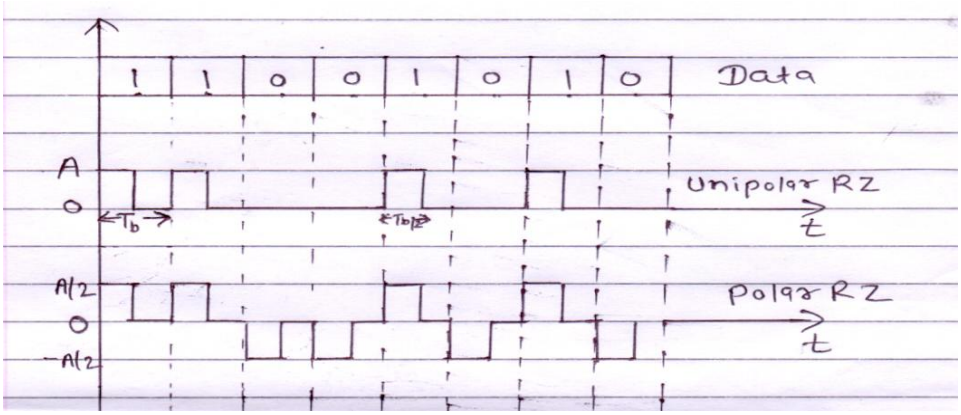
Electromagnetic waves that are directed above the horizon level are called as sky waves. Typically, sky waves are radiated in a direction that produces a relatively large angle with reference to earth. Sky waves are radiated toward the sky, where they are either reflected or refracted back to earth by the ionosphere. Because of this, sky wave propagation is sometime called as ionospheric propagation. The ionosphere is the region of space located approximately 50km to 400 km above Earth surface. The ionosphere is the upper portion of earth's atmosphere. Therefore it absorbs large quantities of the sun radiant energy, which ionizes the air molecules, creating free electrons. When radio wave passes through the ionosphere the electric field of the wave exerts a force on the free electrons, causing them to vibrate. The vibrating electron decreases current, which is equivalent to reducing the dielectric constant. Reducing the dielectric constant increases the velocity of propagation and causes electromagnetic waves to bend away from the regions of high electron density toward regions of low electron density. As the wave moves farther from earth ionization increase; however, there are fewer air molecules to ionize. Therefore, the upper atmosphere has a higher percentage of ionized molecules than the lower atmosphere. The higher the ion density, the more refraction. Also because of the ionosphere's non uniform composition and its temperature and density variations, it is stratified. Essentially, three layers makeup the ionosphere (the D, E, Flayers).

b) Draw the waveform for the bit sequence given below:

11001010 using unipolar RZ and polar RZ encoding technique.

(Correct waveform 4 Marks)

Ans:



c) State the two advantages and disadvantages of FSK over ASK.

(Any Two advantages-2Marks & Any two disadvantages-2Marks)

Ans:

Advantages of FSK over ASK:

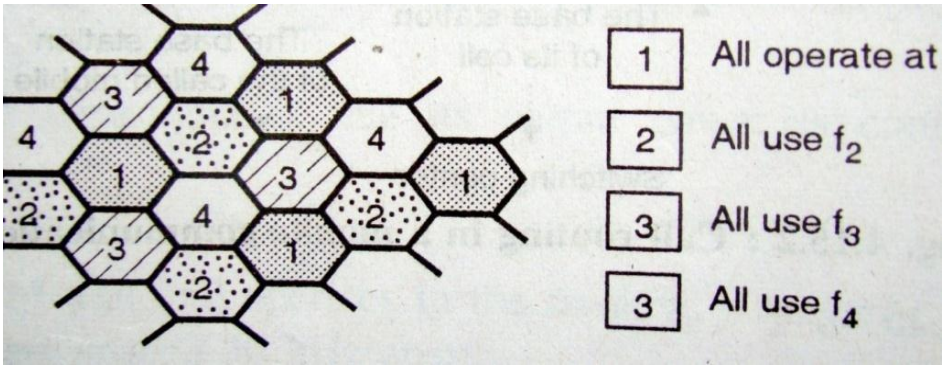
1. Low noise, since amplitude is constant
2. Power requirement is constant
3. Operates in virtually any wires available
4. High data rate
5. Used in long distance communication
6. Easy to decode
7. Good sensitivity
8. It has high security
9. Efficiency is high.

Disadvantages of FSK over ASK:

1. The major disadvantage is its high bandwidth requirement.

2. Therefore FSK is extensively used in low speed modems having bit rates below 1200 bits/sec.
3. The FSK is not preferred for the high speed modems because with increase in speed, the bit rate increases.
4. This increases the channel bandwidth required to transmit the FSK signal.
5. As the telephone lines have a very low bandwidth, it is not possible to satisfy the bandwidth requirement of FSK at higher speed. Therefore FSK is preferred only for the low speed modems

d) Describe the concept of frequency reuse.
(Concept of frequency reuse 2Marks, Relevant Diagram 2Marks)
Ans:

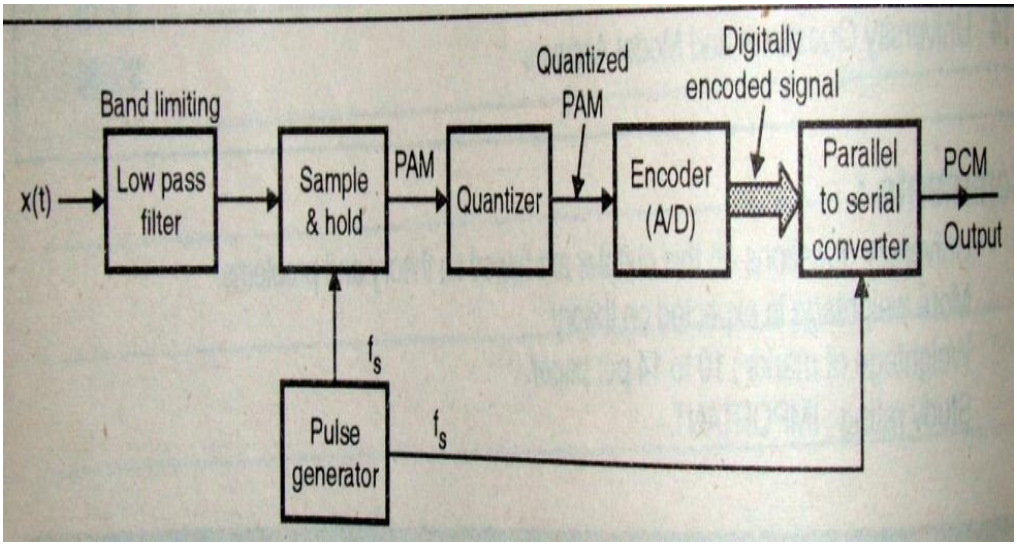


Frequency reuse-

Frequency reuse is the process in which the same set of frequencies (channels) can be allocated to more than one cell. Provided the cells are separated by sufficient distance reducing each cells coverage area invites frequency reuse cells using the same set of radio channels can avoid mutual interference, provided they are properly separated. Each cell base station is allocated a group of channel frequencies that are different from those of neighboring cells & base station antennas are chosen to achieve a desired coverage pattern within its cell. However as long as a coverage area is limited to within a cells boundaries the same group of channel frequencies may be used in different cells without interfacing with each other provided the two cells are sufficient distance from one another.

Q.4 B) Attempt any one: **6M**

a) Describe PCM transmitter with the help of neat diagram. What is quantization error?
(Relevant explanation- 2Marks, Diagram – 2Marks & quantization error-2Marks)



Operation of PCM transmitter:

i. The analog signal x(t) is passed through a band limiting low pass filter, which has a cut-off frequency fc =WHz. This will ensure that x(t) will not have any frequency component higher than "W". This will eliminate the possibility of aliasing.

ii. The band limited analog signal is then applied to a sample and hold the circuit where it is sampled at adequately high sampling rate. Output of sample and hold block is a flat topped PAM signal.

iii. These samples are then subjected to the operation called "Quantization" in the "Quantizer". The quantization is used to reduce the effect of noise. The combined effect of sampling and quantization produces the quantized PAM at the quantizer output.

iv. The quantized PAM pulses are applied to an encoder which is basically an A to D converter. Each quantized level is converted into an N bit digital word by the A to D converter. The value of N can be 8,16,32,64 etc.

v. The encoder output is converted into a stream of pulses by the parallel to serial converter block. thus at the PCM transmitter output we get a train of digital pulses.

Quantization error: The error between the original analog signal & its quantized version which is measured is called Quantization error.

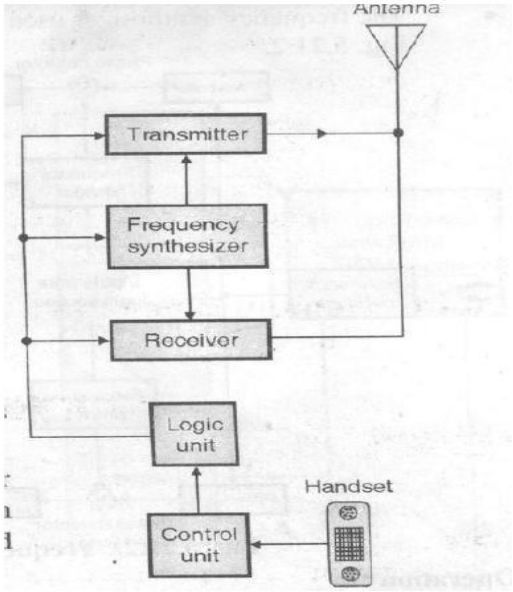
b) Draw and explain the block diagram of cellular mobile phone system.

(Relevant Explanation 3 Marks & Diagram 3Marks)

Ans:

The five major parts of this system are:

1. Control Unit
2. Logic unit
3. Transmitter
4. Receiver
5. Frequency synthesizer



Functions of each block:

Transmitter: It is low power FM unit operating in the frequency range of 825 to 845MHz. There are 666, 30 KHz transmit channel. The carrier is furnished by a frequency synthesizer is a phase modulated by voice signal.

Receiver: The receiver is a dual conversion super heterodyne. The incoming signal frequency is down converted twice to frequency of 455 KHz or 10.7MHMz with the help of mixer and IF amplifier stages. The signal is then demodulated deemphasized and filtered and given to loud speaker.

Frequency Synthesizer: This block generates all the signals used by transmitter and receivers. It uses standard PLL circuits and a mixer.

Logic Unit: This unit contains master control circuit for a cellular radio. It is made up of microprocessor with RAM and ROM and additional circuit used for interpreting signals from MSC and BS and generates control signal for the transmitter and receiver.

Control unit: The control unit contains the handset with speaker and microphone. The control unit is operated by a separate microprocessor that drives the LCD display and other indicators.

Q.5 Attempt any four: **16M**

a) Compare PAM, PWM and PPM system w.r.to bandwidth transmitted power, noise immunity, characteristics.

(Any four points 1 Mark each)

Ans:

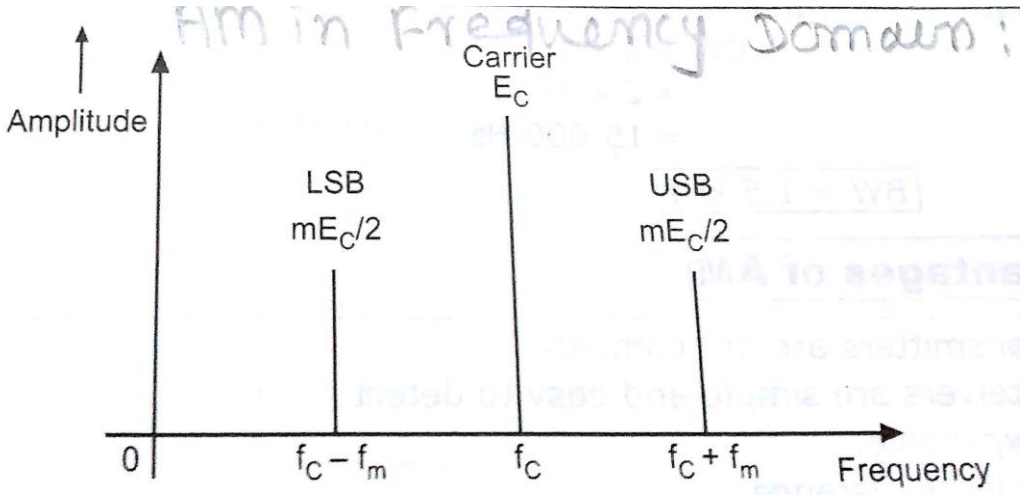
Parameter	**PAM**	**PWM**	**PM**
Type of Carrier	Train of pulses	Train of pulses	Train of pulses
Bandwidth requirement	Low	High	High
Transmitted Power	Varies with amplitude of pulses	Varies with variation in width	Remains constant
Noise immunity	Low	High	High
Variable characteristics of the pulsed carrier	Amplitude	Width	Position

b) Draw AM and FM signal in frequency domain.

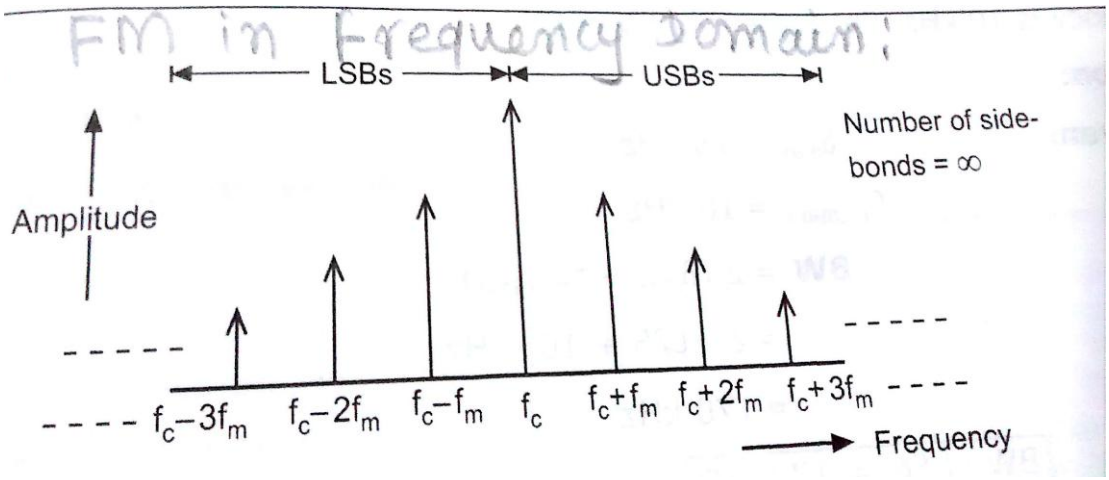
(Each waveform 2Marks)

Ans:

AM signal in frequency domain

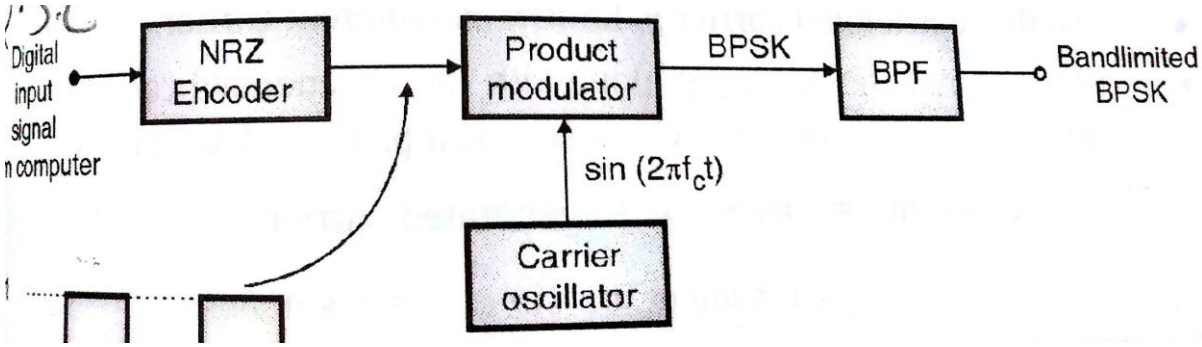


FM signal in frequency domain



c) Draw block diagram of BPSK transmitter. State two advantages of it.

(Diagram 2 Marks, Advantages 2 Marks)
Ans:



Advantages of BPSK:
1. Bandwidth is less than FSK signal.
2. Used for high bit rate than 1800 bits/sec.

d) Compare baseband and passband transmission (any 2 point). State the limitation of baseband transmission.
(Any 2 points for comparison 2 Marks, any 2 points for limitations 2Marks)
Ans:

Baseband Transmission	**Passband Transmission**
It uses digital signalling	It uses digital signalling
Bi-directional transmission	Unidirectional transmission

Limitations of Baseband Transmission:
Baseband signal has low frequency range from 20Hz to 20kHz only. Due to low frequency range, cannot travel long distance in free space or air. After a travel of short distance signal gets attenuated. So cannot be used for radio communication.

e) Define Bit rate and Band rate.

(Each definition 2 Marks)

Ans:

Bit rate:

Bit rate is the number of bits transmitted per second. Data rate is also known as bit rate.

$$\text{Bit rate} = \frac{1}{\text{Bit interval}}$$

If the bit duration is T_b (known as bit interval), then bit rate will be $1/T_b$

Bit rate should be as high as possible.

With increase in data rate the bandwidth of transmission medium must be increased in order to transmit the signal without any distortion.

Baud rate:

Baud rate is the number of signal units per second.

Baud is the unit of signalling seed or modulation rate or rate symbol transmission.

f) State the steps for forward and reverse call processing.

(Each process 2Marks)

Ans:

Mobile to wireline(PSTN) call procedure

- The mobile subscriber enters the wireline telephone number into the units memory using a standard touch-Tone keypad. The subscriber then press a send key which transmits the called number as well as the mobile units identification number over a reverse control channel to the base station switch.
- If the mobile unit's ID number is valid, the cell site controller routes the called number over a wireline trunk circuit to the MTSO.
- The MTSO uses standard call progress signals to locate the switching path through the PSTN to the destination party.
- Using the cell site controller, The MTSO assigns the mobile unit a non busy user channel and instructs the mobile unit to tune to that channel.
- After the cell site controller receives the verification that the mobile unit has tuned to the selected channel the mobile unit receives a call progress ring tone while the wireline caller receives a standard ringing signal.
- If a suitable switching path is available to the wireline telephone number, the call is completed when the wireline party answers the telephone.

Wireline(PSTN) to mobile(cellular)call procedures:

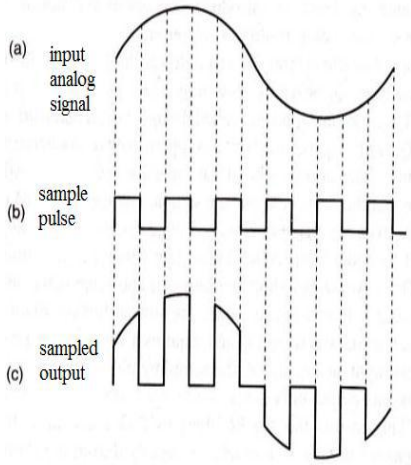
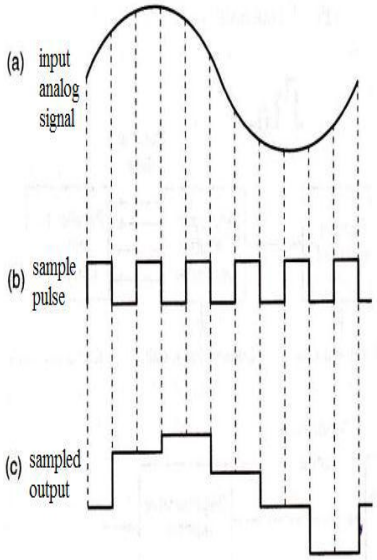
- The wireline telephone goes off hook to complete the loop ,receives a dial then inputs the mobile units telephone number.
- The telephone number Is transferred from the PSTN switch to the cellular network switch (MTSO)that services the destination mobile number.
- The cellular network MTSO receives the incoming call from the PSTN, translates the received digits, and locates the base station nearest the mobile unit is on or off hook(i.e. available).
- If the mobile unit is available, a positive page response is sent over
- A reverse control channel to the cell site controller which is forwarded to the network switch(MTSO)
- The cell site controller assigns an idle user channel to the mobile unit and then instructs the mobile unit to tune yo the selected channel
- The mobile unit sends verification of the channel tuning through the cell site controller.
- The cell site controller sends an audible call progress tone to the subscribers mobile telephone, causing to ring. At the same time, a ring back signal is sent back to the wireline calling party.
- The mobile answers(goes off hook),the switch terminates the call progress tones, and the conversation begins.

Q.6 Attempt any four: **16M**

a) Compare natural sampling and flat top sampling.

(Any four points 1Mark each)

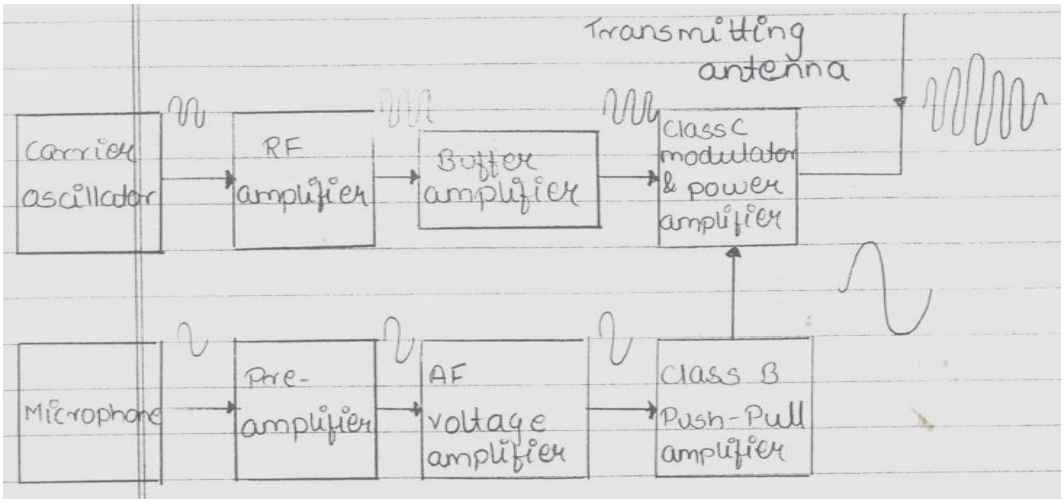
Ans:

Criteria	Natural sampling	Flat top sampling
Circuit used for generation	chopper circuit	Sample and hold circuit
Sampled signal	Sampled signals do not have Flat top. Pulses retain natural shape	Sampled signals have Flat top.
waveform		
Shape of the samples	Takes natural shape of modulating signal.	Does not take the shape of modulating signal.

b) Describe high level AM transmitter with the help of block diagram.

(Diagram 2Marks, Explanation 2Marks)

Ans:



1. Carrier Oscillator:
It consists of LC or crystal oscillator. Its function is to generate a stable and accurate high frequency sinusoidal signal.

2. RF Amplifier:
It is a high gain amplifier to amplify carrier produced by oscillator. It amplifies RF signal and attenuates other frequencies.

3. Microphone:
It is a pick-up device which converts sound signal into voltage in the order of microvolts (μV).

4. Pre-amplifier:
The output of the microphone is very weak and is fed to the pre-amplifier. It amplifies the μV to mV level. It is a very sensitive amplifier.

5. AF Voltage amplifier:
It is a transistorized low frequency amplifier having bandwith of audio frequency. It amplifies modulating signal from millivolts to volts.

6. Buffer Amplifier:
It is an impedance matching circuit. It matches the output impedance of modulator. It is also used as a isolation circuit for isolating RF amplifier with the modulator.

7. AM modulator:

It uses either base or emitter modulator. It is a class A or Class B type. The output is AM signal.

8. Class B Push pull amplifier:

The modulating signal power required for modulation is very high and hence Class B push pull amplifier is used.

9. Class C modulator & power amplifier:

High level transmitters use collector modulation – it is operated in Class C mode to provide very high efficiency. The output modulated wave is directly fed to the transmitting antenna.

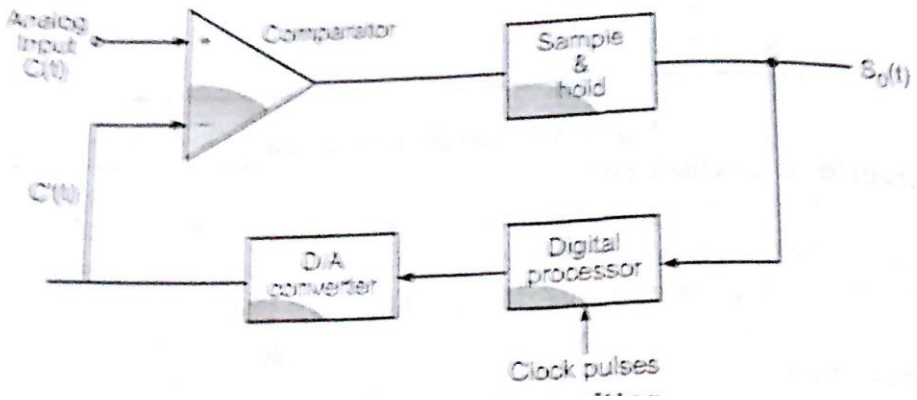
11. Transmitting antenna:

It converts the modulated signal in electrical form into electromagnetic waves. These waves are transmitted through the atmosphere as ground wave or sky wave to reach the receiver.

c) Draw and describe the block diagram of ADM.

(Diagram 2Marks, Explanation 2Marks)

Ans:



In this, the step size of the DAC is automatically varied depending on the amplitude characteristics of the analog input signal. When the output of the transmitter is a string of consecutive 1's or 0's, this indicates that the slope of analog signal either in +ve or –ve direction. The DAC has lost track of exactly where the analog samples are and the possibility of slope overload occurring is high. In ADM, the value of delta changes in accordance with the slope of the sampled analog input.

d) Compare TDMA and FDMA on the following points:

i) Multiplexing technique

ii) Power efficiency

iii) Synchronization

iv) Guard band

(Any for points 1 Mark each)

Ans:

	TDMA	**FDMA**
Multiplexing Technique	Time division multiplexing	Frequency division multiplexing
Power efficiency	More	Less
Synchronization	Required	Does not required
Guard Band	Guard time band is required	Guard frequency band is required

e) Compare BPSK and DPSK.

(Any four points 1Mark each)

Ans:

Sr. No	**Parameters**	**BPSK**	**DPSK**
1	Variable characteristics	Phase	Phase
2	Bandwidth	f_b	f_b
3	Error probability	Low	Higher than BPSK
4	Complexity	Lower than DPSK	Higher than BPSK
5	Detection method	Synchronous	
6	Effect of noise	Low	Higher than BPSK
7	Need of synchronous carrier	Needed	Not Needed
8	Bit determination at the receiver	Based on single bit interval	Based on signal received in two successive bit intervals.