MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION
(Autonomous)
(ISO/IEC - 27001 - 2005 Certified)

Winter – 15 EXAMINATIONS

Subject Code: **17472** **Model Answer**

Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in the 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 judgment 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.

17472

Q1. A) Attempt any SIX the following (12)

i. State the sampling theorem

ANS: **(statement 2 M)**

A continuous time signal x(t) can be completely represented in its sampled form and recovered back from the sampled form if the sampling frequency fs >= 2fm, where fm is the maximum frequency of the continuous signal.

ii. Define geostationary satellite. State its two advantages.

ANS:

(Define- 1mks, Any 2 advantages – 1mks)

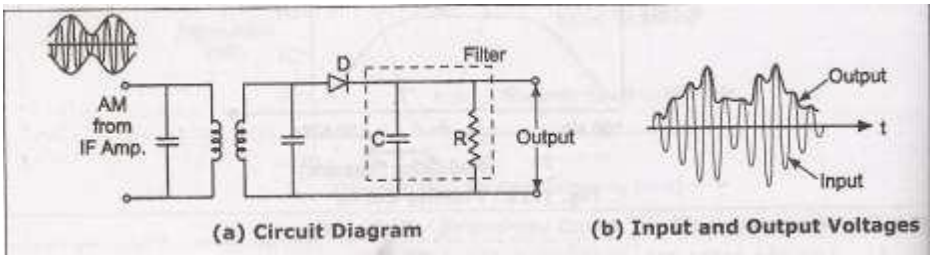
Geostationary satellite: The orbit in which satellite completes one revolution around the earth in 24 Hrs, the orbit is called as geostationary satellite. Satellite uses synchronous orbit is called geosynchronous satellite.

Advantages:

1) Geostationary satellite remains almost stationary in respect to given earth station. Consequently, expensive tracking equipment is not required at the earth stations.
2) Geostationary satellites are available to all earth station within their shadow 100% of the time. The shadow of a satellite includes all the earth station that have a line of sight path to it and lie within the radiation patterns within the antennas.
3) There is no need to switch from geostationary satellite to another as they orbit overhead. Consequently, there are no transmission breaks due to switching times.
4) The effects of Doppler shift are negligible.

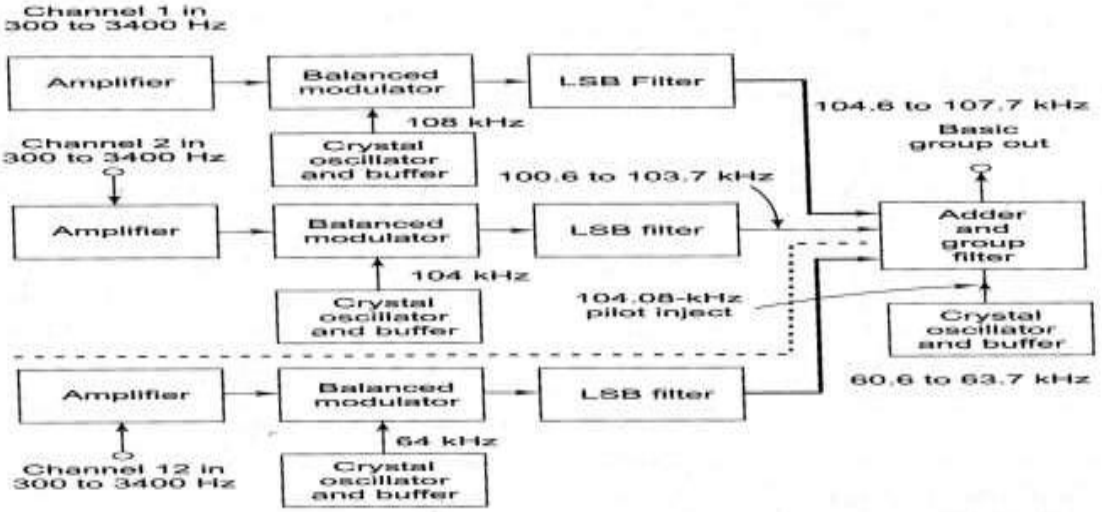
iii. Draw the circuit of AM demodulator. Draw its input and output waveforms.

ANS:-(Circuit diagram- 1 mks,waveforms- 1mks)



iv. Draw the block diagram of FDM generation.

ANS: (Proper diagram – 2mks)



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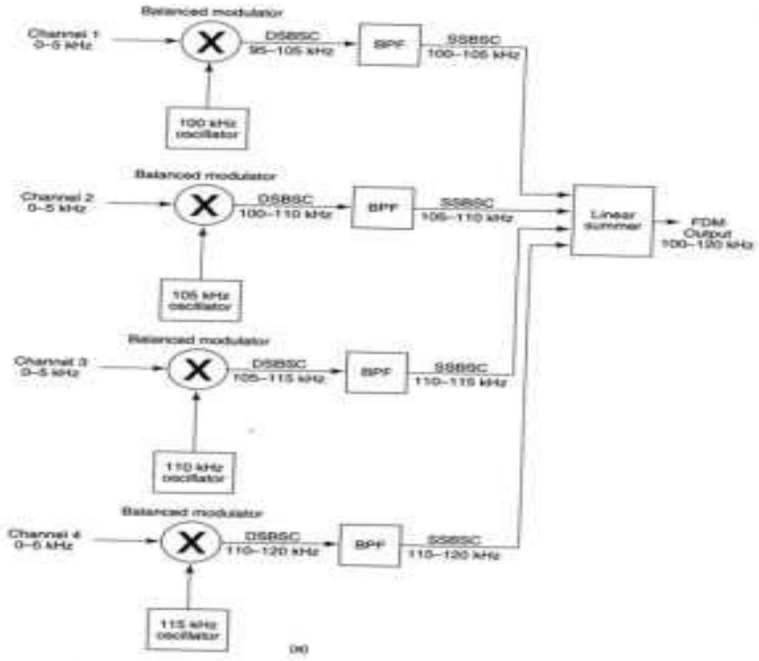
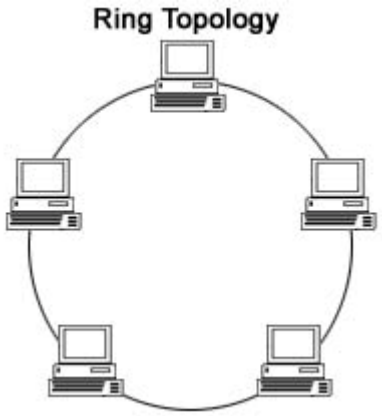
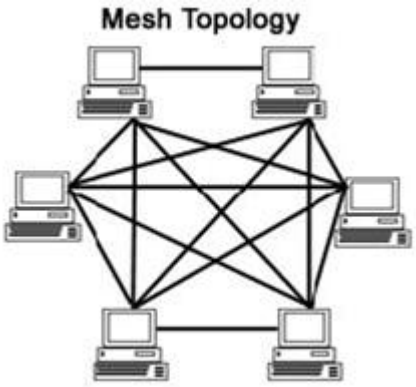


v. Draw sketches of ring and mesh network topology.

ANS:- (Each sketch- 1 mks)





vi. State and explain Snell's law with neat diagram.

ANS: (Statrement – 1 mks, ex[lanation- 1 mks)

It states that , incident angle θ_o is related to exit angle θ_1 by the relation

$n_o \sin \theta_o = n_1 \sin \theta_1$

$n_o / n_1 = \sin \theta_0 / \sin \theta_1$

Explanation- Angle of incidence should be equal to angle of reflection.

vii. Define TDM and WDM.

ANS: (Each proper definition- 1 mks)

Time-division multiplexing (TDM) :- It is multiplexing technique in which signals from multiple source are send using single link separated by time quanta.

Wave- Division Multiplexing (WDM) : WDM is an analog multiplexing techniques to combine optical signal. Very narrow bands of light from different sources are combined to make wider band of light and at the receivers, the signals are separated by the demultiplexer.

viii. Give the classification of communication system.

ANS: Communication system is classified into two types (2 mks)

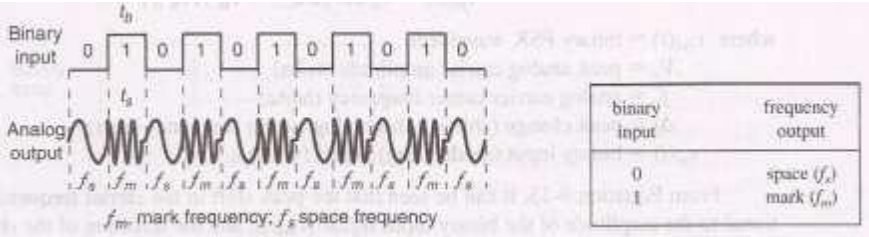
1. Wired / line communication.
2. Wire less / radio communication.

Q. 1). B)-Attempt any two **8**

i. Define FSK and PSK with waveforms

ANS:- (Each definition with proper waveforms- 2 mks)

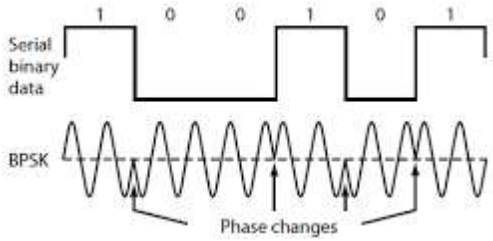
Definition of FSK: If the information signal is digital and the frequency of the carrier is varied proportional to the information signal , a digitally modulated signal called frequency shift keying is produced



binary input	frequency output
0	space (f_s)
1	mark (f_m)

Definition of PSK:

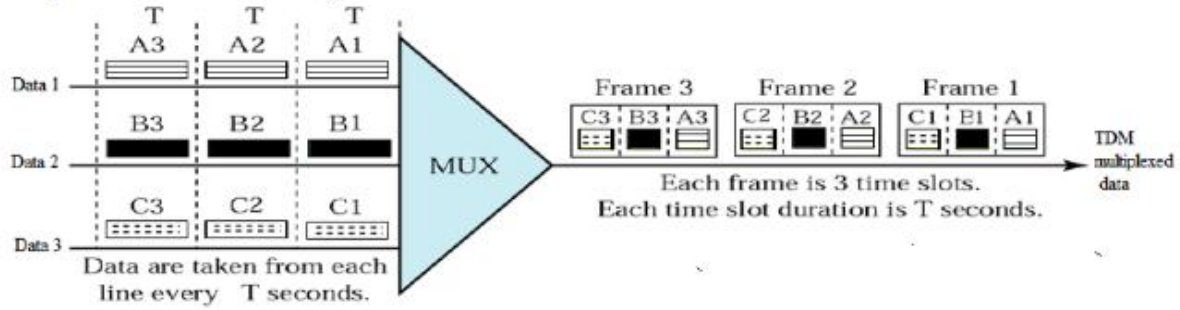
In phase shifting the phase of carrier is varied or shifted representing binary 1 & 0. Both amplitude and frequency remain constant.



ii. Describe TDM generation with suitable block diagram

ANS: (Block diagram- 2 mks, description – 2mks)

Diagram: TDM Block diagram

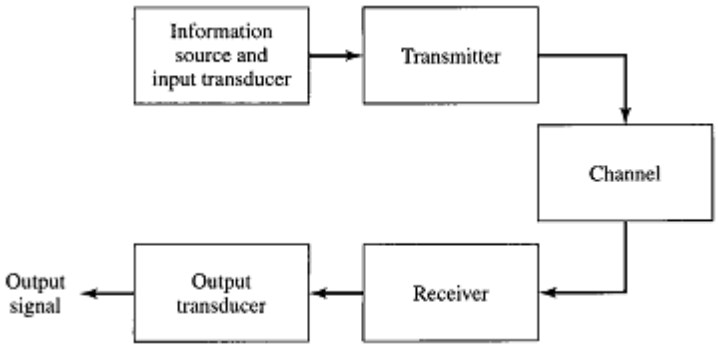


Explanation

- Process of combining digital signals from several sources whereby each connection occupies a portion of time in the link is called Time Division Multiplexing (TDM).
- Links are sectioned by time rather than frequency.
- Data flow of each connection is divided into units.
- In TDM data units from each input connection is collected in to a frame i.e link combines one unit of each connection to make a frame.
- If we have "n" connection a frame is divided in to "n" time slots and one slot is allowed for each unit. i.e. *n* input connections →*n* time slots.
- One for each input line, if the duration of input is T, the duration of each slot is T/n and the duration of each frame is T.
- Data rate of link must be *n* times the duration of a time slot to guarantee flow of data.
- Time slots are grouped into frames; one complete cycle of time slots; each slot dedicated to one device.
- A simple TDM process for three different data transmission is shown above.
- Here, all three data are divided into equal timeslots also called as units.
- And each data unit from all three data are combined / multiplexed together to form TDM frames comprising of small units of all three data which is further transmitted.

iii. Draw block diagram of electronic communication system.
Explain the function of each block.

ANS☹Block diagram- 2 mks, explanation- 2 mks)



Explanation-

i) Input signal: - The information can be in the form of sound, picture or data coming from computer.
ii) Input transducer: - it converts original information into equivalent electrical signal.
iii) Transmitter: - it converts electric equivalent into suitable form. It increases the power level of signal so that it can cover long distance.
iv) Communication Channel: - it is the medium used for transmission of electromagnetic e.g. from one place to another.. it can be wire or optical fibre or free space.
v) Noise: - It is unwanted signal which gets added in transmitting signal.
vi) Receiver: - the received signal is demodulated & converted back to suitable form.
vii) Output transducer: - It converts electrical signal into original form.

Q2. Attempt any FOUR of the following 16

a. Give four advantages of pulse modulation over analog modulation.

ANS:(any 4 advantages- 4 mks)

Advantages:
1) Transmit modulated signal with low loss.
2) Avoid interference with other communication.
3) Make receiving antennas quite small.
4) Multiplex signals.
5) Increase channel allocations.
6) Have better noise immunity

b. Define modulation. State the need of modulation.(any 3 points)

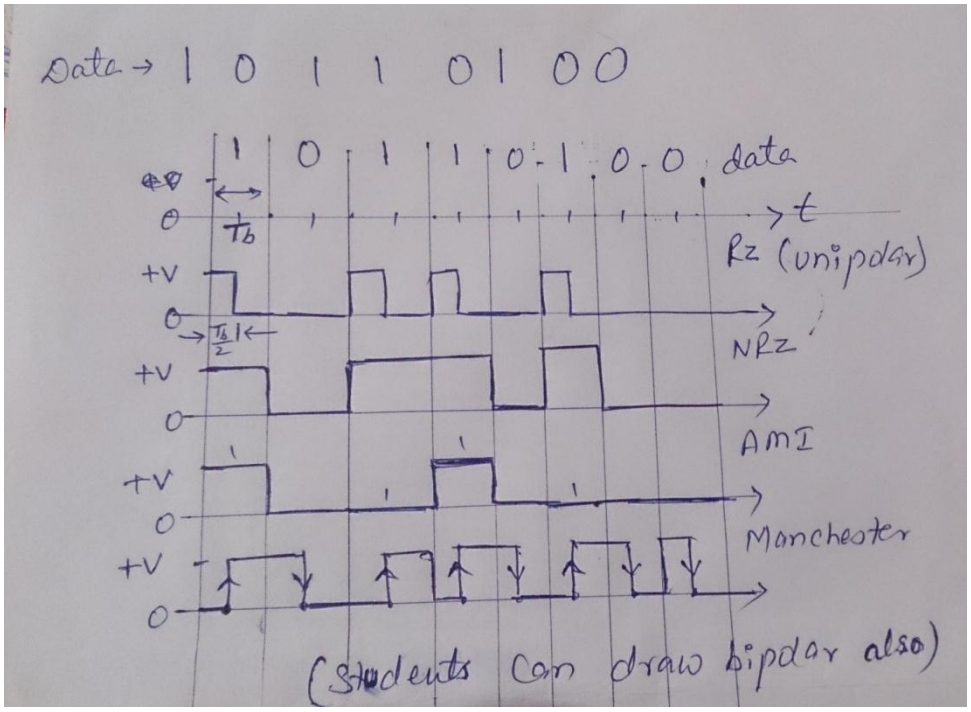
ANS: (Definition – 1 mks, Need 3 points- 3 mks)

Ans:-Modulation:- The process in which any one parameter of a high frequency carrier signal (i.e. either amplitude,frequency or phase)is varied in accordance with the instantaneous value of the modulating signal ,keeping the other two parameters constant.

Need of modulation
1. To reduce the height of the antenna.
2. To avoid the mixing of the signals.
3. To increase the range of
ommunication.
4. To make multiplexing possible.
5. To improve quality of reception

c. Encode the binary data stream 100110100 into Return to Zero.(RZ), Non-return to Zero (NRZ), AMI and Manchester code.

ANS: (Each code – 1mks)



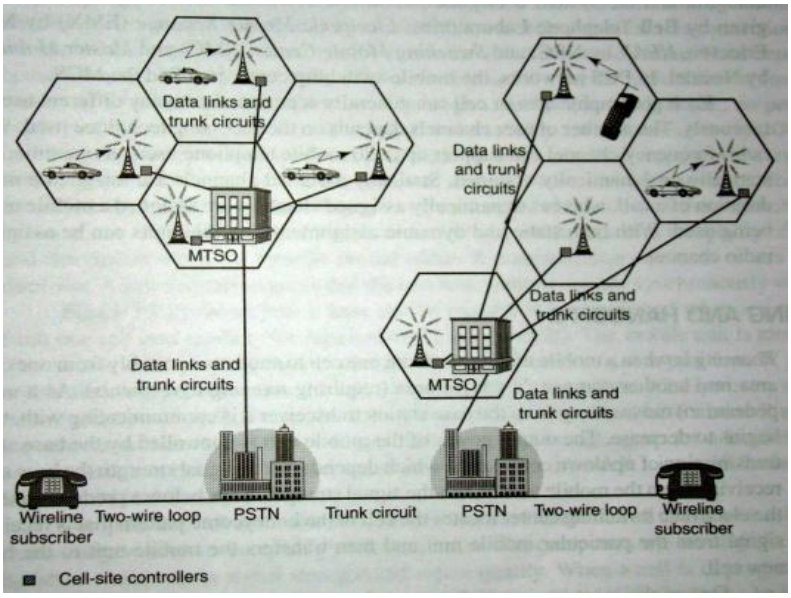
d. Compare LEO, MEO and GEO satellites based on following parameters.
   i. Orbit height
   ii. Time for one revolution
   iii. Coverage Area
   iv. Applications

ANS:- (Proper comparison- 4 mks)

Parameters	LEO	MEO	GEO
Orbit height	500 to 2000 Km above the earth	5000 Km to 18000 Km above the earth	36000Km above the earth
Time for one revolution	1 to 1 and 1/2 hour	6 hours	24 hours
Coverage Area	Small area of earth	Smaller area of earth	Full area of earth
Applications	Scientific experiments, weather forecasting, etc	GPS	TV , DTH, mobile communication etc.

e. Draw block diagram of cellular communication system. State frequencies used for transmitter and receiver.

ANS:- (Diagram- 2 mks, explanation- 2 mks)



Explanation:-
Fig shows a mobile or cellular telephone system that includes all the basic components necessary for mobile communication.
The radio network is defined by a set of radio frequency transreceiver located within each of the cells. The location of these radio frequency transreceivers are called base station
Base station: base station serves as central control for all users within that cell.
Mobile unit communicate directly with the base stations & the base stations communicate directly with a mobile
Telephone switching office (MTSO):-An MTSO controls channel assignment, call processing, call setup & call termination which includes signaling switching, supervision & allocating radio-frequency channels. The MTSO provides a centralizes administration & maintenance point for the entire network & interfaces with the public telephone network over wire line voice trunks & data links.

f. Define modulation index of AM. Calculate modulation index of AM signal with Vmax = 4V and Vmin = 2V.

ANS: (Definition 1 mks, Formula 1 mks, correct answer- 2 mks)

Modulation index in AM : it is the ratio of amplitude of modulating signal to the amplitude of the carrier signal.

$$\mathbf{M_a = V_m / V_c}$$

$\mathbf{M_a = V_{max} - V_{min} / V_{max} + V_{min}}$

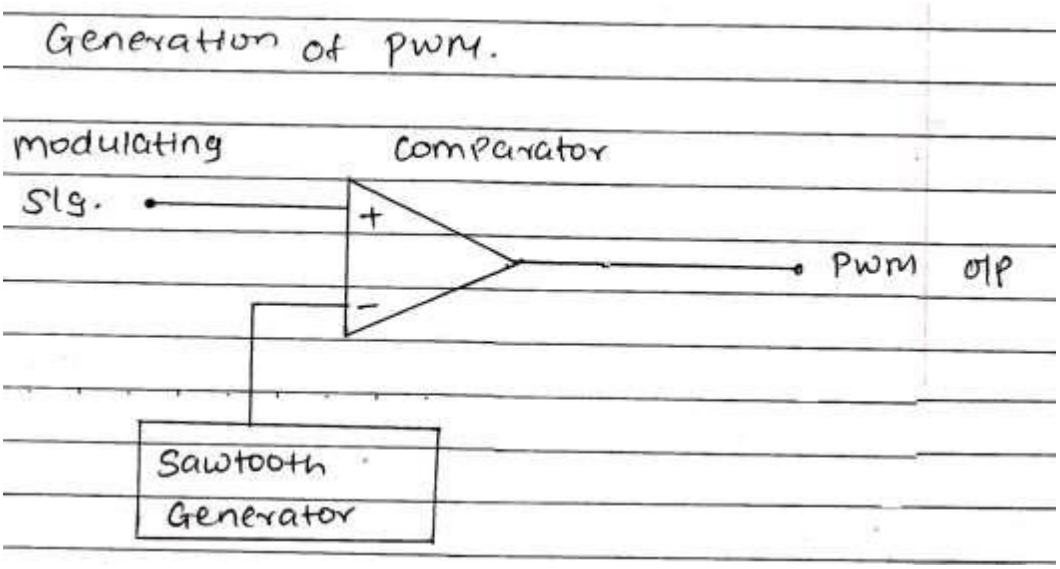
$\mathbf{M_a = 4-2/ 4+2}$

$\mathbf{M_a = 0.33 \text{ or } 33\%}$

Q3. Attempt any FOUR of the following (16)

a. Draw the circuit diagram of PWM generator and explain its working with waveform.

ANS:-(Circuit diagram- 2 mks, Explanation- 1mks, Waveforms- 1 mks)



Working: The sawtooth generator generates the sawtooth signal (sampling signal) and is applied to the inverting terminal of a comparator. The modulating signal is applied to the non-inverting terminal of the same comparator. The comparator output will remain high as long as the instantaneous amplitude of modulating signal is higher than the sawtooth signal. This gives rise to a PWM signal at the comparator output.

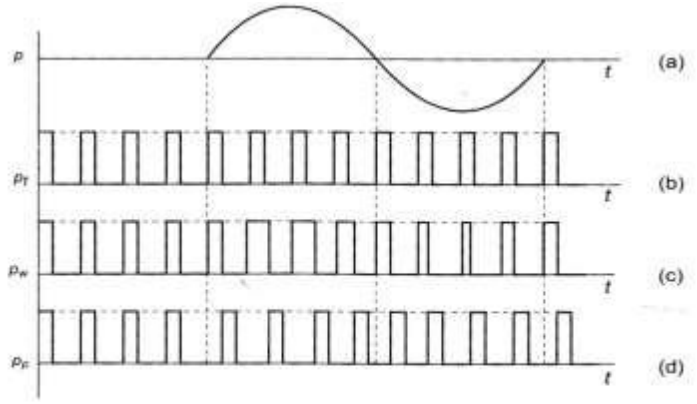


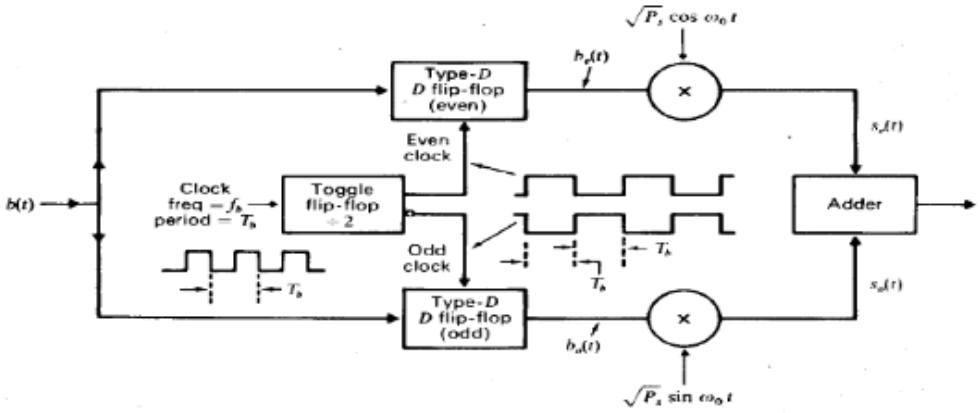
Fig. *Generation of PPM. (a) Message, (b) pulse train, (c) PWM and (d) PPM.*

NOTE: Only PWM waveform is required

b. Draw the block diagram of QPSK generator. Stare functions of each block.

ANS::- (Block diagram- 2 mks, Explanation- 2 mks)

QPSK Transmitter



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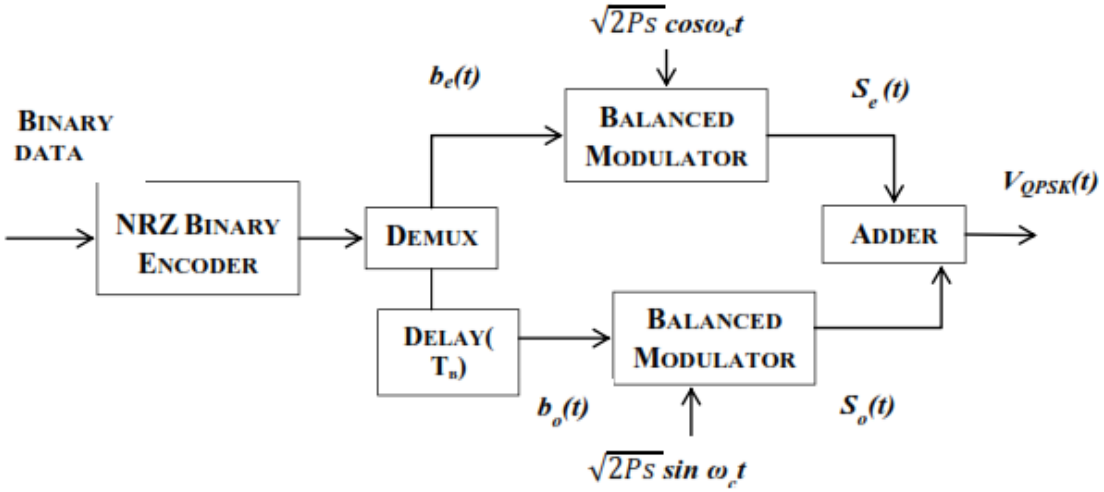


Working Principle

- QPSK is an expanded version from binary PSK where in a symbol consists of two bits and two orthonormal basis functions are used. A group of two bits is often called a 'dibit'. So, four dibits are possible. Each symbol carries same energy.

- The number of phase shifts in phase shift keying is not limited to only two states. The transmitted "carrier" can undergo any number of phase changes and, by multiplying the received signal by a sine wave of equal frequency, will demodulate the phase shifts into frequency-independent voltage levels which is nothing but the demodulated output.

- This is indeed the case in quadrature phase-shift keying (QPSK). With QPSK, the carrier undergoes four changes in phase (four symbols) and can thus represent 2 binary bits of data per symbol. Although this may seem insignificant initially, a modulation scheme has now been supposed that enables a carrier to transmit 2 bits of information instead of 1, thus effectively doubling the bandwidth of the carrier.

c. Draw block diagram of optical communication system and explain function of each block .

ANS: (Block diagram- 2 mks, explanation- 2 mks)

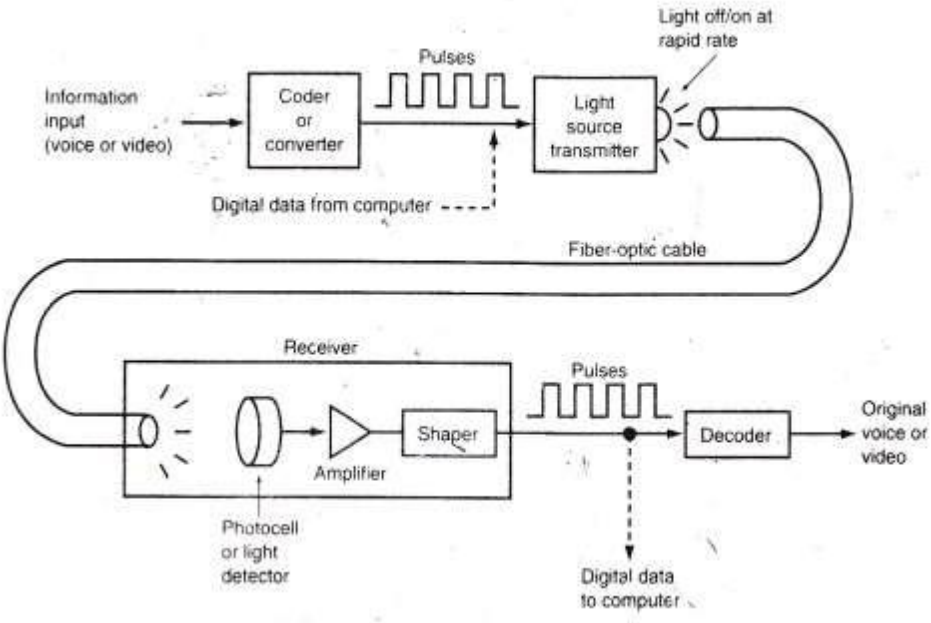


Fig. Optical fiber communication system

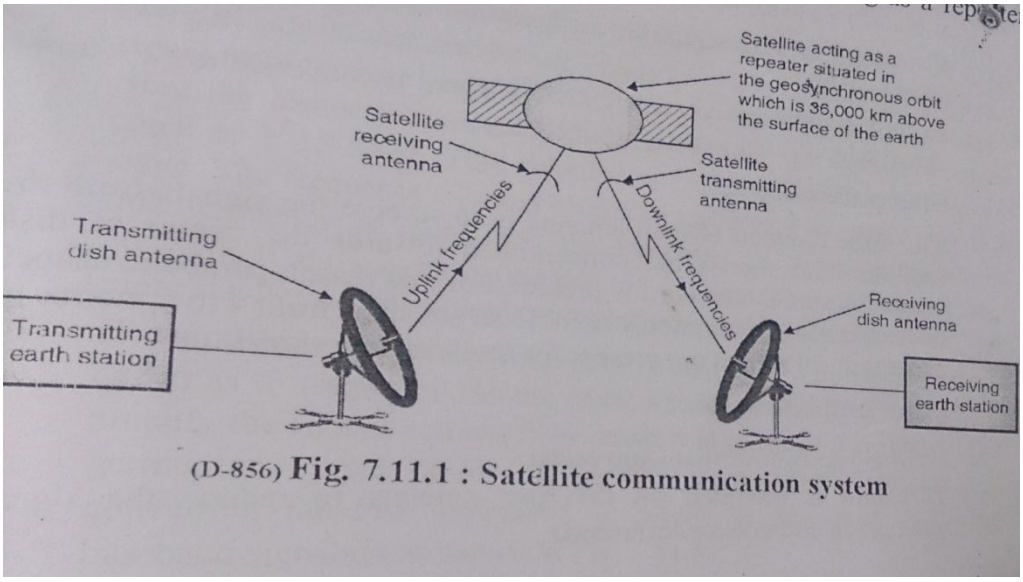
Explanation:

1. In the transmitter, the light source can be modulated by digital or an signal.
2. The voltage to current converter serves as an electrical interface berween the input circuitary and light source.
3. Light source is either infrared light emitting diode(LED0 or an injection laser diode (ILD).

4. The amount of light emitted by either an LED or ILD is proportional to the amount of drive current.
5. Thus, the voltage to current converter converts an input signal voltage to current that is used to drive the light source.
6. The light outputted by the light source is directly proportional to the magnitude of the input voltage.
7. The source to fiber coupler is a mechanical interface. It's function is to couple light emitted by the light source into the optical fiber cable.
8. The optical fiber consists of a glass or plastic fiber core surrounded by a cladding and then encapsulated in a protective jacket.
9. The fiber to light detector coupling device is also a mechanical coupler.
10. It's function is to couple as much light as possible from the fiber cable into the light detector.

11. The light detector is generally a PIN diode or phototransistor.
12. All three of these devices convert light energy to current.
13. The current to voltage converter is required to produce an output voltage proportional to the original source information.

d. Draw the block diagram of satellite communication system. State any four applications of satellite.



(D-856) Fig. 7.11.1 : Satellite communication system

ANS: (Block diagram- 2 mks, any 4 applications- 2 mks)

Applications-1) Remote sensing

2) Metrological application

3) Military application

4) Scientific and technological applications.

e. Explain co channel and adjacent channel interference in mobile communication system.

ANS:- (Each – 2 mks)

Co-channel Interference is a crosstalk from two different radio transmitters using the same frequency. Or interference in nearby channels having same frequency
Co-channel interference can be avoided by using
1. proper frequency planning.
2. Increasing distance between two co-channels

Adjacent channel interference:
Interference resulting from signals which are close in frequency to the desired signal is called adjacent channel
interference.
The adjacent channel interference can be reduced by
1) Careful filtering
2) Careful channel assignment.
3) There should be adequate frequency separation between the spectrums of the adjacent channels in a cell

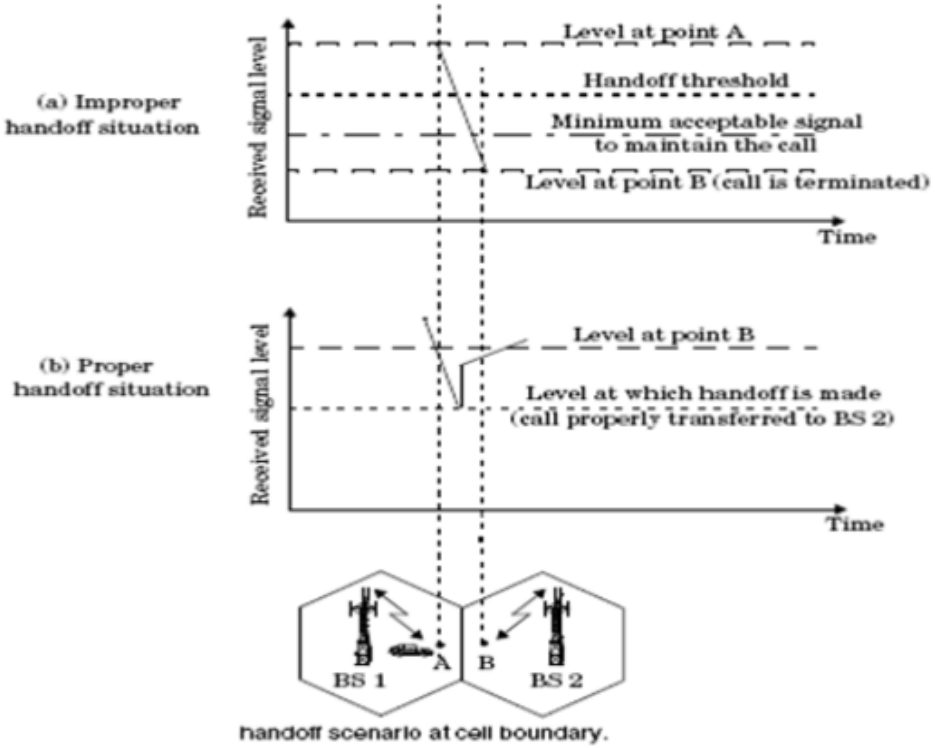
4) If the frequency reuse factor is large or cluster size is small the adjacent channel at the base station will be too close to each other in the frequency domain and this will increase the interference.

f. Define hand-off in mobile communication. Describe hand-off procedure with neat diagram

ANS:(Definition-1 mks, procedure- 1mks, relevant diagram- 2 mks)

Handoff: Cellular system has the ability to transfer calls thar are already in progress from one cell-site controller to another as the mobile unit moves from cell to cell within the cellular network.The transfer of a mobile unit from one base stations control to another base stations control is called a handoff.

Steps involved in handoff process are:
1) Initiation
2) Resource reservation
3) Execution
4) Completion

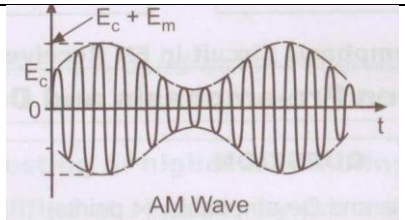
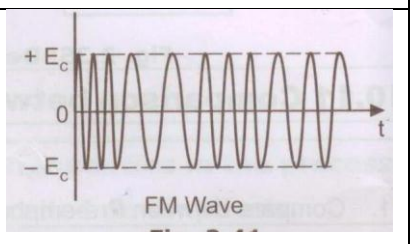


handoff scenario at cell boundary.

Q4. Attempt any FOUR of the following: 16

a. Compare AM and FM w.r.t
   i. Bandwidth
   ii. Modulation index
   iii. Waveform
   iv. Type of wave

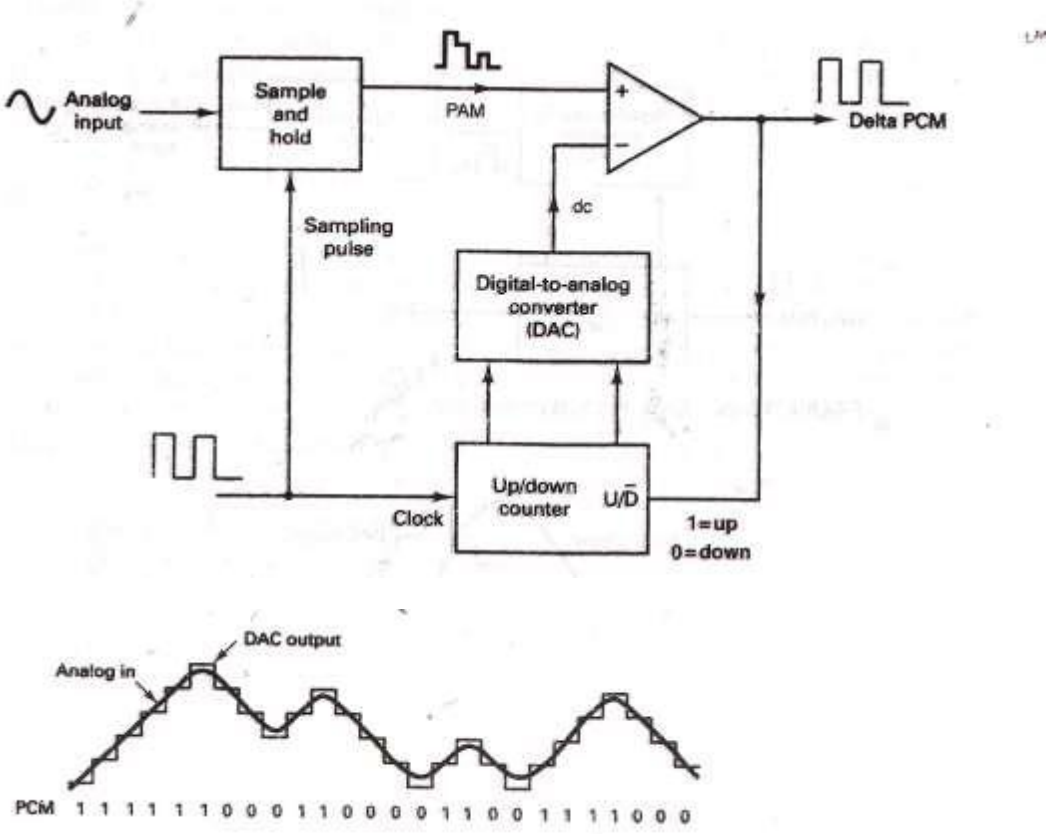
Ans: (Each point- 1 mks)

Sr. No.	Parameter	AM	FM
1	Bandwidth	$BW = 2f_m$	$BW = 2(\delta + f_{m(max)})$
2	Waveform		
3	Type of wave	Ground wave	Space wave
4	Modulation	$ma = V_m/V_c$	$mf = \delta/f_m$

	index		

b. Draw the block diagram of delta modulation. Explain working of each block.

ANS: (Block diagram- 2 mks, working – 2 mks)



Working:

1. Sample and Hold circuit:

The input analog is sampled and converted to a PAM signal.

2. **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.

3. **Up-Down counter**:

The up-down counter is incremented or decremented depending on whether the previous sample is larger
smaller than the current sample. The up-down counter is clocked at a rate to the sample rate. Therefore up-down
counter is updated after each comparison.

c. State any four frequency bands used in satellite communication along with its uplink and downlink frequencies.

Ans:

Frequency bands used in satellite communication. (any 4 bands- 4 mks)

Band Frequency

L 1.53 – 2.7 GHz

S 2.5 – 2.7 GHz
C 3.4 – 6.4 GHz
X 7.2 – 8.4 GHz
Ku 10.95 – 14.5 GHz
Ka 17.7 – 31 GHz
Q 36 – 46 GHz
V 46 – 56 GHz
W 56 – 100 GHz

d. State any four advantages of optical fiber communication over other communication system.

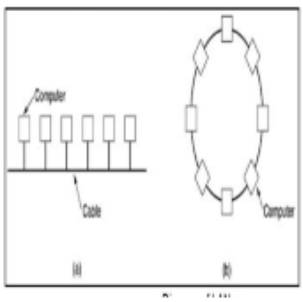
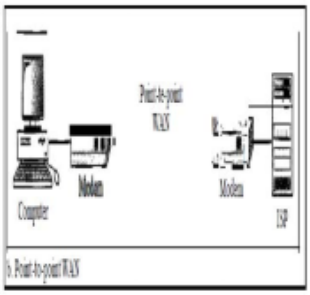
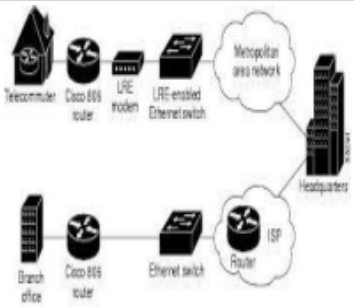
ANS: (Any 4 points- 4 mks)

Advantages of optical fiber communication over other communication system:

1) High Bandwidth
2) Light weight and small diameter
3) Low Losses
4) Less number of repeaters
5) Immune to electromagnetic interference
6) High degree of data security
7) Noise is comparatively less in optical communication
8) Lower attenuation
9) Transmission cost per bit is low
10) Controlled dispersion gives low error rate

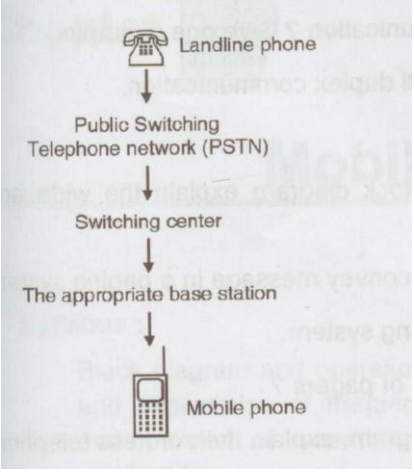
e. Compare between LAN,MAN and WAN(any four points)

Ans:- (each point- 1 mks)

Criteria	LAN	WAN	MAN
Extend of geographical area	LAN is network within a single building or campus of up to 1 kilometer.	WAN is network within countries or continent building or campus of up to few kilometers.	MAN is network within a single city or town up to 10 kilometers.
Basic structure diagram			
Speed	Highest Speed of operation Up to GBPS in some LAN Technology	Lowest Speed of Operation Range between Kbps to Few MBPs, WAN speed varies based on geographical location of the servers.	MAN network has lower speed compared to LAN.
Application	For small scale application like Home ,office, School Network	For long distance data communication like web browsing	For application limited to periphery of 10 km like Cable net

f. Describe call routing procedure of landline to mobile phone with neat diagram.

Ans:- (Proper relevant explanation- 4 mks)



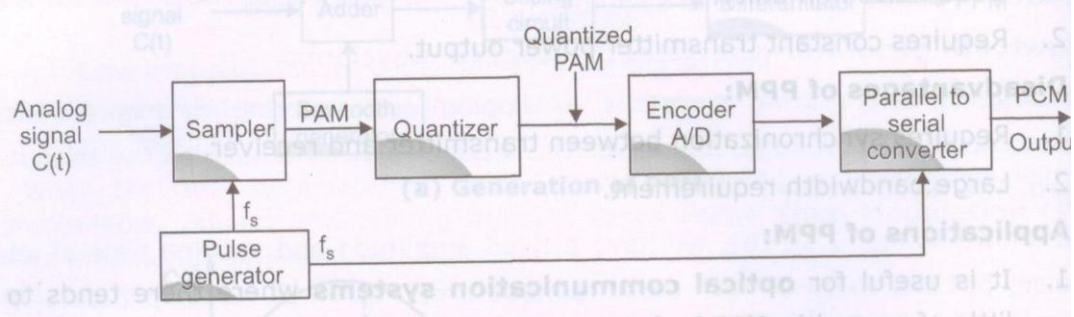
- When we turn on a cellular phone and it is yet to be engaged in a call, it will first scan the group of forward channel in order to identify the one having strongest signal and then monitors that control channel until the signal drops below a usual level.
- Then it again searches all the control channel so as to find the strongest base station signal.
- When the telephone call is placed to a mobile user, the MTSO or MSC will sent the request to all the base stations in the system.
- The subscribers telephone number called as mobile identification number (min) is then broadcast as a paging message over all the forward control channels (FCCs) in the system.
- The desired mobile receive the paging message sent by the base station and respond by identifying itself over the reverse control channel (RCC)
- The base station relays the acknowledgement sent by the mobile and inform the MTSO about the handshake.
- MTSO tells the base station to move the call to a free voice channel.

Once the call is in process, the MTSO will adjust the transmitted power of the mobile and changes the channel of mobile unit and base station and so as to maintain call quality even

Q5. Attempt any FOUR of the following (16)

a. Draw block diagram of PCM generation and state function of each block

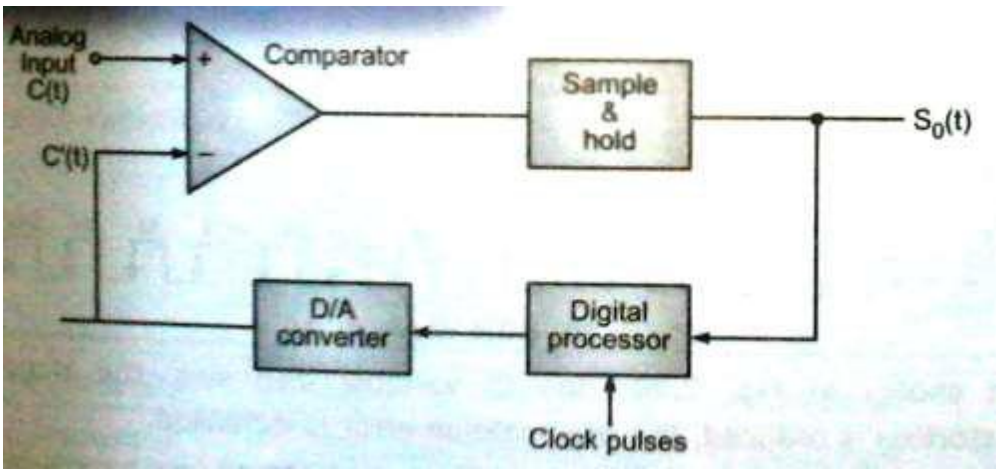
Ans : (Block diagram- 2 mks, explanation- 2 mks)



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

b. Draw the block diagram of ADM transmitter. Explain how slope overload error is reduced in ADM.

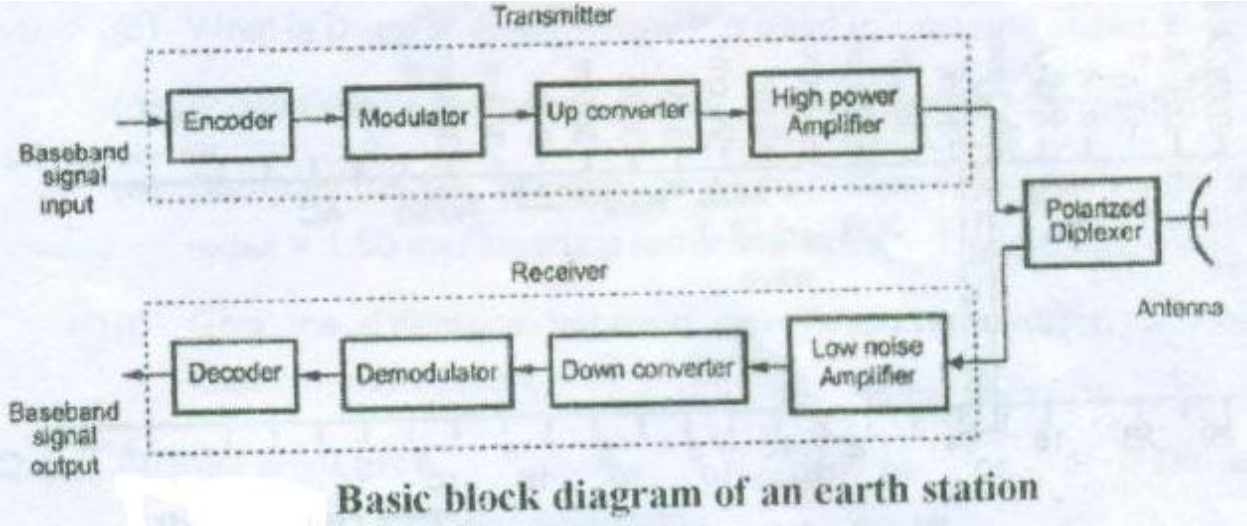
ANS: (Block diagram- 2 mks, explanation- 2 mks)



EXPLANATION- In response to the kth pulse the processor generates a step which is equal in magnitude to the step generated in response to previous i.e(k-1)th clock pulse. If c(t) >c'(t) then processor will increase the step size by ' '.If c(t)<c'(t) then processor will decrease the step size by ' '.The comparator compares the analog input c(t) and approximated signal c'(t) generated by the digital to analog converter. The sample and hold circuit holds the output of comparator which is ADM signal.

c. Draw the block diagram of an earth station.

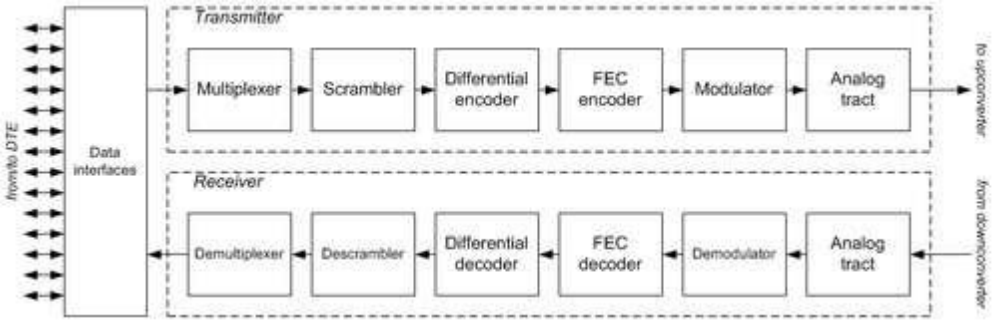
ANS: (Proper relevant diagram- 4 mks)



Basic block diagram of an earth station

d. Draw block diagram of modern and explain its working.

ANS: (Block diagram- 2 mks, explanation- 2 mks)



Working:

A satellite modem is not the only device needed to establish a communication channel. Other equipment that are essential for creating a satellite link include satellite antennas and frequency converters. Data to be transmitted are transferred to a modem from Data terminal equipment (e.g. a computer). The modem usually has Intermediate frequency (IF) output (that is, 50-200 MHz), however, sometimes the signal is modulated directly to L-band. In most cases frequency has to be converted using an upconverter before amplification and transmission.
A modulated signal is a sequence of symbols, pieces of data represented by a corresponding signal state, e.g. a bit or a few bits, depending upon the modulation scheme being used. Recovering a symbol clock (making a local symbol clock generator synchronous with the remote one) is one of the most important tasks of a demodulator.
Similarly, a signal received from a satellite is firstly downconverted (this is done by a Low-noise block converter - LNB), then demodulated by a modem, and at last handled by data terminal equipment. The LNB is usually powered by the modem through the signal cable with 13 or 18 V DC.

e. Give operation of hubs and routers in networking.

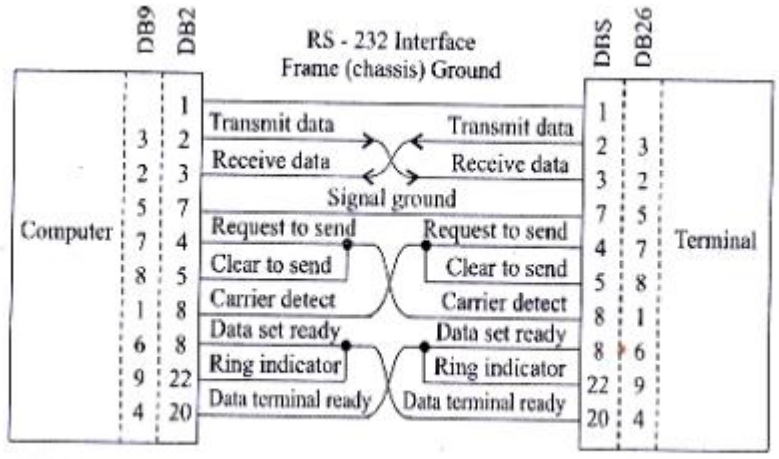
ANS: (Each two mks)

Hub: - A Hub is a connecting device. It is actually a multiport repeater. It is normally used to create connections between terminals in a physical star topology.

Router: - A Router operates at the physical, data link and network layer of OSI model. A router is useful for interconnecting two or more networks. These networks can be heterogeneous. Which means that they can differ in their physical characteristics such as frame size, transmission rates, topologies, addressing etc.

f. Draw pin configuration of RS-232 standard.(9-pin connector). Explain the function of TXD and RXD.

Ans-(Diagram- 2 mks, explanation – 2 mks)



: RS232 interface signal connections between computer and terminal

Explanation-

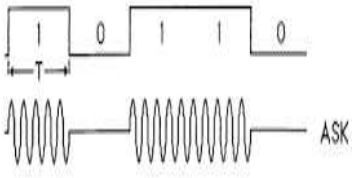
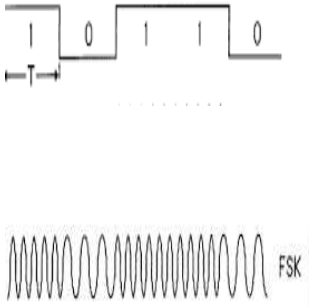
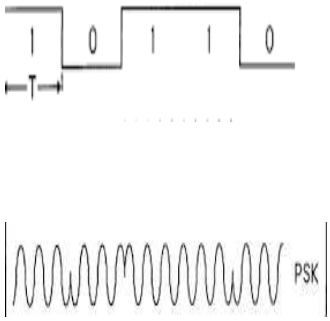
- **Transmit Data**: The serial data leaving the port travels on Transmit data line
- **Receive Data**: The bits coming in from a distant serial port go through receive data line.
- **Data Terminal Ready**: when the data terminal is able to participate in communications, it signals its readiness by applying a positive voltage on the DTR line.
- **Data Set Ready**: When the data terminal is ready to receive data, it signals its readiness by applying a positive voltage on the DSR line.
- **Request To send**: When the data terminal is on and capable of receiving transmissions, it puts a positive voltage on the request to send line. Absence of RTS signal will prevent the data set from sending out the data.
- **Clear To Send**: The data set needs to control the signal flow of from the data terminal. The CTS signal indicates to the data set that data can be sent. Absence of CTS signal will prevent the data set from sending out the data.
- **Carrier Detect**: This signal gives a modem a means of signaling the data terminal that it has made a connection with the distant modem.
- **Signal Ground**: It provides the return path to all the signals used in the serial port.

Q6. Attempt any FOUR of the following (16)

a. Compare ASK, FSK, PSK, w.r.t
   i. Waveform
   ii. Variable characteristic
   iii. Bit rate
   iv. Noise immunity

Ans:-(Each correct point – 1mks)

Parameter	ASK	FSK	PSK
Variable	Amplitude	Frequency	Phase

characteristic			
Bit rate	Suitable upto 100 bit /sec	Suitable upto 1200 bits /sec	Suitable upto 1800 bits/sec
Noise immunity	Low	HIGH	HIGH
Waveform			

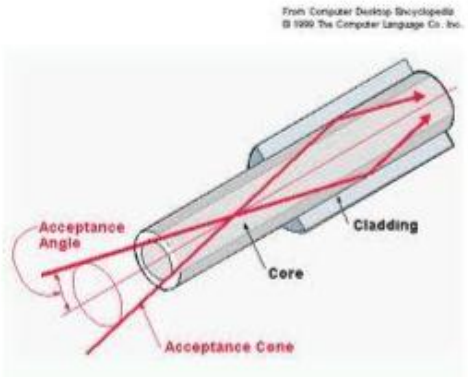
b. Describe light propagation in optical fiber with neat diagram. Define acceptance angle and numerical aperture.

ANS: Propagation of light- Light travels at the speed of $3 * 10^8$ m/sec in free space. If material denser than free space, speed of the light gets reduced. This reduction in speed as light passes from free space into the denser medium results in reflection(bending of light). (1 mks)

1) Numerical aperture : Numerical aperture is a measure of light collecting ability of a fiber. It is independent of fiber core diameter.

$NA = (n1^2-n2^2)^{1/2}$

2) Acceptance cone : Acceptance cone is defined as the range of angles for rays to be transmitted by total internal reflection within the fiber core.



(each definition 1 ½ mks)

c. State different modes of propagation in an optical fiber. Describe them with neat diagram.

ANS: (Different modes – 1 mks, description 1 mks, diagram- 2 mks)

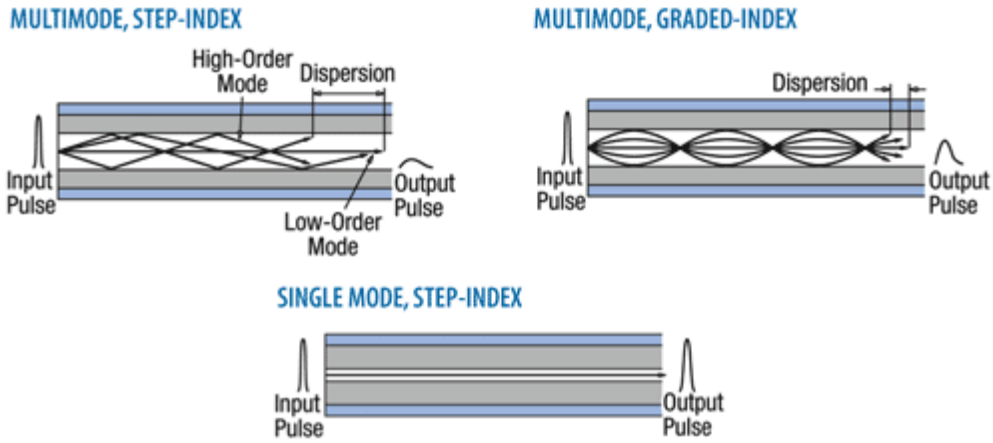
Classification of fibers is as follows;
1 .Step index fibers
i. Single mode
ii. Multimode
2. Graded index
i. Multimode

Single mode- In optical fiber technology, single mode fiber is optical fiber that is designed for the transmission of a single ray or mode of light as a carrier and is used for long-distance signal transmission. For short distances, multimode fiber is used.

Multi mode- In optical fiber technology, multimode fiber is optical fiber that is designed to carry multiple light rays or modes concurrently, each at a slightly different reflection angle within the optical fiber core. Multimode fiber transmission is used for relatively short distances because the modes tend to disperse over longer lengths (this is called *modal dispersion*) . For longer distances, single mode fiber (sometimes called *monomode*) fiber is used.

Multi mode graded index-In fiber optics, a graded-index or gradient-index fiber is an optical fiber whose core has a refractive index that decreases with

increasing radial distance from the optical axis of the fiber.

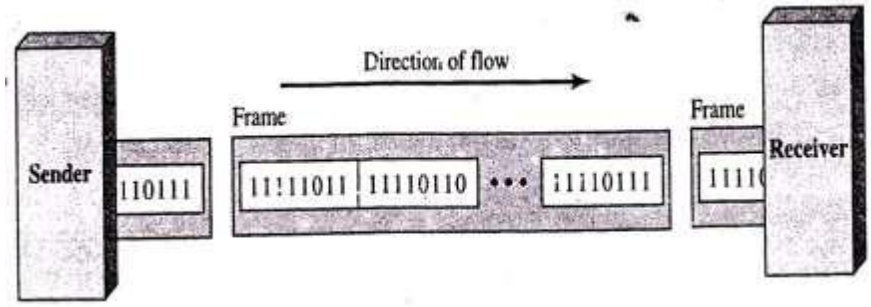


d. Explain synchronous and asynchronous mode of data transmission.

ANS: (Diagram – 1mks each, explanation- 1 mks each)

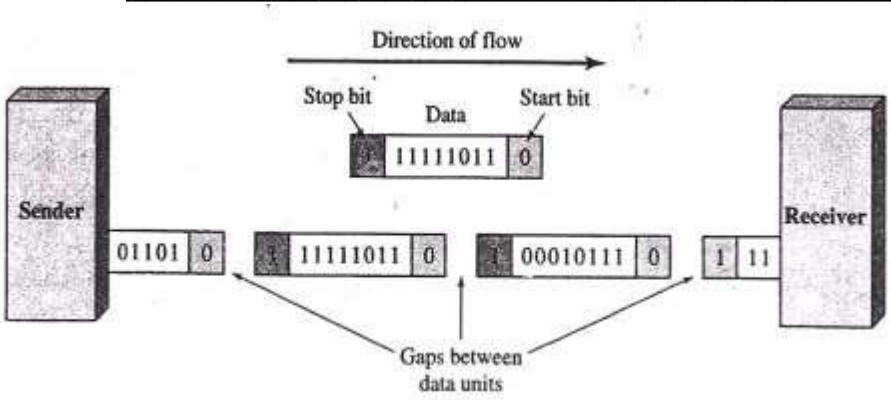
There are two types of serial data transmission.

i) Synchronous data transmission:-



It is carried out under the control of a common master clock. Here the bits which are being transmitted are synchronized to a reference clock. No start and stop bits are used instead the bytes are transmitted as a block in a continuous stream of bits. The receiver operates at exactly same clock frequency as that of transmitter. There is no gap between the frames.

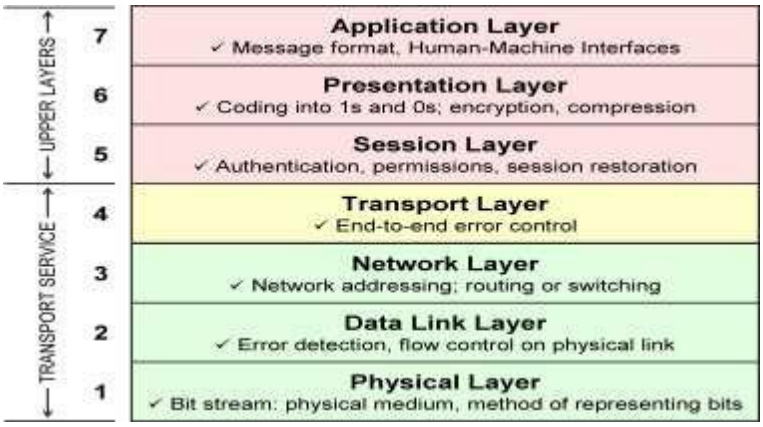
ii) **Asynchronous data transmission** :-



In asynchronous transmission the transmitter commences transmission of data bytes at any instant of time.Only one byte is sent at a time. After sending one byte, the next byte can be sent after an ordinary time delay. The transmitter and receiver operate at different clock frequencies. Start and stop bits are used along with each data byte. There are gap between two data bytes.

e. List the layers of OSI model and state function of any three layers.

ANS: (List – 1mks, any 3 functions- 3 mks)



Layer 1 – Physical:
Physical layer defines the cable or physical medium itself, e.g., thinnet, thicknet, unshielded twisted pairs (UTP). All media are functionally equivalent. The main difference is in convenience and cost of installation and maintenance.Converters from one media to another operate at this level.
Layer 2 – Data Link: Data Link layer defines the format of data on the network. A network data frame, aka packet, includes checksum, source and destination address, and data. The largest packet that can be sent through a data link layer defines the Maximum Transmission Unit (MTU). The data link layer handles the physical and logical connections to the packet's destination, using a network interface. A host connected to an Ethernet would have
an Ethernet interface to handle connections to the outside world, and a loopback interface to send packets to itself.
Layer 3 – Network: NFS uses Internetwork Protocol (IP) as its network layer interface. IP is responsible for routing, directing datagrams from one network to another. The network layer may have to break large datagrams, larger than MTU, into smaller packets and host receiving the packet

will have to reassemble the fragmented datagram. The Internetwork Protocol identifies each host with a 32-bit IP address. IP addresses are written as four dotseparated
decimal numbers between 0 and 255, e.g., 129.79.16.40.

Layer 4 – Transport: Transport layer subdivides user-buffer into network-buffer sized datagrams and enforces desired transmission control. Two transport protocols, Transmission Control Protocol (TCP) and User Datagram Protocol (UDP), sits at the transport layer. Reliability and speed are the primary difference between these two protocols. TCP
establishes connections between two hosts on the network through 'sockets' which are determined by the IP address and port number.

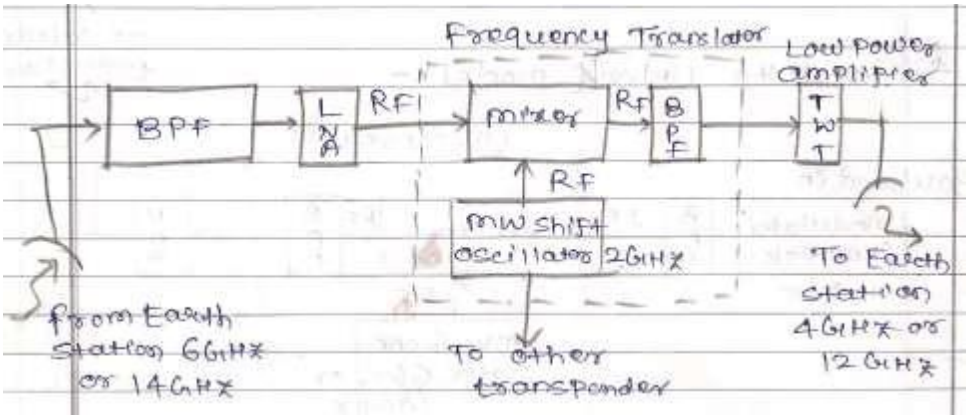
Layer 5 – Session: The session protocol defines the format of the data sent over the connections. The NFS uses the Remote Procedure Call (RPC) for its session protocol. RPC may be built on either TCP or UDP. Login sessions use TCP whereas NFS and broadcast use UDP.

Layer 6 – Presentation: External Data Representation (XDR) sits at the presentation level. It converts local representation of data to its canonical form and vice versa. The canonical uses a standard byte ordering and structure packing convention, independent of the host.

Layer 7 – Application- Provides network services to the end-users. Mail, ftp, telnet, DNS, NIS, NFS are examples of network applications.

f. Draw block diagram of transponder in satellite and explain its working.

Ans:(Diagram – 2 mks, explanation – 2 mks)



EXPLANATION-

A typical satellite transponder consists of an input band limiting device (BPF), an input low-noise amplifier (LNA), a frequency translator, a low-level power
amplifier, and an output BPF.

The input BPF limits the total noise applied to the input of the LNA. The output of the LNA is fed to a frequency translator (a shift oscillator and a BPF), which converts the high-band uplink frequency to the low0band downlink frequency.
The low-level power amplifier, which is commonly a travelling wave tube,
amplifies the RF signal for transmission through downlink to earth station
receivers. Each RF satellite channel requires separate transponders