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

Winter – 15 EXAMINATIONS

Subject Code: **17438** **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.

1A) Attempt any six of the following: (12)

i) Define the term:

1. Noise voltage:

ANS: It is the interfering and unwanted voltage in electronics device or system. It is measured in terms of SNR.

2. Noise figure:

ANS: For comparison of receivers or amplifiers working at different impedance levels the use of the equivalent noise resistance is misleading. For example it is hard to determine at a glance whether a receiver with an input impedance of 50 and Req=90 is better , from the point of view of noise , then another receiver whose input impedance is 300 and Req=400.As a matter of fact ,the second receiver is the better one as will be seen. Instead of equivalent noise resistance, a quality known as **noise figure**, sometimes called as **noise factor** is defined and used.

The noise figure is denoted by **F** and is defined as the ratio of the signal to noise power supplied to input terminals of the receiver or amplifier to the signal to noise power supplied to the output or load resistor.

ii) Give details of geostationary satellite about, location of satellite , distance ,viewing point.

ANS: (First point 1M and remaining two points 0.5 M each)

Location of satellite – In Geo synchronous or Geo stationary orbit

Distance: Approx 36000Km. From the earth surface.

Viewing point : View as a stationary object from the Earth surface

iii) State the meaning of:(Each 1M)

i) **Hub-**
ANS : Hub is amplifying & splitting device .Hub contains multiple ports & is a common connection point for connecting all segments of a LAN. When a packet arrives on a port, it is forwarded to rest of ports so that it can be sent to all other nodes in the network.

ii) Repeater in connection to network topology
ANS: Repeaters -As signals travel along a cable, they degrade and become distorted in a process called "attenuation." If a cable is long enough, attenuation will finally make a signal unrecognizable. Installing a repeater enables signals to travel farther. A repeater is a physical layer device. It receives, amplifies (regenerates), and retransmits signals in both directions.

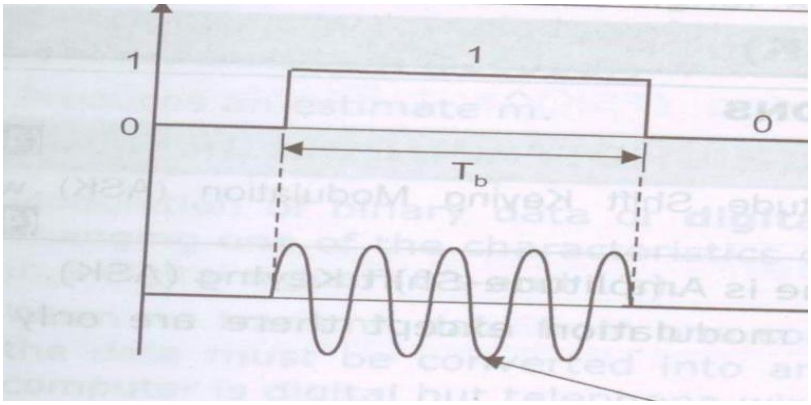
iv) Draw waveform of :

1. **ASK**
2. **FSK**

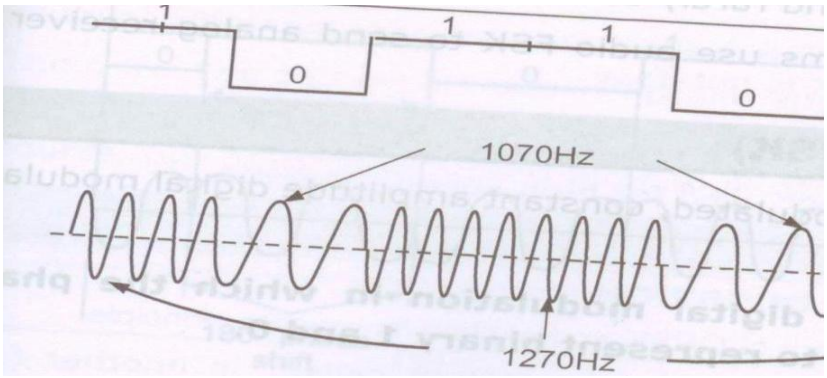
For digital data – 10110.

(Each 1M)

ANS:ASK:

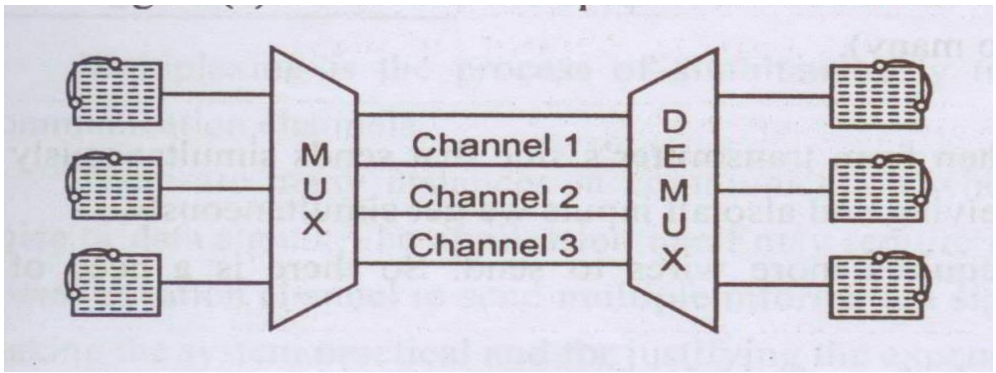


FSK:



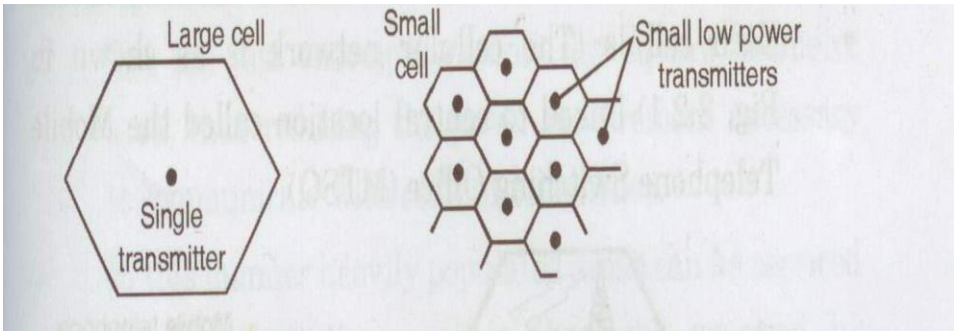
v) Draw block diagram of FDM system.
(Diagram 2M)

ANS:



vi) Draw a concept of cell pattern and cell.
(Each diagram 1M)

ANS:



vii) State two advantages of:

1.TDM

2. FDM

ANS: (Two point for each 1M)

Advantages of TDM

1) TDM system are more flexible than FDM
2) NO intermodulation distortation
3) Problem of crosstalk is not severe.
4) Full available channel bandwidth can be utilize for each channel.

Advantages of FDM

1) Simple to generate and has easy demodulation
2) It does not need synchronization between its transmitter and receiver
3) Due to slow narrow band fading only one channel gets affected
4) Large no. of signals can be transmitted simultaneous.

viii) Define uplink and down link frequency and state their values

Ans: (Each 1 M)

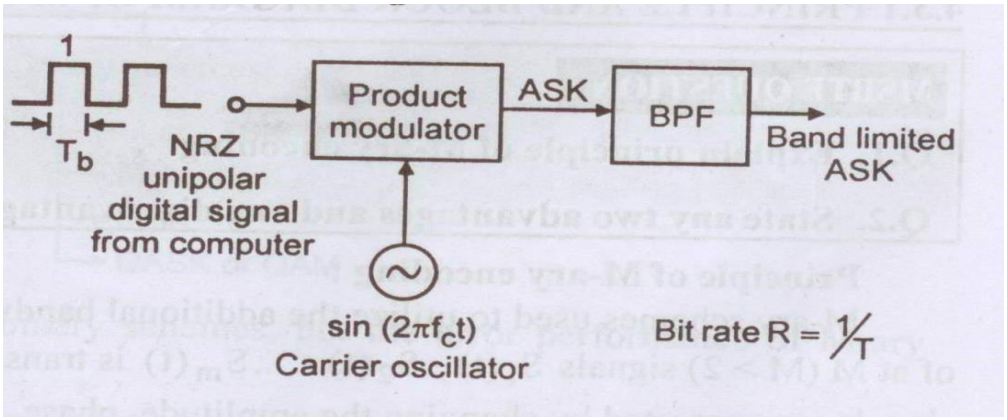
Uplink frequency:-
The signal to be transmitted such as telephone signal is converted to another signal having a particular microwave frequency by the transmitter in the earth station.
This signal is then transmitted up towards the satellite therefore the frequency of signal transmitted from earth station to satellite is called as uplink frequency
The uplink frequency is generally higher than corresponding downlink frequency.
The range of uplink frequency is 6 GHz for c band.
Downlink frequency-
The satellite receive signal coming from earth station and amplifies it, changes its frequency and radiates back to the earth

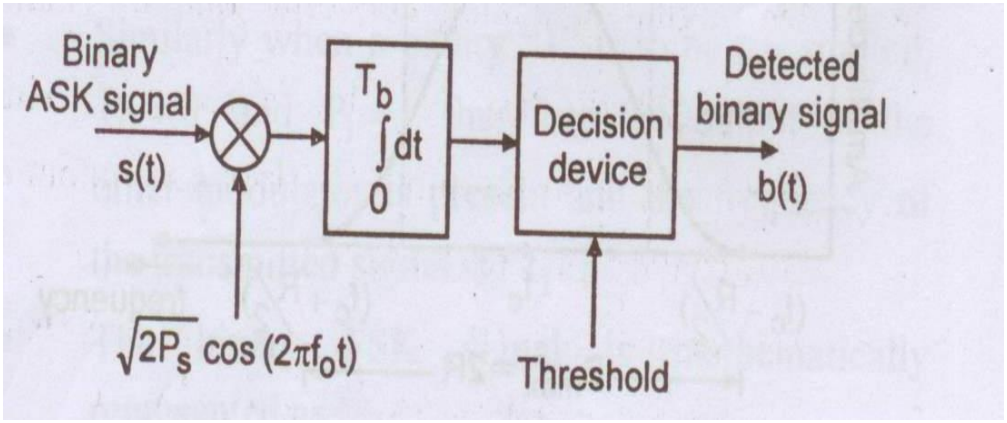
The frequency of signal transmitted from satellite towards the earth is called as downlink frequency. Uplink and downlink frequencies are different from each other to avoid interference
The range of downlink frequency is 4 GHz for c band.

b) Attempt any two of the following: (8)

i) Draw a block diagram of ASK. Also state two advantages.

ANS: (Block diagram 2M and advantage 2M)





Advantages:

1. It is simple.
2. Easy generation and detection.

ii) Define the term:
(Each 1M)

1. Co channel interference:

ANS:

Interference resulting from signal frequency which is immediately next to the desired signal Frequency is called next channel interference. Suppose the desired frequency of receiver is 90.3MHz. If it captures the frequency 91.3MHz .Transmitter then it results in next channel interference.

2. **Adjacent channel interference:**

ANS: Interference resulting from signals which are close in frequency to the desired signal is called adjacent channel interference. Adjacent channel interference results from imperfect receiver filters which allow nearby frequencies to leak in to pass band. It is serious problem can be a particularly serious if an adjacent channel user is transmitting very close range to a subscribers receiver, while receiver attempts to receive a BS on the desired channel this is referred to as near far effect. **(1 mark)**

3. **Cell spitting:**

ANS: The process of subdividing of the congested cell into smaller cells by reducing the antenna height and transmitted power is called as cell splitting. The cell splitting increases the co-channeled interference ratio reducing the interference. The channel capacity of the cells increases accordingly. The antenna height is reduced.

4. **Sectoring in connection to cellular telephone.**

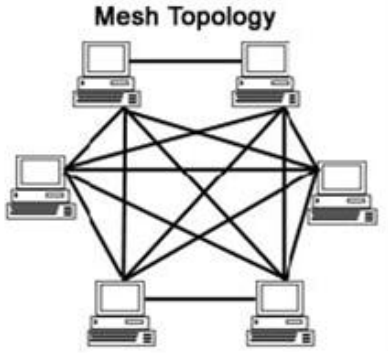
ANS: The technique used for decreasing the co-channel interference and thus improving the performance of a cellular system by using directional antenna is called sectoring. Sectoring means doing partition that is breaking of the channel used in a particular cell into sectored group.

iii) Draw diagram of:

(Each 1M)

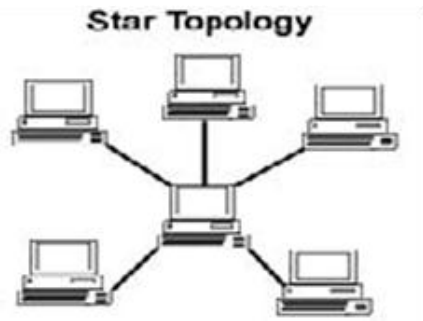
1. **Mesh**

ANS:



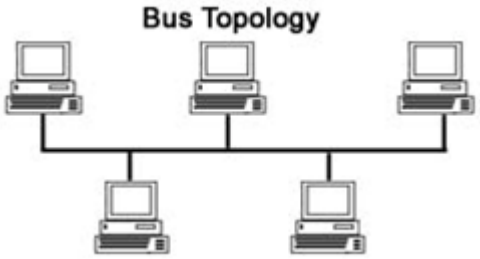
2. **Star**

ANS:



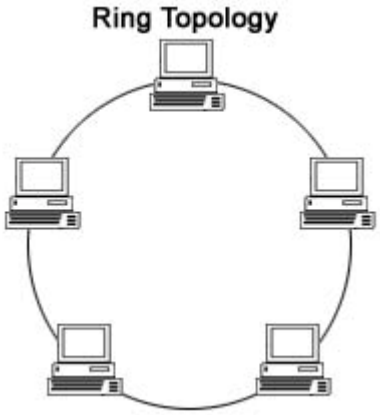
3. Bus

ANS:



4. Ring network topology.

ANS:

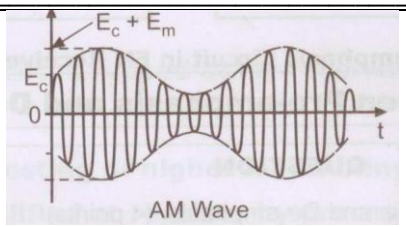
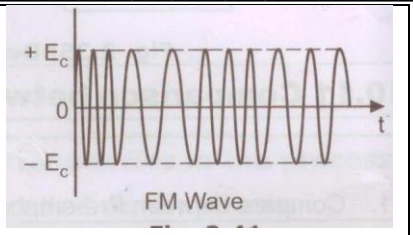


Q2. Attempt any four of the following: (16)

a) Differentiate between AM and FM on basis of definition, waveform,bandwidth, modulation index.

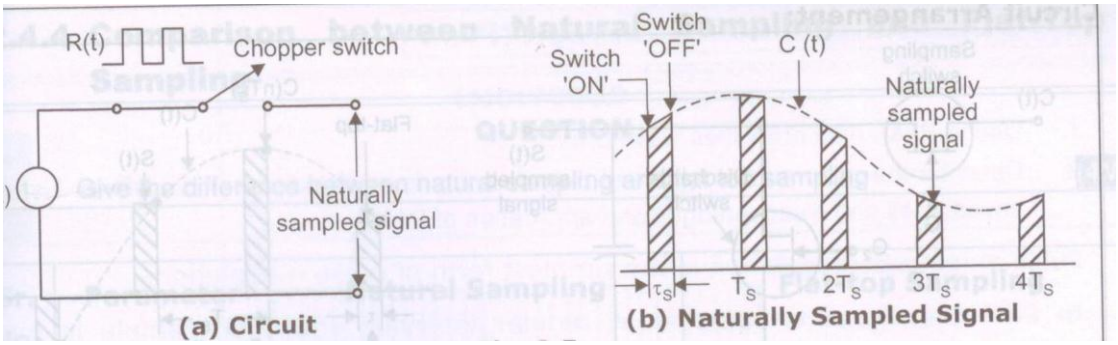
ANS: (Each Parameter 1M)

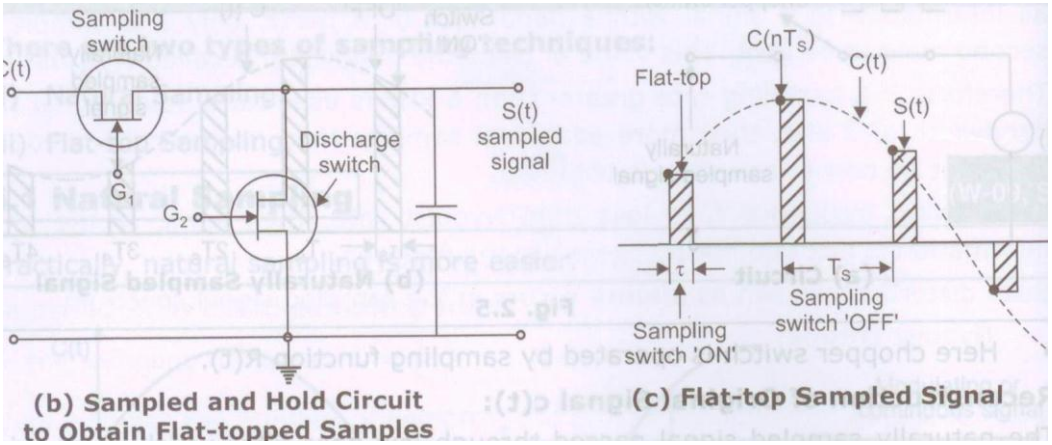
Sr. No.	Parameter	AM	FM
1	Definition	Amplitude modulation is the process in which amplitude of carrier signal varies in accordance to instantaneous value of modulating signal	Frequency modulation is the process in which Frequency of carrier signal varies in accordance to instantaneous value of modulating signal.

2	Waveform		
3	Bandwidth	$BW = 2f_m$	$BW = 2(\delta + f_{m(max)})$
4	Modulation index	$ma = V_m/V_c$	$mf = \delta/f_m$

b) Draw a block diagram of natural sampling and flat top sampling. Also draw their i/p and o/p waveform.

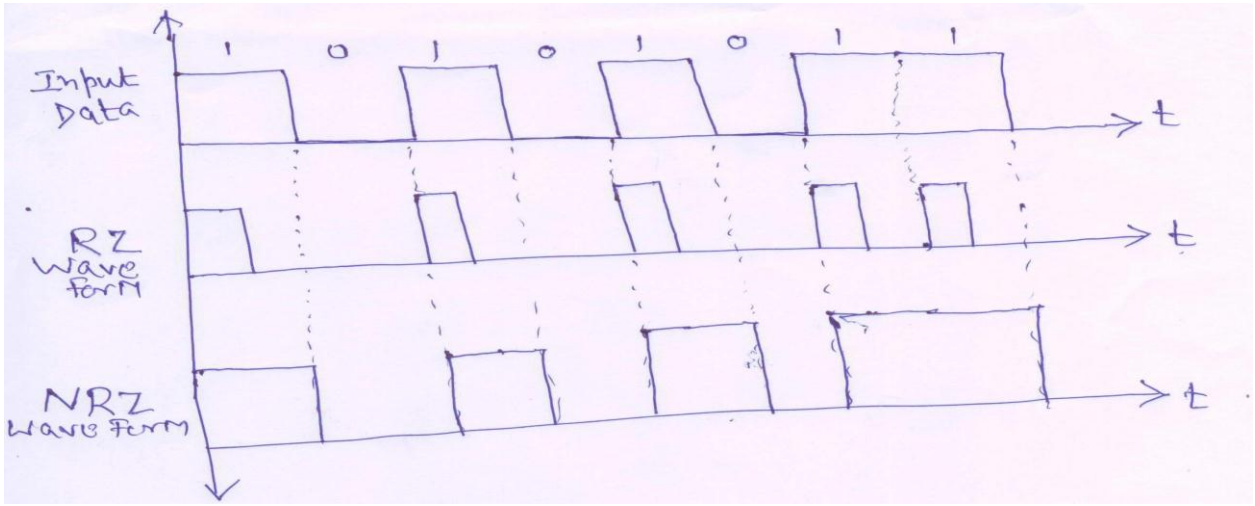
ANS: Note: Block diagram not required , (Circuit diagram 2M and Waveform 2M)





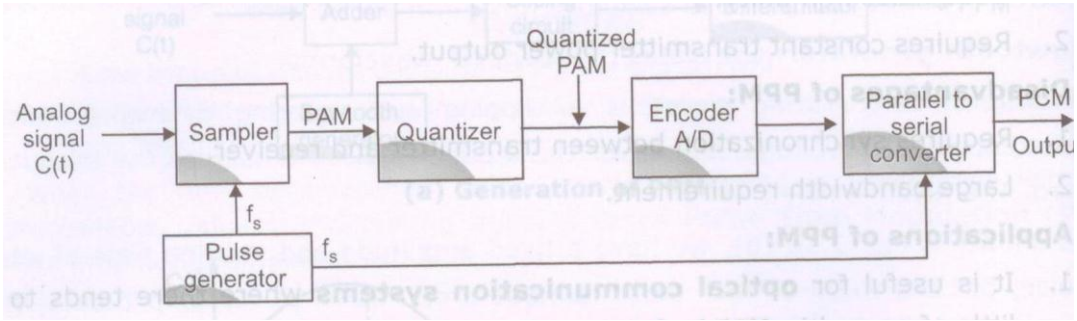
c) Draw waveform for polar RZ and NRZ for the digital data 10101011.

ANS: (Each waveform 2M)



d) With the help of block diagram explain the working principle of PCM.

ANS: (Block diagram 2 M and working principle 2M)



Working principle of PCM:-

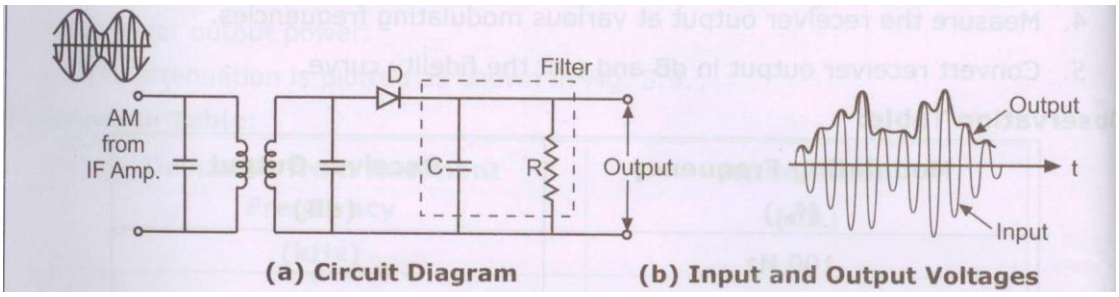
The analog signal x (t) is passed through a band limiting low pass filter, which has a cut-off frequency fc =W Hz. This will ensure that x (t) will not have any frequency component higher than "W". This will eliminate the possibility of aliasing.

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.

e) Draw AM diode detector circuit. Sate its working and draw waveform at various points such as i/p, o/p of diode. o/p of filter.

ANS: (Circuit diagram 2M Working 2M)



- The diode is the most common device used for AM demodulation.
- The simple diode detector is shown in figure.
- AM signal is applied to input of the simple detector.
- In every positive half cycle diode is in forward bias so that capacitor charges to peak the value of input voltage.
- As soon as input voltage goes below peak point voltage diode will reverse bias and capacitor discharges through R.
- Charging and discharging of capacitor repeats for each cycle that results in positive envelope of AM signal appear at output as shown in figure .
- This envelop is nothing but original modulating signal.

f) State any four advantages of pulse modulation over amplitude modulation.

ANS: (Each 1M)

1. Comparing to continuous wave modulation, the performance of all pulse modulation schemes except PAM in presence of noise is very good.

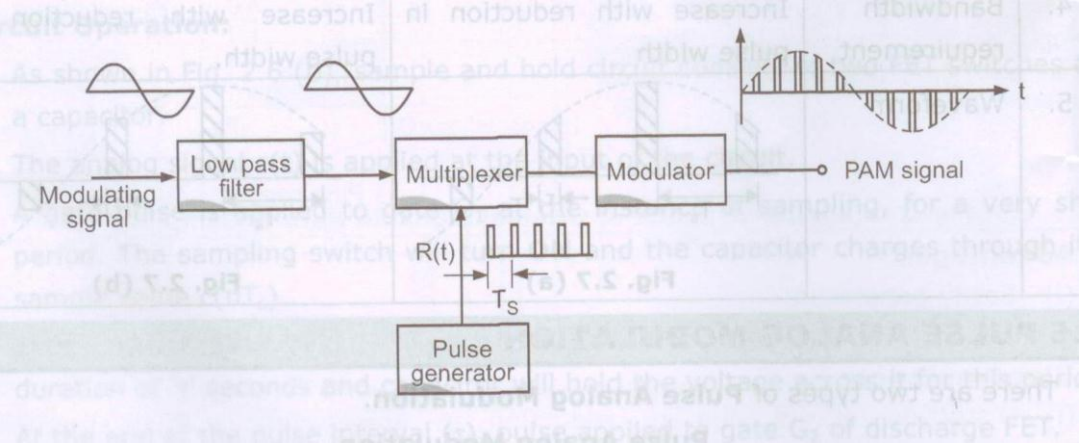
2 Due to better noise performance, it requires less power to cover large area of communication.

3. In analog pulse modulation carrier used as train of pulses so that modulated output is also in the form of pulse by varying one of the parameter such as amplitude, phase or frequency, noise is easily detected.
4. The digital pulse modulation like PCM:
   i. Robustness to noise and interference.
   ii. Efficient regeneration of the coded pulses along the transmission path and
   iii. Uniform format for different kinds of baseband signals.
5. Digital pulse modulation like delta modulation having advantage, is the simplicity of its circuitary.
6. PCM is in coded form so that is more secure.

Q3. Attempt any four of the following: (16)

a) Draw a block diagram for generation of PAM also state two advantages and disadvantages.

ANS: (Block diagram 2M advantages 1M and disadvantages 1M)



Advantages:

i. It is easy to generate and demodulate PAM.
ii. No need of synchronization.

Disadvantages:

I. The amplitude of PAM signal changes according to the amplitude of modulating signal. Therefore like AM, the effect of additive noise is maximum in PAM. The added noise cannot be removed easily.
II. The transmission bandwidth required for a PAM signal is too large as compared to the maximum frequency content in x(t).

b) If the carrier has a peak amplitude of 4V modulated by sine wave of 3V. Calculate the modulation index of AM signal.
(Formula 1M and Proper Answer 3M)

ANS: Vc = 4V

Vm = 3V

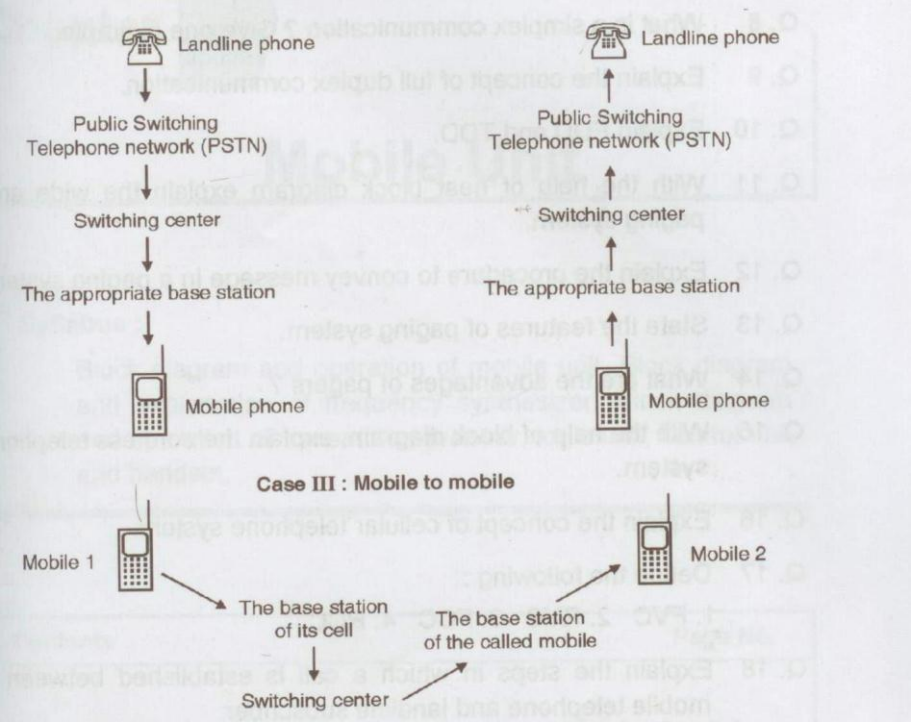
Modulation index ma = V_m/V_c

= ¾

= 0.75

c) With the help of neat sketch explain the call processing from mobile to wire line phone.

ANS: (Diagram 2M and Explanation 2M)



- 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 when subscriber moves out of the coverage area of a cell. This process is called as the handoff process.

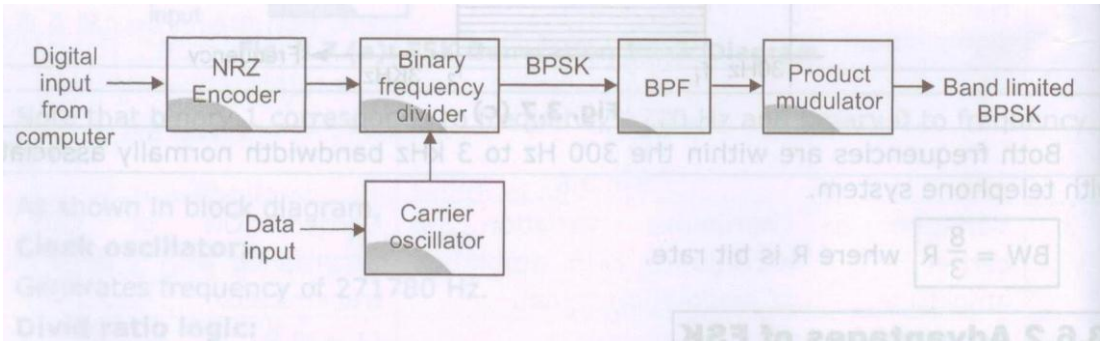
  Mobile originates a calls:

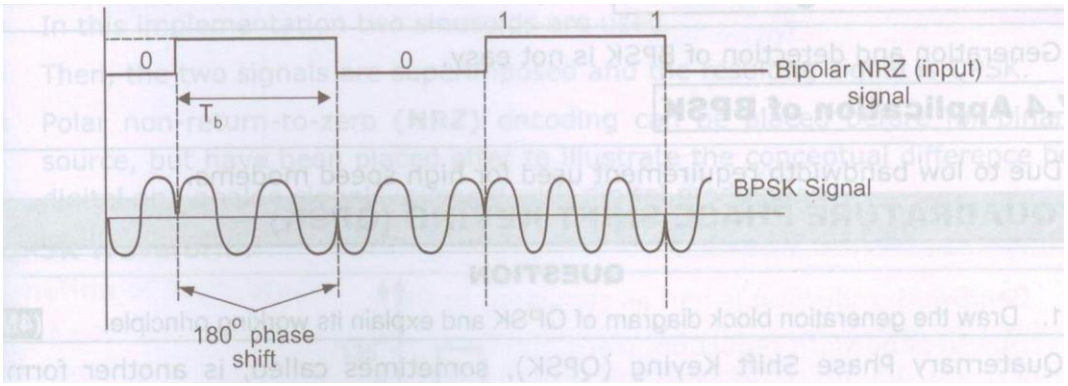
- When the mobile originates the call, then a call initiation request is sent on the reverse control channel (RCC).
- After receiving the request the mobile unit transmits its telephone number (MIN), electronic serial number (ESN) and the telephone number on the party being called.

- The mobile also sends the station class marks (SCM). This indicates the maximum power level for that particular user.
- Then base station receives this data and conveys it to MTSO which validates the request, makes connection to the party being called through PSTN and begins the conversation.

d) Draw a block diagram of BPSK generation.State its working principlewith the help of suitable waveform.

ANS: (Block diagram 1.5M, Working Principle 1.5 and Waveform 1M)





Working Principle: In PSK , as the input digital signal changes the state (i. e. from 1 to 0 or from 0 to 1), the phase of the output carrier shift between two angles that are separated by 180^0.

Generation of PSK :

- Figure shown the generation block diagram of PSK.
- NRZ encoder: This converts binary data signal (0's and 1's) into NRZ bipolar signal.
- Carrier oscillator: Generates sine wave carrier signal.
- Product modulator: Multiplies input data and carrier which results BPSK signal.
- BPF: It is bandpass filter which limits the frequency band of BPSK.

As shown in waveform, the carrier phase is changed between 0^0 and 180^0 by the bipolor digital signal.

e) Draw the circuit and waveform for emitter modulator for AM generation.

ANS: (Circuit diagram 2M Explanations 2M)

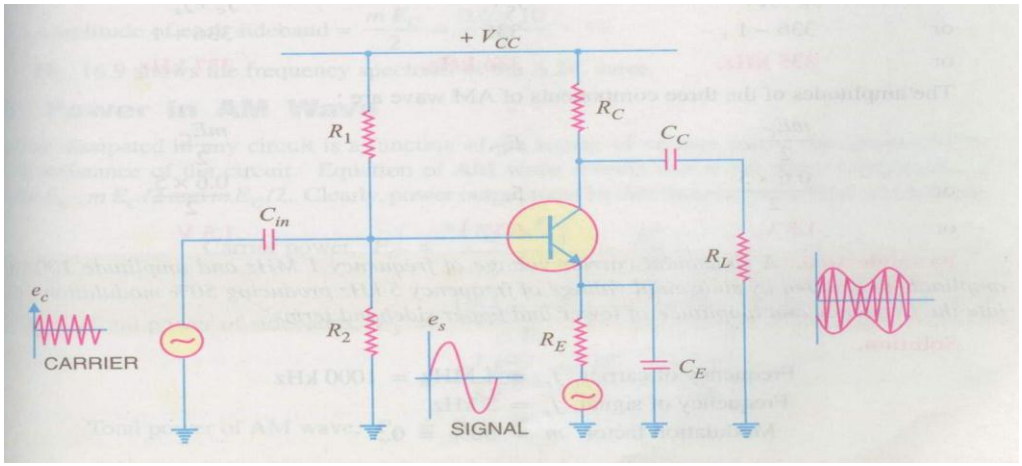


Figure shows the circuit of a simple AM modulator. It is essentially a CE amplifier having a voltage gain of A. the carrier signal is the input of the amplifier. The modulating signal is applied in the emitter resistance circuit.

Working: The carrier e_c is applied at the input of the amplifier and the modulating signal is es is applied in the emitter resistance circuit. The amplifier circuit amplifies the carrier by a factor "A" so that the output is A_{ec} . Since the modulating signal is a part of the biasing circuit, it produces low-frequency variations in the emitter circuit. This in turn causes variation in "A ". The result is that amplitude of the carrier varies in accordance with the strength of the signal. Consequently, amplitude modulated output is obtained across RL. It may be noted that carrier should not influence the voltage gain A; only the modulated signal should do this. To achieve the objective carrier should have a small magnitude and signal should have large magnitude.

f) State two advantages and disadvantages of tele medicine.

ANS: (Advantages 2M Disadvantages 2M)

Advantages:-

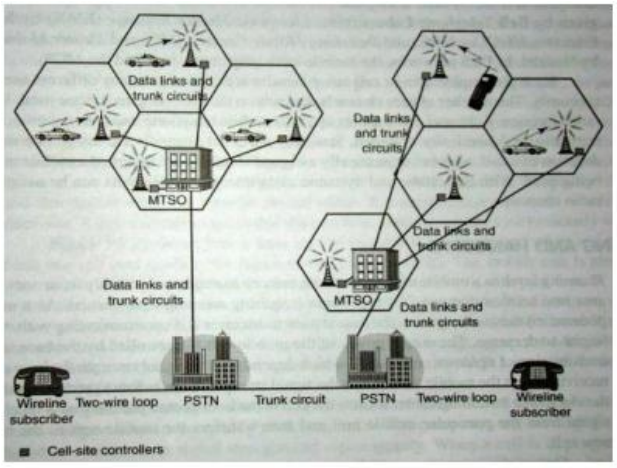
i)Doctor can attend patient at remote location without being in front of patient physically
ii)Expenses Decreases.

Disadvantages:-
i)Doctor cannot take readings by using specific instruments
ii)Lack of some clinical information
iii)It completely dependent on connectivity

4. Attempt any four of the following: 16

a) Draw a block diagram and explain the working of mobile communication system.

Ans:- (Block 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

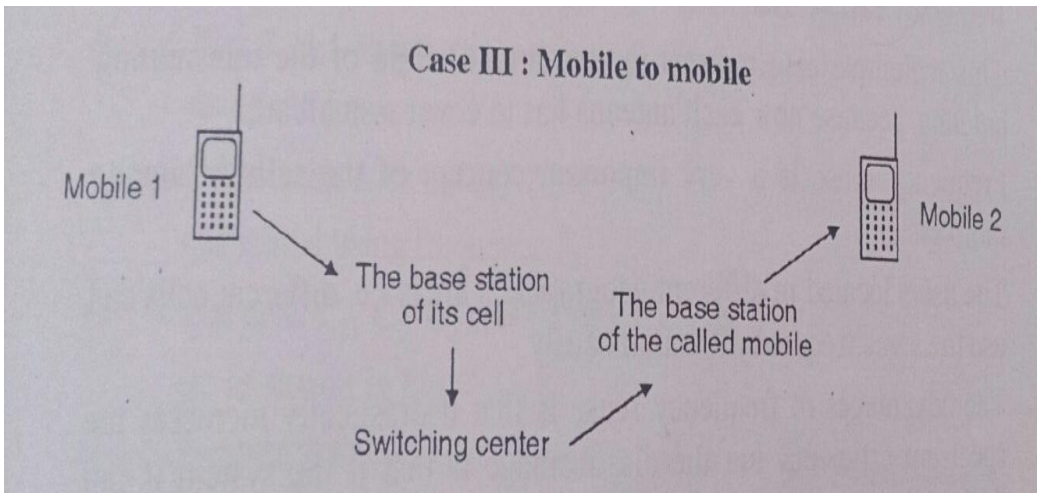
Telephone switching office (MTSO):-An MTSO controls channel assignment, call processing, call setup & call termination which includes signaling switching, supervision & allocating radio-frequency channels. The MTSO provides a centralizes administration & maintenance point for the entire network & interfaces with the public telephone network over wire line voice trunks & data links.

OR

Note :-Student can interpret block diagram in different way but it should consist basic blocks marks should be given for that also.

b) With the help of suitable sketch explain the call processing from mobile to mobile cell.

Ans:- (Sketch – 2mks, explanation- 2mks)



1The originating mobile unit initiates the call in same manner as it would for a mobile to wireline call.

2. The cell site controller receives caller identification number through reverse control channel which are then forwarded to MTSO.

3 . The MTSO sends a page command to all cell site controllers to locate destination party (which may be anywhere in or out service area)

4. Once the destination mobile unit is located , the destination cell site controller sends page request through control channel to destination party to determine of the unit is on or off hook.

5. After receiving a positive response to page , ideal user channels are assigned to both mobile units.

6. Call progress tones are applied in both the directions (ring and ring back)

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

8. If mobile subscriber wishes to initiate a call and all user channels are busy, the switch sends directed retry command instructing subscriber unit to reattempt the call through the neighboring cell.

9. If the system cannot allocate the user channels through a neighboring cell the switch transmits an intercepts message to calling mobile unit over control channel.

10. If called party is off hook ,calling party receives busy signal.

11. If called number is invalid ,the calling party receives recorded message announcing that the call cannot be processed.

c) Explain the concept of:
   i. Message confidentiality
   ii. Message integrity

Ans:- (2 mks each concept)

1) Message integrity- Is an assurance to an entity that the data has not been altered (intentionally or unintentionally) between ‘ there’ and’ here’ or between ‘then’ and ’ now’.

Message confidentiality:- It is concept related to protecting message while transmission. Two or more hosts communicate securely, typically using encryption. The communication cannot be monitored (sniffed) by untrusted hosts. The communication between trusted parties is confidential

2)

OR

Message Confidentiality OR Privacy:

- It means that the sender and receiver expect confidentiality
- The transmitted message must make sense only to required receiver.
- For others message must appear as garbage.
- To achieve message confidentiality message must be encrypted at sender side and decrypted at receiver side which can be done by using cryptography.

d) Explain the operation of:

i. Bridges ii. Routers

Ans:-Bridges-Are network devices used to connect two similar devices.

A device that connects two local-area networks (LANs), or two segments of the same LAN. The two LANs being connected can be alike or dissimilar. For example, a bridge can connect an Ethernet with a Token-Ring network. Unlike routers, bridges are protocol -independent. They simply forward packets without analyzing and re-routing messages. Consequently, they're faster than routers, but also less versatile

ROUTER:

A device that connects any number of LANs. Routers use headers and a forwarding table to determine where packets go, and they use ICMP to communicate with each other and configure the best route between any two hosts. Very little filtering of data is done through routers. Routers do not care about the type of data they handle.

Router is a device that connects two or more networks. It consists of a combination of hardware and software.

1) A router is a specialized computer connected to more than one n/w
2) Router operate at the n/w layer

3) The primary function of a router is to connect n/w together & keep layer 2 broadcast traffic under control.
4) A router is typical connected to at least two n/w commonly two LAN OR WAN or LAN and its ISP s n/w or more n/w connect.
5) Routers are located at gateways, the places where two or more n/w connect.

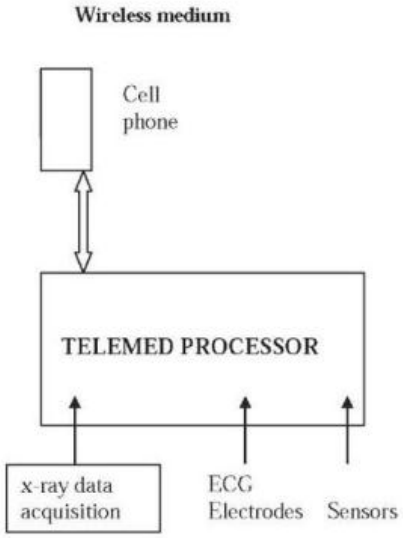
Types of Router

1) Static

2) Dynamic

e) Draw a block diagram and state the working of tele radiology.

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



Teleradiology system is a system used for sending raw data from a complete patient study to a remote location for a radiologist to make a final decision.

A teleradiology system consists of an image acquisition system, an image server to compress, and a telecommunication network to transmit the images.

The input signals are analog data from electrocardiogram (ECG) acquired from conventional chest electrodes, x-ray data from x-ray data acquisition systems, or digital data from other types of physiological sensors.

The processor is a computer that can have any amount of memory. Since the signals are from many channels, multiplexing is done to send the desired signal based on a priority scheme in a particular time instant.

Signals from the telephone are transmitted.

f) State the concept of tele psychiatry and tele dermatology.

Ans:- (2 mks each concept)

Tele psychiatry-It involves providing psychiatric theory remotely .It involves spoken conversation between consultant & patient but does not involves transmission of any test data Real time video conferencing is used for tele psychiatry. **(2 marks)**

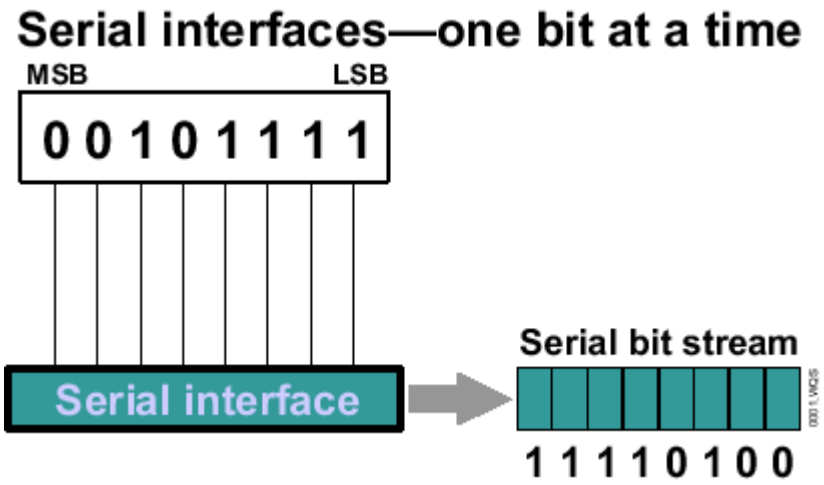
Tele dermatology- Tele dermatology is delivery of dermatologic patient care through telemedicine technologies. The dermatologist uses telecommunication equipments to evaluate clinical and laboratory data as well as diagnose and prescribe therapy for patients located at different location .Its goal is to reach underprivileged and provide services to them. It is categorized in real-time & store and forward tele dermatology. **(2 marks)**

5. Attempt any four of the following: 16 marks

a) With the help of block diagram explain the working of :
   i. Serial
   ii. Parallel mode of data transmission.

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

Serial mode-In this mode data is transmitted bit by bit /serially one after other for each clock pulse. Thus it has a single data transmission line. so data rate is slow. It is generally used for low distance data transmission and long distance communication.



Parallel mode-

Definition: Transmitting several bits of **data** simultaneously using multiple lines (8, 16, 32, and 64). The pathways between the CPU and memory are **parallel**, and they used to be **parallel** between the CPU and peripheral devices.

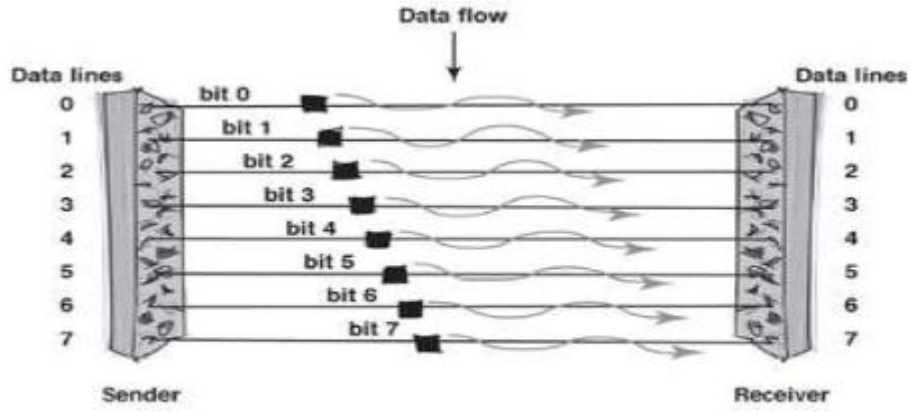


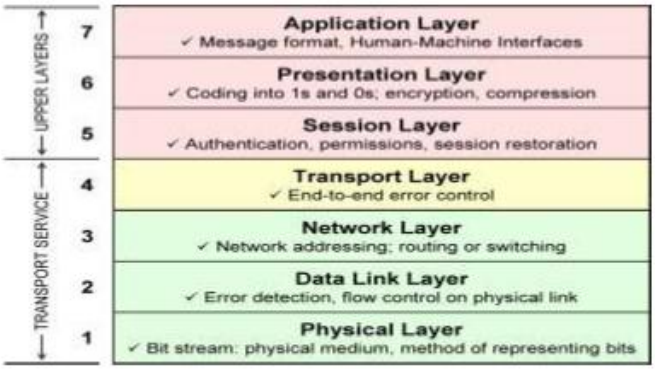
Fig. Parellel data transmission

Explanation:

- In parallel transmission, multiple **bits** (usually 8 bits or a byte/character) are sent simultaneously on different channels (wires, frequency channels) within the same cable, or radio path, and **synchronized** to a clock.
- Parallel devices have a wider data bus than serial devices and can therefore transfer data in words of one or more bytes at a time. As a result, there is a speedup in parallel transmission bit rate over serial transmission bit rate.
- However, this speedup is a tradeoff versus cost since multiple wires cost more than a single wire, and as a parallel cable gets longer, the synchronization timing between multiple channels becomes more sensitive to distance.
- The timing for parallel transmission is provided by a constant clocking signal sent over a separate wire within the parallel cable; thus parallel transmission is considered **synchronous**

b) Explain architecture of OSI model.

Ans:- (Sketch- 2 mks, explanation -2 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.

- Ethernet addresses a host using a unique, 48-bit address called its Ethernet address or Media Access Control (MAC) address. MAC addresses are usually represented as six colon-separated pairs of hex digits, e.g., 8:0:20:11:ac:85. This number is unique and is associated with a particular Ethernet device. Hosts with multiple network interfaces should use the same MAC address on each. The data link layer's protocol-specific header specifies the MAC address of the packet's source and destination. When a packet is sent to all hosts (broadcast), a special MAC address (ff:ff:ff:ff:ff:ff) is used.

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 dot-separated decimal numbers between 0 and 255, e.g., 129.79.16.40.

- The leading 1-3 bytes of the IP identify the network and the remaining bytes identifies the host on that network. The network portion of the IP is assigned by InterNIC Registration Services, under the contract to the National Science Foundation, and the host portion of the IP is assigned by the local network administrators. For large sites, the first two bytes represents the network portion of the IP, and the third and fourth bytes identify the subnet and host respectively.

- Even though IP packets are addressed using IP addresses, hardware addresses must be used to actually transport data from one host to another. The Address Resolution Protocol (ARP) is used to map the IP address to it hardware address.

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.

- TCP keeps track of the packet delivery order and the packets that must be resent. Maintaining this information for each connection makes TCP a stateful protocol. UDP on the other hand provides a low overhead transmission service, but with less error checking. NFS is built on top of UDP because of its speed and statelessness. Statelessness simplifies the crash recovery.

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:

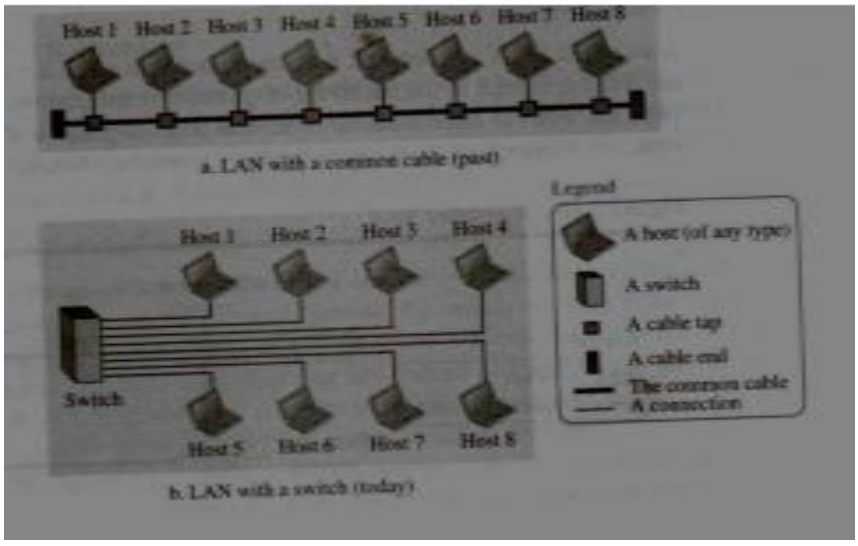
External Data Representation (XDR) sits at the presentation level. It converts local representation of data to its canonical form and vice versa. The canonical uses a standard byte ordering and structure packing convention, independent of the host.

Layer 7 – Application

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

c) Explain a short note on:
   i. LAN
   ii. WAN

Ans:-LAN



1) LAN covers a limited geographical area of few kilometers
2) Provides a high speed
3) Application is for limited distance in building or inter building data transmission, sharing resources

WAN-

1) It covers alarge area ,can operate worldwide
2) Provides a high speed
3) Used for long distance intercontinental data transmission like internet,long distance telephony etc.

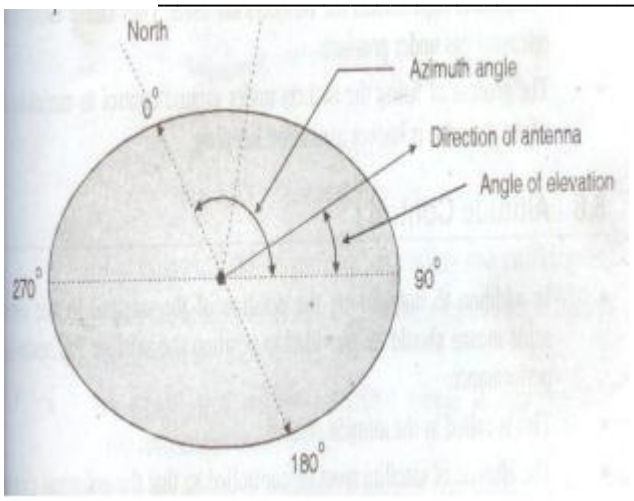
d) Define the term:
   i. Satellite orbit
   ii. Elevation angle
   iii. Foot print

Ans:- Satellite orbit-There are different types of satellite orbits-(1 ½ mks)

1. Polar orbit: A satellite orbit in which the satellite passes over the North and South poles on each orbit, and eventually passes over all points on the earth. The angle of inclination between the equator and a polar orbit is 90 degrees.
2. Inclined orbit: A satellite is said to occupy an inclined orbit around the Earth if the orbit exhibits an angle other than zero degrees with the equatorial plane.
3. Equatorial orbit: A satellite in equatorial orbit flies along the line of the Earth's **equator**.

Elevation angle- (1 ½ mks)

It is the vertical angle formed between the direction of travel of an electromagnetic wave radiated from an earth station antenna pointing directly towards the satellite & the horizontal plane.



Foot print- (1 mks)

It is coverage area on earth surface where satellite signals are available.

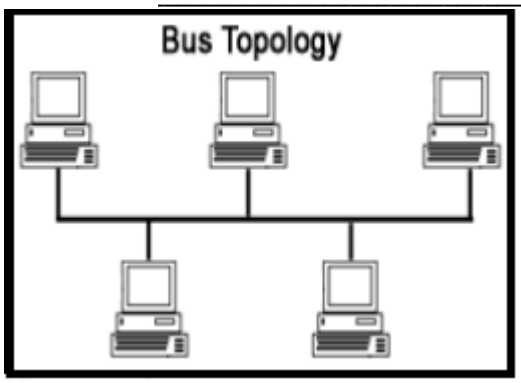
It is the ground area that its transponder offer coverage .It determines the satellite dish diameter required to receive each transponders signal.

e) State the working of:
   i. Bus
   ii. Ring topology .Also state two advantages and disadvantages.

Ans:- (Diagram- 1mks each, explanation- 1mks each)

Bus- A bus network is a network topology in which nodes are directly connected to a common linear (or branched) half-duplex link called a bus. Easy to connect a computer or peripheral to a linear bus. It requires less cable length than a star topology resulting in lower costs. It works well for small networks. Also it is easy to Extend. A host on a bus network is called a station or workstation. In a bus network, every station receives all network traffic, and the traffic generated by each station has equal transmission priority. A bus network forms a single network segment and collision domain. In order for nodes to transmit on the same bus simultaneously, they use a media access control technology such as carrier sense multiple access (CSMA) or a bus master.

If any link or segment of the bus is severed, all network transmission ceases due to signal bounce caused by the lack of a terminating resistor



Star- A ring network is a network topology in which each node connects to exactly two other nodes, forming a single continuous pathway for signals through each node - a ring. Data travel from node to node, with each node along the way handling every packet.

Rings can be unidirectional, with all traffic travelling either clockwise or anticlockwise around the ring, or bidirectional (as in SONET/SDH). Because a unidirectional ring topology provides only one pathway between any two nodes, unidirectional ring networks may be disrupted by the failure of a single link. A node failure or cable break might isolate every node attached to the ring. In response, some ring networks add a "counter-rotating ring" (C-Ring) to form a redundant topology: in the event of a break, data are wrapped back onto the complementary ring before reaching the end of the cable, maintaining a path to every node along the resulting C-Ring. Such "dual ring" networks include Spatial Reuse Protocol, Fiber Distributed Data Interface (FDDI), and Resilient Packet Ring. 802.5 networks - also known as IBM token ring networks - avoid the weakness of a ring topology altogether: they actually use a star topology at the physical layer and a media access unit (MAU) to imitate a ring at the datalink layer.

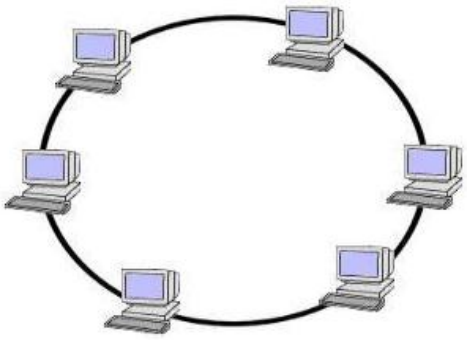
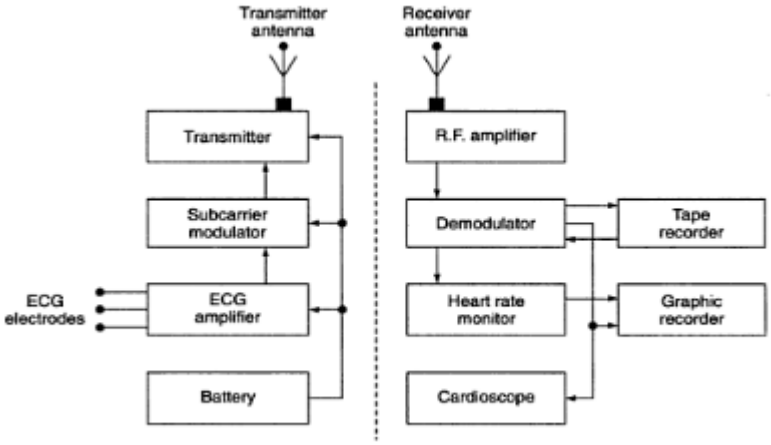


Fig. Ring Topology

f) Draw a block diagram of biotelemetry system and state the function of each block.

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



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Explanation-

It consist of mainly two parts namely telemetry transmitter & telemetry receiver .

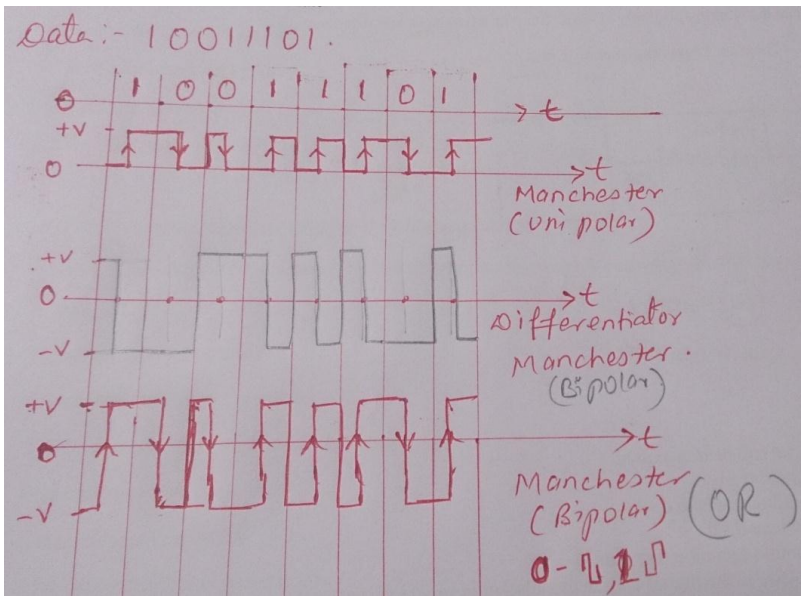
Transmitter:- signals picked up by pre gelled electrodes are amplified & modulated at frequency of 1 KHz. It is again modulated to UHF frequency. The resulting signal is radiated with of electrode lead (RL) which works as antenna .

Receiver – it uses unidirectional quarter wave monopole receiving antenna which receives signals .These signals are in turn fed to RF amplifier RF amplifier which performs RF filtering &image frequency rejection & it prevents cross coupling .The output of RF amplifier is fed to demodulator .demodulator demodulates signal & it is provided to ECG filter

6. Attempt any four of the following: 16

a) Draw the waveform for Manchester and differential Manchester technique for the digital data 10011101.

Ans:-



b) With the help of block diagram explain the working of delta modulation.

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

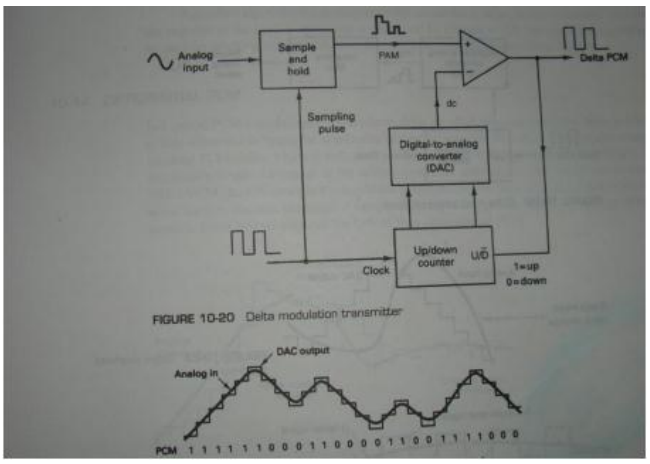


FIGURE 10-20 Delta modulation transmitter

Operation:-

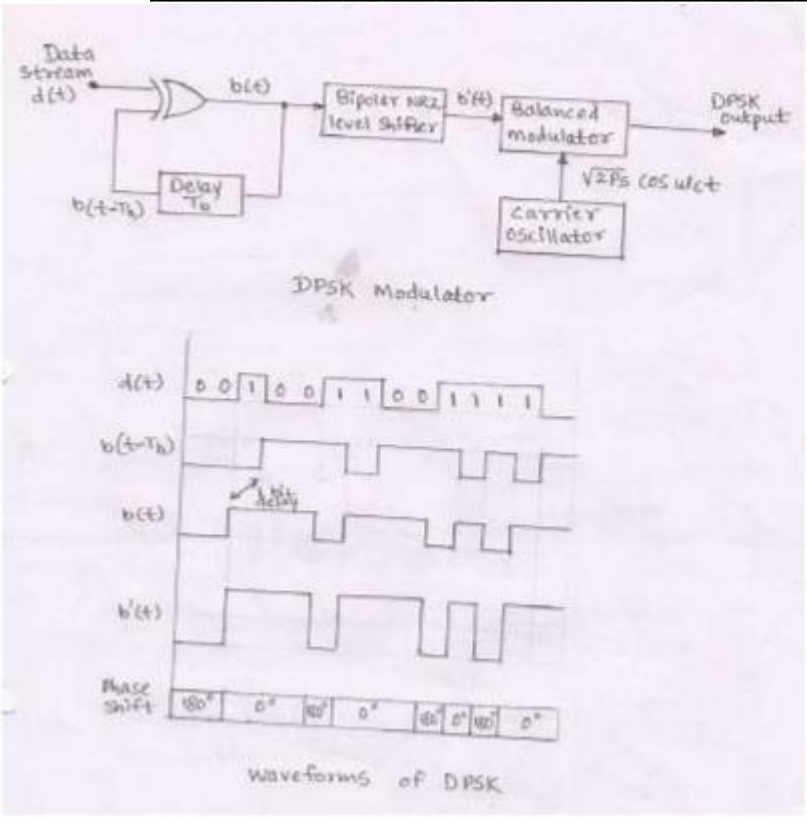
In figure above, the input analog is sampled and converted to PAM signal, which is compared with the output of DAC. The output of DAC is a voltage equal to regenerated magnitude of the previous sample, which was stored in the up-down counter as a binary number. The up-down counter is incremented or decremented 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 the sample rate. Therefore 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 a PAM signal, and compared with zero volts.

The output of 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 count of 1. The DAC now outputs a voltage equal to the magnitude of the minimum step size (resolution).With the input signal shown, the up-down counter follows the input analog signal up until the output of the DAC exceed the analog sample; then the up-down counter will begin counting down until the output of DAC drops below the sample amplitude

c) Draw block diagram of DPSK and Draw suitable i/p 7 o/p waveforms.

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

The differential phase shift keying can be treated as the non coherent version of PSK. It combines two basic operations. i) Differential encoding ii) Phase shift keying. The block diagram of DPSK modulator is shown as follows.



Operation of DPSK modulator :-

- d(t) represents the data stream which is to be transmitted. It is applied to one input of EX-OR logic gate.
- The EX-OR gate output b(t) is delayed by one bit period T_b and applied to other input of EX-OR bit. The delayed output is represented by $b(t-T_b)$

- Depending on the value of d(t) and b(t-T_b) EX-OR gate produces the output sequence b(t).
- The output of EX-OR gate is then applied to a bipolar NRZ level shifter which converts b(t) to a bipolar level signal b '(t).

b(t)	b'(t)
0	-1
1	+1

- These bipolar NRZ signal is then multiplied with the carrier signal in balanced modulator to produce DPSK signal.
- The DPSK output signal is mathematically expressed as

$V_{DPSK}(t) = b'(t) X \sqrt{2PS}\cos\omega ct$

When b(t) = 1 , b'(t) = 1 hence

$V_{DPSK}(t) = \sqrt{2PS}\cos\omega ct$

That means no phase shift has been introduced.

- But when b(t) = 0, b'(t) = -1 hence

$V_{DPSK}(t) = -\sqrt{2PS}\cos\omega ct$

Thus 180 ^{0} phase shift introduced to represent b(t)=0

d) Draw a block diagram and state working principle of TDMA system. State two advantages.

Ans:- (Any appropriate diagram- 2 mks, principle – 1 mks,any 2 advantages- 1 mks)

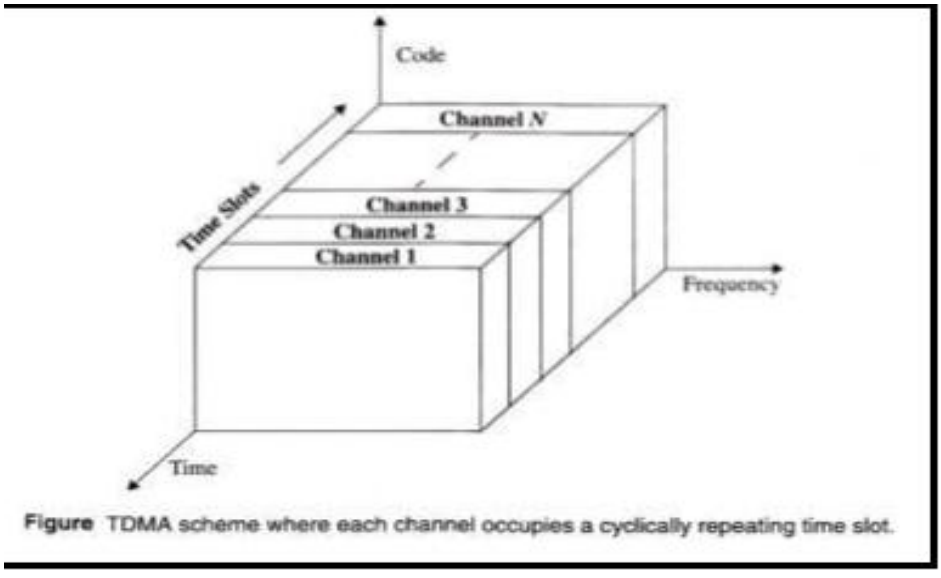


Figure TDMA scheme where each channel occupies a cyclically repeating time slot.

OR

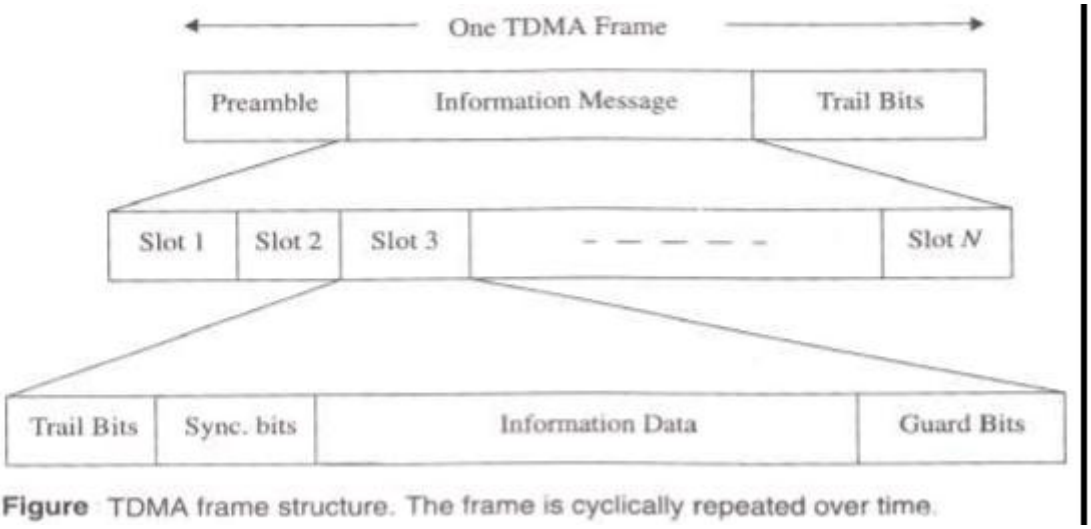


Figure TDMA frame structure. The frame is cyclically repeated over time.

Principle:

- **TDMA**- time division multiple access system divide radio spectrum into time slots & in each slot only one user is allowed to either transmit or receive.
- It can be seen that if frame consists of a number of slots. Each frame is made-up of a preamble, and information message & tail bits.
- In **TDMA**, half of the time slots in the frame information message would be used for the forward link channels and half would be used for reverse link channel. But the carrier frequencies would be different for forward and reverse links.
- **TDMA** shares single carrier frequencies with several users, where each user makes use of non-overlapping time slots.
- Data transmission for users of TDMA system is not continuous but occurs in bursts.

Advantages- (any 2 points- 1 mks)

1) Provides full power efficiency
2) Requires only guard time

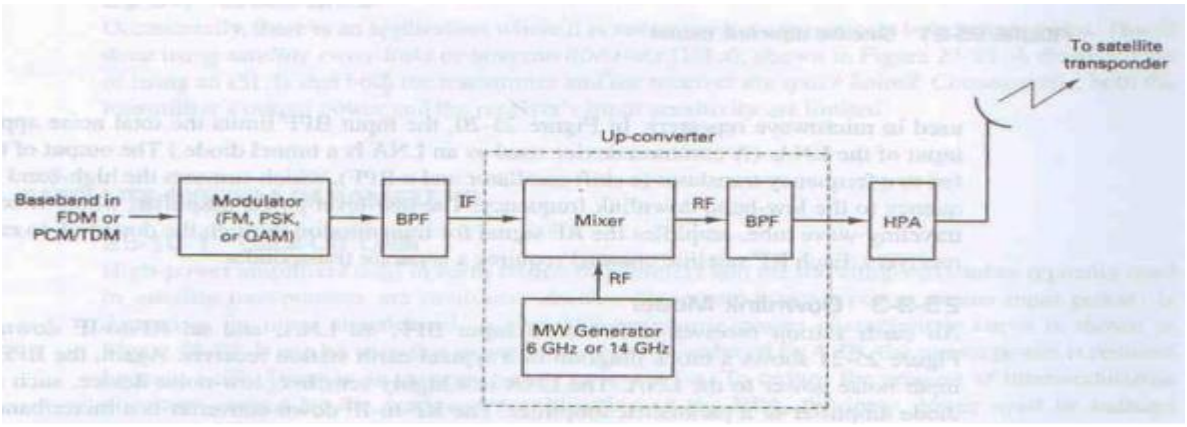
e) With the help of suitable diagram explain the working principle of Uplink model and down link model.

Ans:- (Models- 1mks each, explanation – 1 mks each)

Uplink model:-

Uplink of a satellite is a one in which the earth station is transmitting the signal and satellite receiving it.Uplink frequency range =5.9Ghz to 6.4 Ghz. (1 mks)

As seen from the block diagram of the uplink model the base band signal is modulated ,passed through selective filters . The signal is frequency up converted using mixer and passed through high power amplifier and then radiated towards the satellite using high gain narrow beam width dish antenna.



Downlink model-

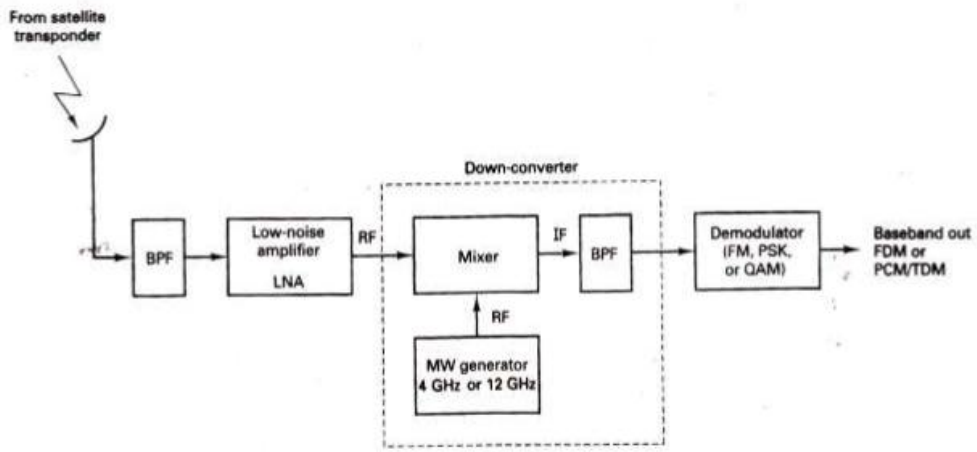


Fig. Satellite downlink model

- The amplified signal is then passed through a down convertor or mixer. The frequency of signal at the mixer output is equal to the difference between oscillator frequency and signal frequency.
- The BPF only selects IF frequencies to pass through it.
- The IF is then applied to a demodulator which demodulates it and then to de multiplexer which separates it from the remaining multiplexed signals.
- A parabolic reflector horn type antenna is used for transmitting as well as receiving the signals. Thus it can receive the downlink signals from the satellite or can send uplink signals to the satellite.
- The received signal is routed to the receiver via a special microwave device called diplexer. It couples the antenna output signals only to the receiver input and isolates the receiver into from the transmitter output.
- The received signal is then passed through a band pass filter which allows only the downlink frequency signal to pass through to LNA.
- A low noise amplifier (LNA) is a specially designed amplifier that produces a very low noise voltage. It operates at extremely low temperatures to minimize thermal noise generation.

f) State two advantages and disadvantages of CDMA over FDMA.

Ans:-Advantages

1) Sharing of both bandwidth and time
2) No synchronization required
3) Full power efficiency is possible
4) More security

Disadvantages-

1) Performance is affected because of adjacent time and frequency slots
2) Code words are required by group stations.
3) Requires both guard time and bands.
4) Due to frequency hopping the effect of adjacent channels becomes less.