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

Q.1 [A] Attempt any SIX: 12M

(a) State any four advantages of pulse modulation over continuous wave modulation

Ans: **(Any 4 valid points ½ Marks each)**

Advantages:

- Transmit modulated signal with low loss.
- Avoid interference with other communication.
- Make receiving antennas quite small.
- Multiplex signals.
- Increase channel allocations.
- Have better noise immunity

(b) Define (i) footprint (ii) station keeping.

Ans: **(Correct definition 1 Mark each)**

Definition:

Footprint: Earths reference area illuminated by the satellite antenna.

OR

The footprint of a satellite is the earth area that the satellite can receive from or transmit to.

Station Keeping: The control signals that are to be generated on ground to keep the satellite in position is called station keeping.

(c) A 400 watts carrier is modulated to the depth of 75%.Calculate the total power in the modulated wave

Ans: **(correct formula 1 Mark, 1/2 Mark for substitution ½ Mark for correct answer)**

Given: Pc=400 watts m=0.75

$P_t = P_c[1+m^2/2]$

$= 400[1+(0.75)^2/2]$

Transmitted power P_t= 512.5 watts.

(d) What is line or data encoding technique ? state its characteristics.

Ans: (1 Mark for definition and 1/2 Mark for any two characteristics)

Definition:

The manner in which data bits (0,1), or blocks of data bits, are represented on a line(communication channel) is called line coding.

Characteristics:

- Transmission bandwidth.
- Error detection and correction capability.
- Ease of detection and decoding.
- Transparency.
- Power efficiency.

(e) Draw sketch of bus and star topology. State its advantages and disadvantages.

Ans: (½ Mark for each diagram ½ Mark for writing 1 advantage, ½ Mark for writing 1 disadvantage for either bus or star topology)

Star topology:

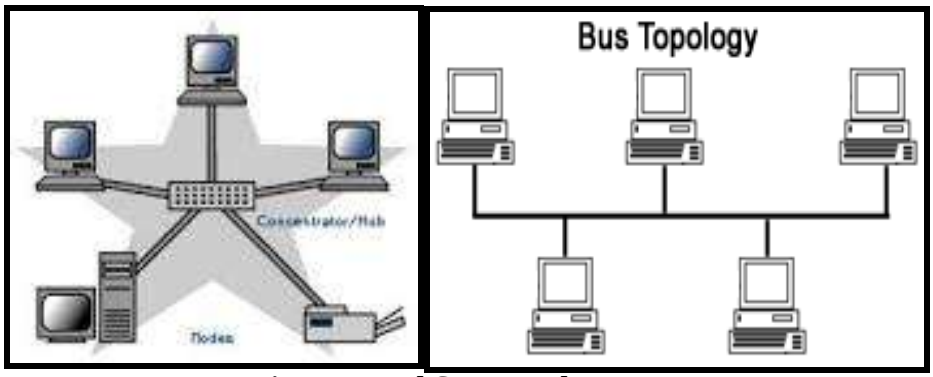


Fig: Bus and Star topology

Advantages of star topology:

1) Addition and deletion of nodes is easy
2) Easy troubleshooting

Disadvantage of star topology:

1) Failure of hub causes whole network failure
2) More expensive than bus topology

Advantage of bus topology:

1) Easy to use and understand
2) Simple topology

Disadvantage of bus topology:

1) Difficult to troubleshoot
2) Failure of backbone cable causes whole network failure

(f) Define (i) Total internal reflection (ii) Numerical Aperture

Ans: (1 Mark for each correct definition)

Definition:

Total Internal reflection: When the angle of incidence is greater than the critical angle the entire light is reflected back in the same medium (core),no light is refracted in other medium(cladding) is called total internal reflection.

Numerical Aperture: This parameter determines the quantity of light coupled from source to fiber from various angles

OR

Numerical Aperture represents a figure of merit used to find light gathering capability of fiber from various angles

(g) What is multiplexing? State its significance in telecommunication.

Ans: (1 Mark for multiplexing definition and 1 for significance)

Multiplexing:

Simultaneous transmission of multiple messages (more than one) over a channel(medium of transmission) is known as multiplexing.

Significance:

Multiplexing in telecommunication helps in reducing number of channels needed This reduces the cost of installation and maintenance of more channels.

(h) State sampling theorem and Nyquist rate.

Ans: (1 Mark each for correct definition)

Sampling Theorem:

If the sampling rate in any pulse modulation system exceeds twice the signal frequency the original signal can be reconstructed in the receiver with minimal distortion.

fs>=2fm (**1/2 mark can be given**)

Nyquist Rate:

It is the minimum sampling rate required to represent the continuous signal c(t) in its sampled form.

fs =2fm (**1/2 mark can be given**)

[B] Attempt any TWO : 08 M

(a) Draw the generation block diagram of BPSK. State its working with waveform.

Ans: **(2 Marks B.D, 1 Mark explanation, 1 Mark i/p o/p waveform)**

Diagram:

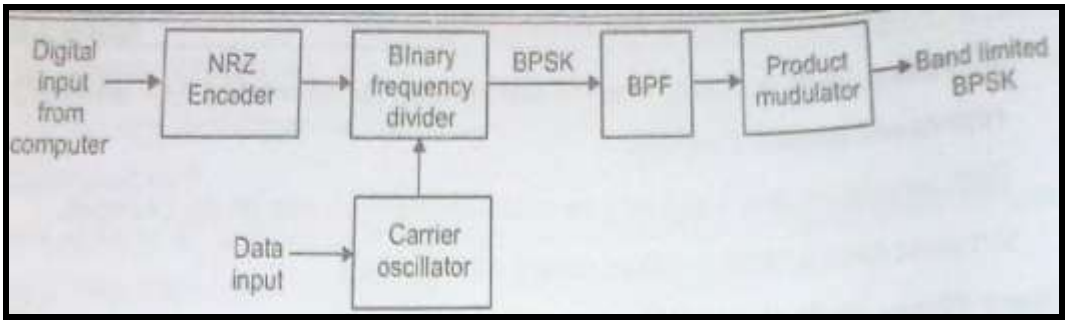


Fig: Block diagram of BPSK

Working:

- **NRZ Encoder:**

  This converts binary data signal (0's and 1's) into NRZ bipolar system**.**

- **Carrier Oscillator:**

  Generates sine wave carrier signal.

- **Product Modulator:**

  Multiplies input data and carrier which results BPSK signals.

- **BPF:**

  IT is band pass signal which limits the frequency band of BPSK.

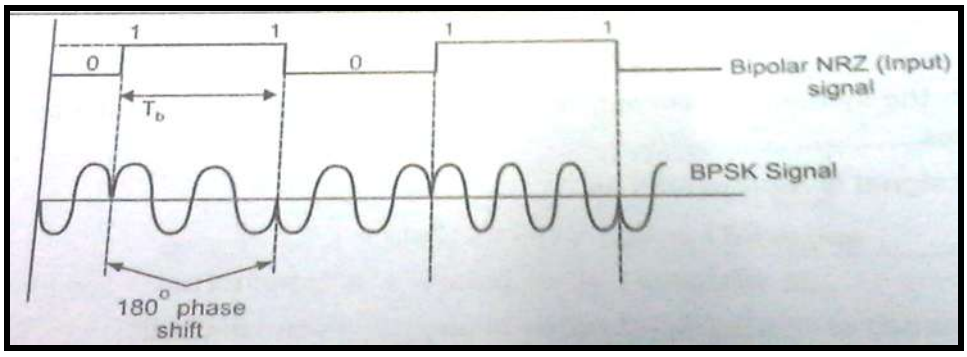


Fig: BPSK input output waveform

(b) Draw the waveform for binary data 1001101 using following encoding techniques :

(i)Polar NRZ-L

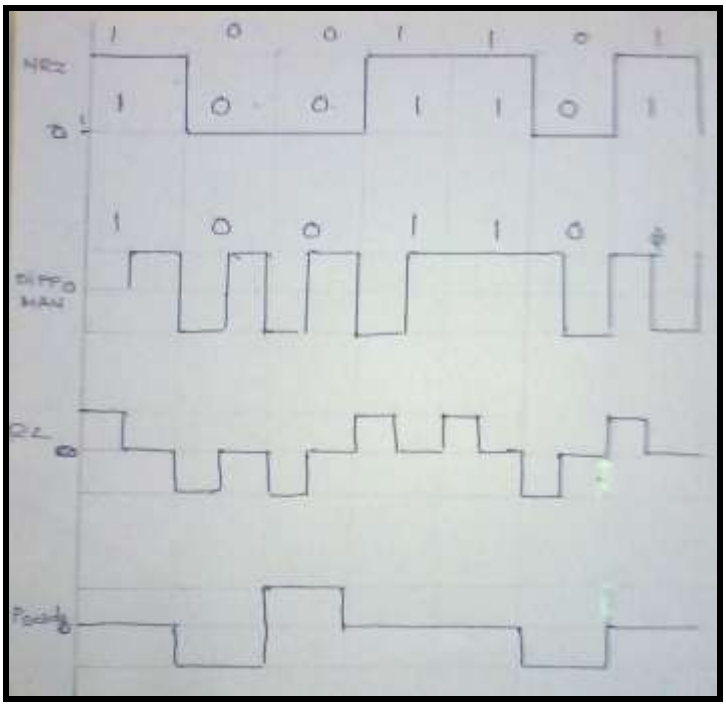
(ii)Differential Manchester

(iii)Bipolar RZ

(iv)Pseudoternary

Ans: : **(1 Mark each coding)**

Diagram:



(c) Draw the circuit diagram of diode detector. State its working with waveform.

Ans: (1 Mark circuit Diagram, 2 Mark Explanation, 1 Mark waveforms)

Diagram:

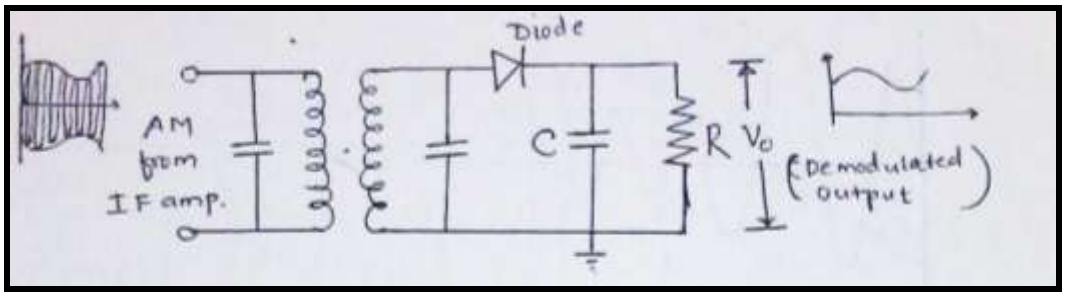


Fig: Diode detector

Explanation:

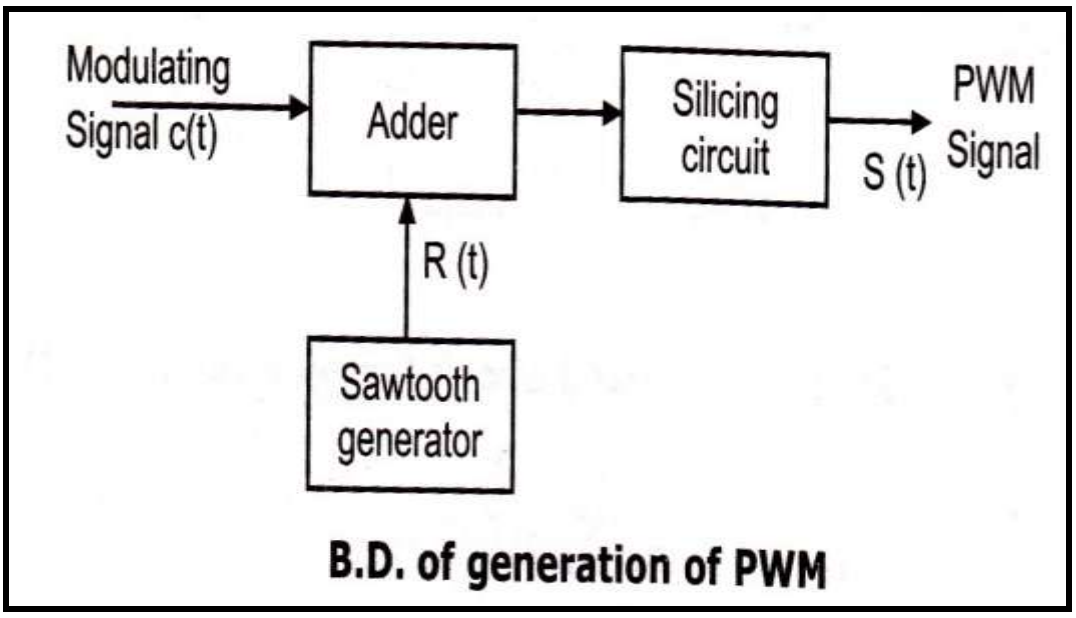
- C is a small capacitance and R is large resistance.
- Parallel combination of R and C is the load resistance across which output is developed
- For each positive half cycle of input RF, carrier signal, diode is forward biased and capacitor C charges up to peak voltage $V_{s.}$ of input signal.
- Between peaks of positive half cycle of input cycle, capacitor discharges through R. again for next positive half cycle C starts charging.
- As a result of this voltage V_o is a modulating signal with RF ripples.
- Time constant RC, while discharging of capacitor should be slow enough to keep RF ripple as small as possible, but sufficient fast for detector circuit to follow fastest modular variations.

Q.2 Attempt any FOUR: 16M

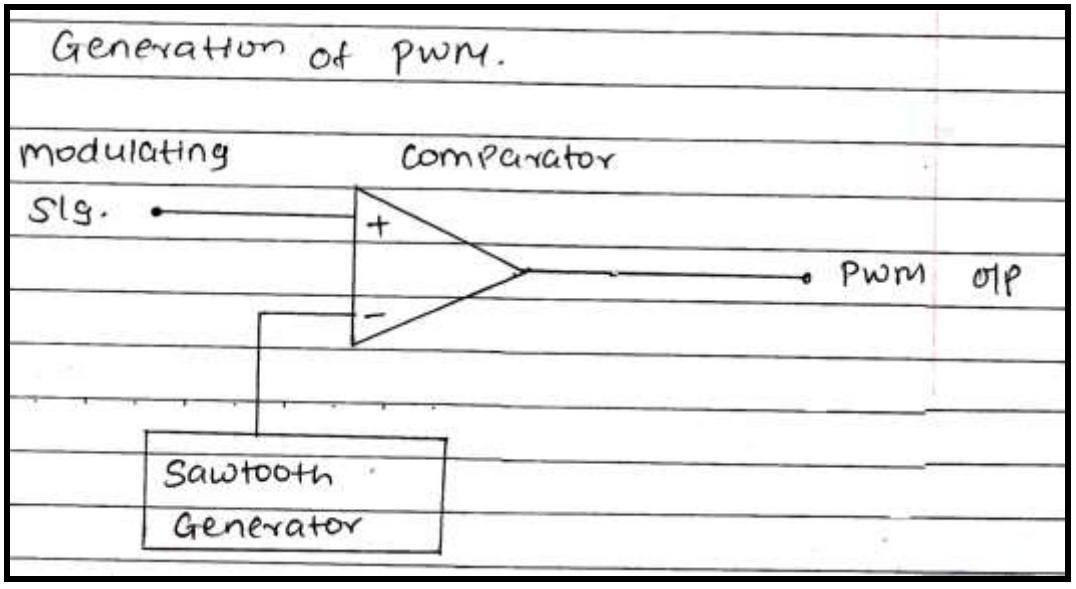
a) Draw generation block diagram of PWM and its working principle.

Ans: (Block Diagram: 2Marks, Working Principle: 2Marks)

Diagram:



OR



Working principle:

- 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.

b) Draw the circuit diagram of FM using varactor diode and write its working principle.

Ans: (Circuit diagram-2Marks, Working principle-2Marks)

Diagram:

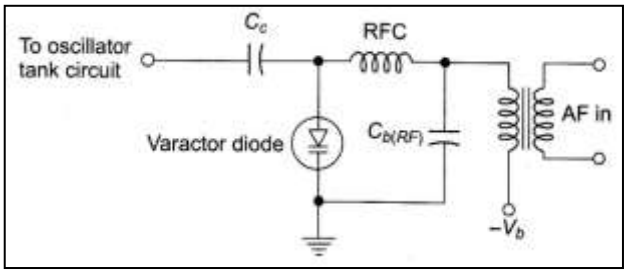


Fig: FM using varactor diode

Working:

- A varactor diode is a semiconductor diode whose junction capacitance varies linearly with the applied voltage when the diode is reverse biased.
- The varactor diode is reverse biased through voltage V_b to provide the junction capacitance effect.
- The modulating AF voltage appeals in series with the negative supply voltage.
- Hence the voltage applied across the varactor diode varies in proportion with the modulating voltage.
- This will vary the junction capacitance of the varactor diode. The varactor diode appears in parallel with the oscillator tuned circuit.
- Hence the oscillator frequency will change with the change in varactor diode capacitance and FM wave is produced.
- The RFC will connect DC and modulating signal; to the varactor diode but it offers very high impedance at high frequency.
- Therefore the oscillator circuit is isolated from the DC bias & modulating signal.

c) Block diagram of FDM system. State its advantages & disadvantages.

Ans: (Diagram:2 Marks, Advantages- 1 Marks,Disadvantages:1 Marks)

Diagram:

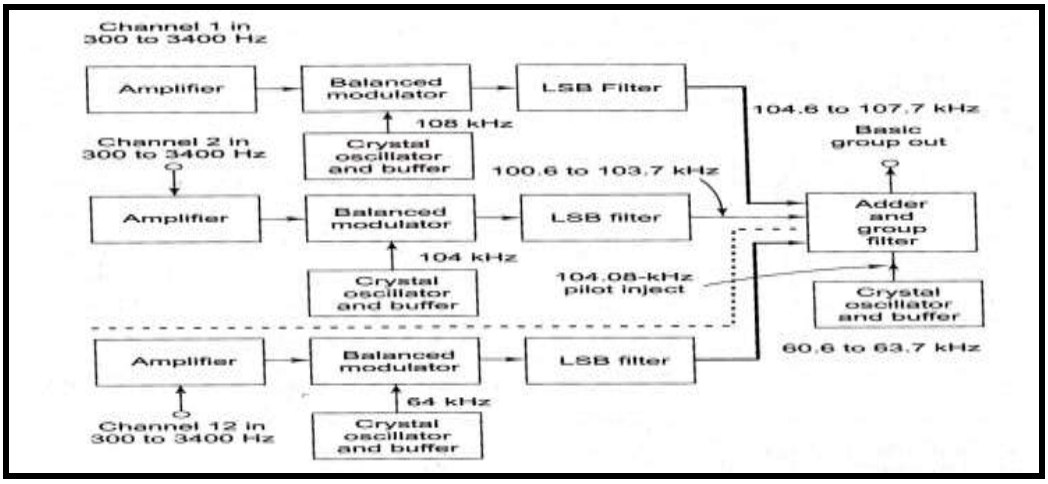
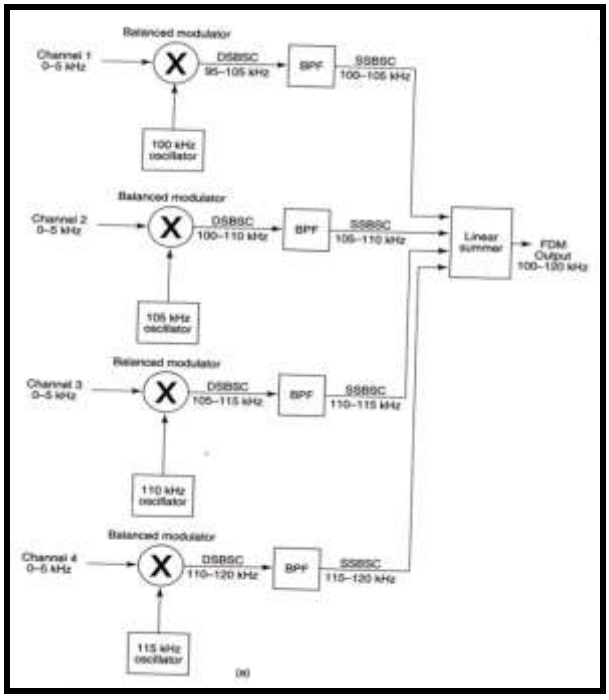


Fig: FDM system

OR



Advantages : 1). Very simpler to important
2). Used for analog Signal.

Disadvantages : 1) Large Bandwidth Require
2) Used at Low speed channel
3) Low Rate

d) State Advantages and Disadvantages of Geostationary satellite.

Ans: (Advantages 2 Marks, Disadvantages 2 Marks)

Advantages:

- Geostationary satellite remains almost stationary in respect to given earth station. Consequently, expensive tracking equipment is not required at the earth stations.
- 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.
- 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.
- The effects of Doppler shift are negligible.

Disadvantages:

- Geostationary satellites require Sophisticated and heavy propulsion devices onboard to keep them in a fixed orbit.
- High altitude geostationary satellites introduced much longer propagation delays. The round trip propagation delay between two earth stations through geostationary satellites is between 500ms & 600ms.
- Geostationary satellites require higher transmit powers and more sensitive receivers because of the longer distances and greater path losses.
- High-precision spaceman ship is required to place a geostationary satellite into orbit and to keep it there.

e) Explain the concept of frequency reuse with neat diagram. State its merit.

Ans: **(Frequency reuse diagram 1 Marks, Explanation 2 Marks, Merit 1 Marks)**

Diagram:

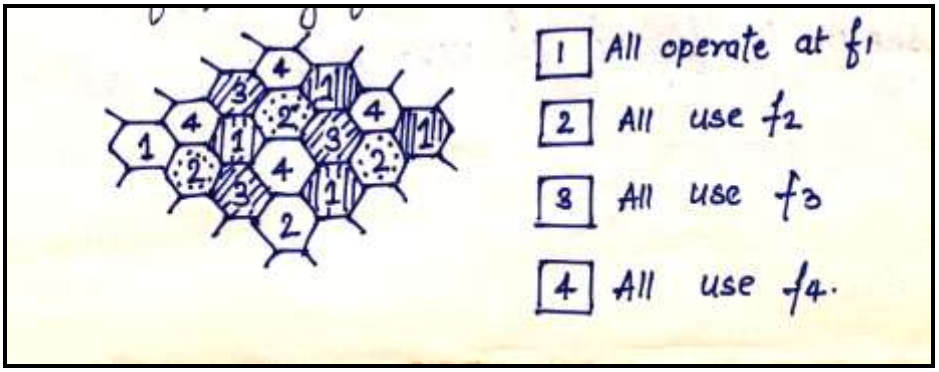


Fig. frequency reuse

Explanation:

- Frequency reuse refers to the use of radio channels operating on the same frequency, to cover different areas that are physically separate from each other.
- In the frequency reuse it is necessary to see that co-channel interference is not objectionable.
- In frequency reuse concept, a single transmitter of higher power need not to be used to cover entire area.
- Instead many transmitters of small output power operating at the same frequency can be used.
- This technique also reduces the minimum height of transmitting antenna, because each antenna has to cover small area.
- The users located in different geographical area i.e. different cells can use same frequencies.
- The advantage of frequency reuse is that it drastically increases the spectrum efficiency but if the system is not designed properly then co-channel interference may take place.
- Frequency reuse technique popularly use in cellular phone system as shown in the above diagram.
- It uses the same frequency repeatedly in the same area in one system.
- Here the total frequency spectrum allocation is divided into four co-channel cells in the system.
- The cells marked -1 will use same frequency say f_1, the cells marked 2 will use same frequency f_2 and so on.
  Merit of frequency reuse: it increases the capacity of entire cellular system.

f) When the modulating frequency in an FM system is 400Hz and the modulating voltage is 2.4V, the modulation index is 60. Calculate the maximum deviation. What is the modulation index when the modulating frequency is reduced to 250Hz and the modulating voltage is simultaneously raised to 3.2V?

Ans:

F_m = modulating frequency= 400Hz
V_m = modulating voltage = 2.4V
M_f = modulation index = 60
Δ = maximum deviation =?

$$M_f = \frac{\delta}{Fm}$$

$$60 = \frac{\delta}{400}$$

$$\Delta = 60*400$$

$$= 24{,}000$$

= 24 KHz **2M**

If modulating frequency is reduced to 250Hz
Modulating voltage is raised to 3.2V
New modulation index =?

$$M_f = \frac{\delta}{Fm}$$

$$\mathbf{M_f = \frac{24000}{250} = 96}$$ **2M**

Q.3. Attempt any FOUR 16M

a) Draw the waveforms of PAM, PPM signal.

Ans: **(2 Marks each waveform)**

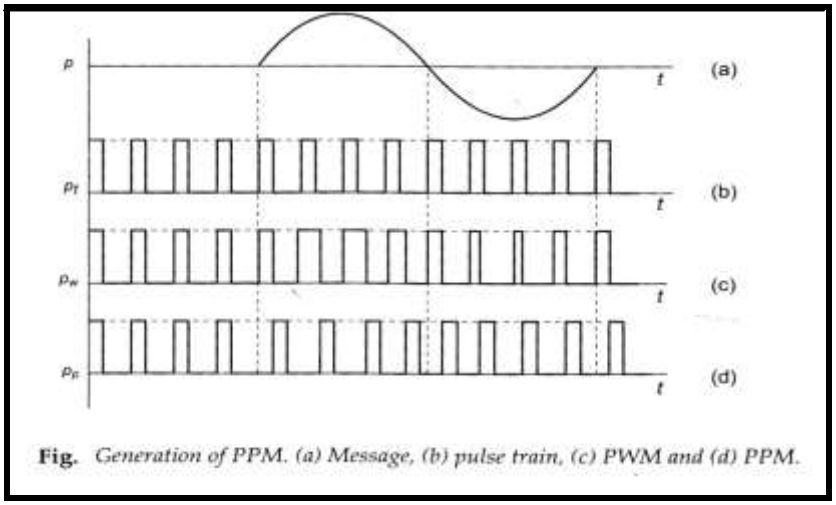


Fig. *Generation of PPM. (a) Message, (b) pulse train, (c) PWM and (d) PPM.*

Fig. Waveforms of PAM, PPM signal

b) Draw the block diagram of PCM transmitter and explain its working principle with waveforms.

Ans: **(Block diagram-2M, working-2M)**

Diagram:

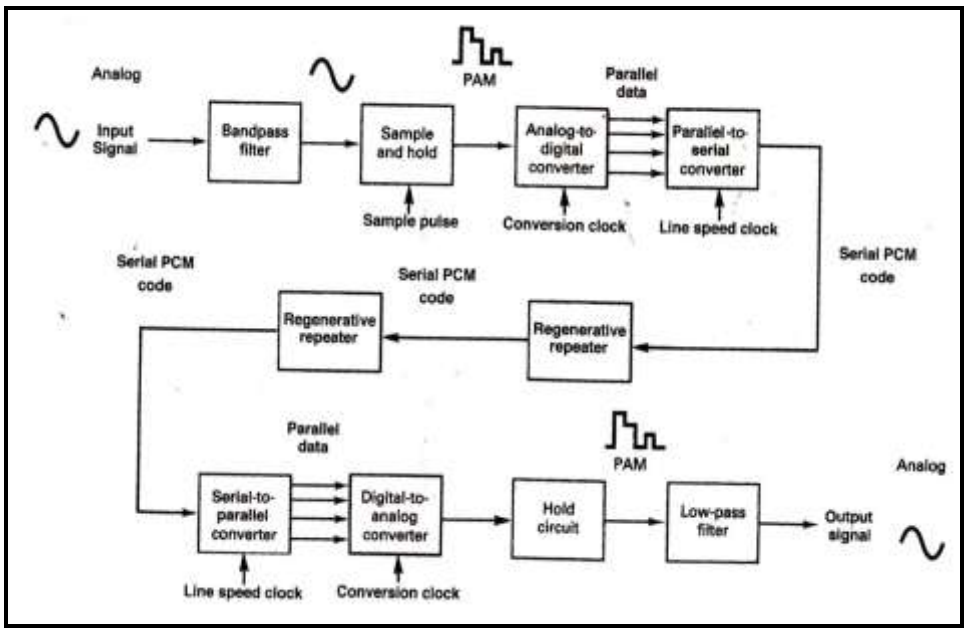


Fig. Block diagram of PCM transmitter

Working:

- Fig shows the block diagram of a single channel PCM transmitter.
- The function of a sampling circuit in a PCM transmitted is to periodically sample the analog input voltage & convert those samples to a series of constant amplitude pulses that can converted to binary PCM.
- For the ADC to accurately convert a voltage to a binary code the voltage must be relatively constant so that ADC can complete conversion before the voltage level changes, otherwise the ADC will not stabilized on any PCM code.
- Sampling can be done by using two techniques:
  i. Natural sampling
  ii. Flat top sampling
- The purpose of a sample and hold circuit is periodically sample the changing analog input voltage and convert those samples to a series of constant amplitude PAM voltage levels.
- The ADC converts the sample voltage to a PCM code.
- PCM code is transmitted serially after converting the PCM code in the serial form by a parallel to a serial convertor.

c) Compare LED and LASER w.r.t:
i) Spectral width
ii) Information capacity
iii) Temperature dependence
iv) Output power

Ans: (**1mark each point**)

Sr. no.	Parameter	LED	LASER
1.	Spectral width	More	Less
2.	Information capacity	Less	More
3.	Temperature dependence	More	Less
4.	Output power	Less	More

d) Explain the working principle of TDMA with diagram.

Ans: **(Working principle-2Marks, diagram-2Marks)**

Diagram:

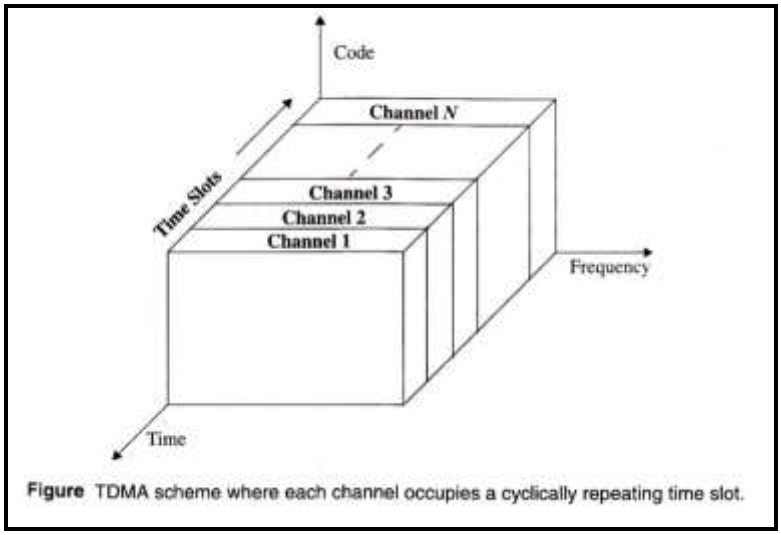


Figure TDMA scheme where each channel occupies a cyclically repeating time slot.

OR

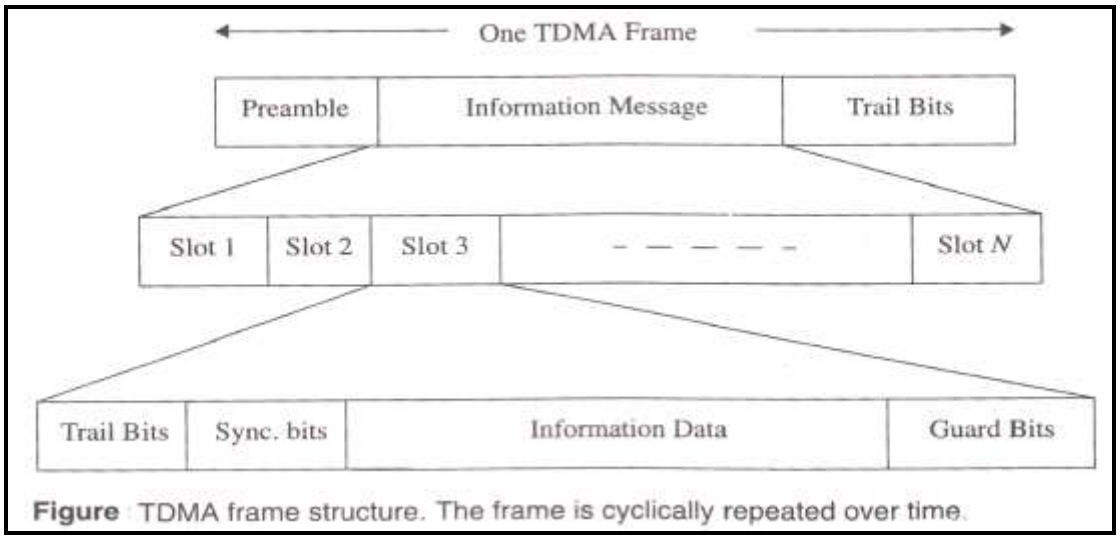


Figure TDMA frame structure. The frame is cyclically repeated over time.

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.

e) State step by step call procedure from wire line (PSTN) to mobile call.

Ans: (each step-1Mark)

The sequential steps for wire line (PSTN) to mobile (cellular) call procedure are as follows:

- The wire line telephone goes off hook to complete the loop, receives a dial tone, and then inputs the mobile unit's telephone number.
- The telephone number is transferred from the PSTN switch to the cellular network switch (MTSO).
- The cellular network MTSO receives the incoming call from the PSTN, translates the received digits, and locates the base station nearest the mobile unit, which determines if 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 the selected channel.
- The mobile unit sends verification of channel tuning through the cell-site controller.
- The cell-site controller sends an audible call progress tone to the subscriber's mobile telephone, causing it to ring. At the same time, a ring-back signal is send back to the wire line calling party.
- The mobile answers (goes off hook), the switch terminates the call progress tones, and the conversation begins.

f) Define the term handoff with its types. Give the steps involved in handoff process.

Ans: (Definition-1Mark, steps-2Marks, Types-1Mark)

Handoff: Cellular system has the ability to transfer calls that 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:

- Initiation
- Resource reservation
- Execution
- Completion

Types of handoff are:

- Soft handoff
- Hard handoff

Q.4 Attempt any FOUR: 16M

a) Define modulation index of AM .Calculate modulation index of AM signal with Emax=20mv and Emin=10mv.

Ans: (Definition 1 mark, 1 mark formula 1 mark substitution ,1 mark answer)

Definition:

Modulation index: It is the ratio of amplitude of modulating signal to the amplitude of carrier signal.

M.I=Em/Ec

Modulation Index (M.I) =(Emax-Emin)/(Emax +Emin)

=(20-10)/(20+10)

=0.3

b) Draw the block diagram of adaptive delta modulation transmitter and write its working principle.

Ans: (2 marks for block diagram , 2 marks for working principle)

Diagram:

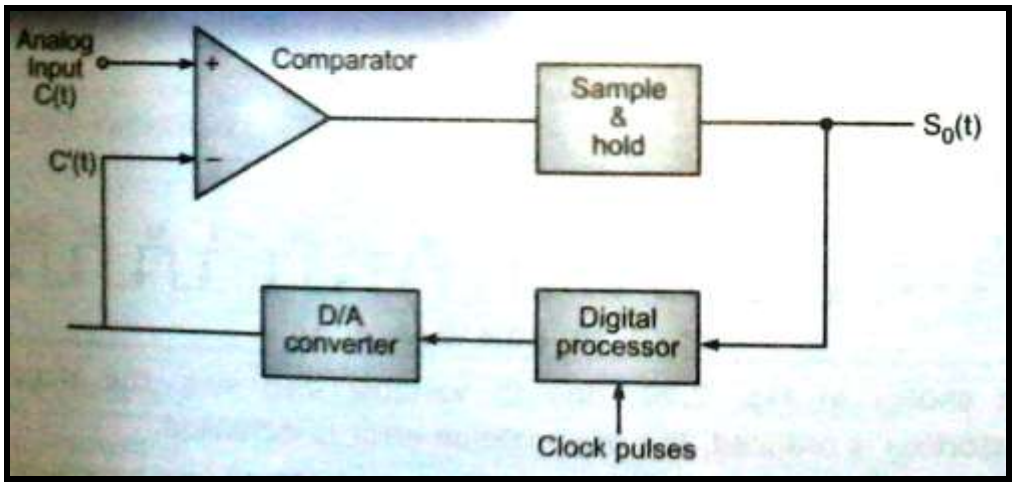


Fig: ADM Transmitter

Working Principle:

In response to the k^{th} 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 'δ'.If c(t)<c'(t) then processor will decrease the step size by 'δ'.

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) What is uplink and down link frequency ?state the uplink and downlink range used in C and Ka band

Ans: (each definition 1 mark, 1/2 mark each for uplink and down link frequency for C and Ka band)

Definition:

Downlink Frequency: It is the range of frequencies transmitted from a satellite down to one or more ground stations / receivers .

OR

Receiving antenna frequency is down link frequency

Uplink Frequency: It is the range of frequencies transmitted from a ground station up to a satellite

OR

Transmitting antenna frequency is uplink frequency

For C- band Uplink frequency is 6 GHz
Downlink frequency is 4GHz

For Ka band Uplink frequency is 27-31 GHz
Downlink frequency is 17-21GHz

d) State eight advantages of optical fiber over metallic cable.

Ans: (Any Eight ½ M each)

Advantages:

- High Bandwidth
- Light weight and small diameter
- Low Losses
- Less number of repeaters
- Immune to electromagnetic interference
- High degree of data security
- Noise is comparatively less in optical communication
- Lower attenuation
- Transmission cost per bit is low
- Controlled dispersion gives low error rate

e) Draw the well labelled layer diagram of OSI model .State function of any 3 layers.

Ans: (1 mark for correct diagram,1 mark each for writing function of any 3 layers)

Diagram:

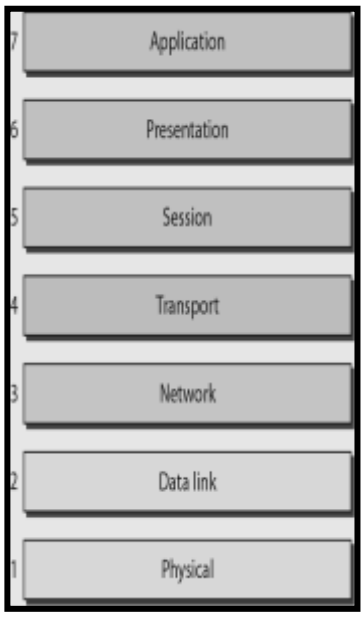


Fig: Layer diagram of OSI model

Function of each Layer:

- **Physical Layer** : To transmit bits over medium. To provide electrical and mechanical Specifications.
- **Data Link Layer**: To organize bits to frame .To provide hop to hop delivery.
- **Network Layer**: To move packets from source to destination .To provide internetworking.
- **Transport Layer**: To provide reliable process to process message delivery and error recovery
- **Session Layer**: To establish manage and terminate session.
- **Presentation Layer**: To translate encrypt and compress data
- **Application Layer** :To allow access to network resources

(f) Define co-channel and adjacent channel interference How it can be avoided.

Ans: (1 mark for each definition and ½ mark for writing 2 avoiding ways)

Definition:

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.

- There should be adequate frequency separation between the spectrums of the adjacent channels in a cell
- 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

Q.5 Attempt any FOUR: 16 M

(a) Draw the generation block diagram of QPSK. State two advantages and two disadvantages.

Ans: (2M for Diagram, 1M for advantages & 1 M for disadvantages)

Diagram:

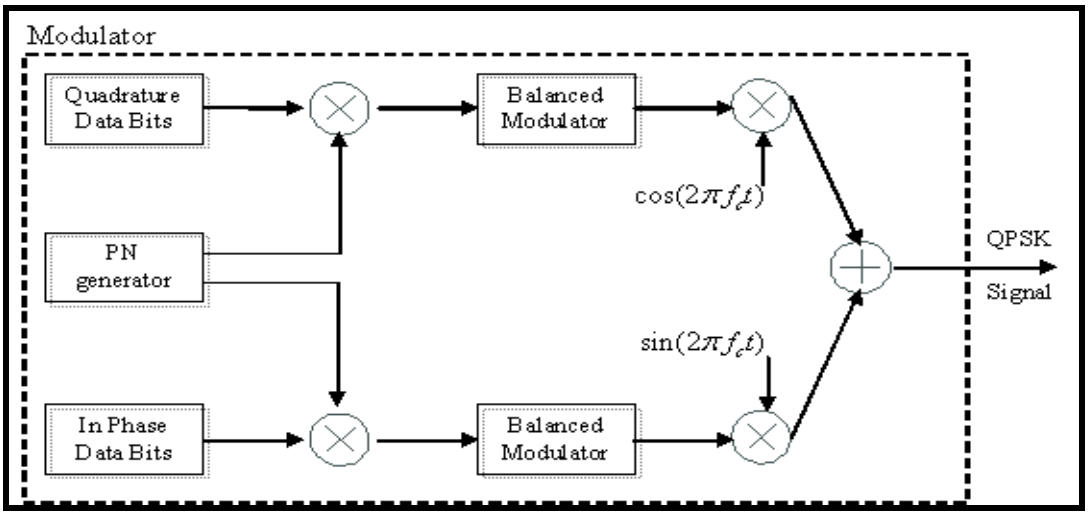


Fig: Block diagram of QPSK

Advantages:

1. Higher data rate (2 bits per bit interval)

2. for same bit error rate the B.W required by QPSK is reduced to half than BPSK.

Disadvantages

Higher rate PSK schemes are limited by ability of equipment to distinguish very small differences in phase.

(b) Compare ASK,PSK and FSK on the basis of :

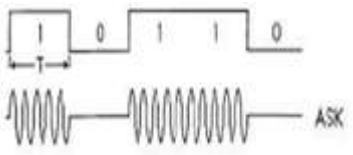
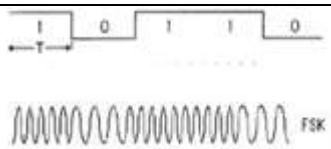
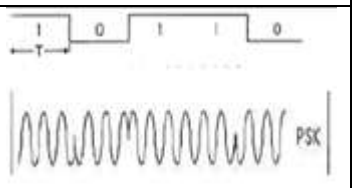
(i) Definition

(ii) Bandwidth

(iii) Noise Immunity

(iv) Waveforms

Ans: (1M for each difference)

PARAMETER	ASK	FSK	PSK
DEFINITION	In this technique, amplitude of the RF carrier is varied in accordance with baseband digital input signal.	In this technique, frequency of the RF carrier is varied in accordance with baseband digital input signal.	In this technique, phase of the RF carrier is varied in accordance with baseband digital input signal.
Band width	(1+r)R R= bit rate,r=1	4fb fb=bit frequency	fb
Noise immunity	Less	More	More
Waveforms			

(c) Draw the block diagram of transponder. State the function of each block.

Ans: (2M Diagram, 2 M Explanation)

Diagram:

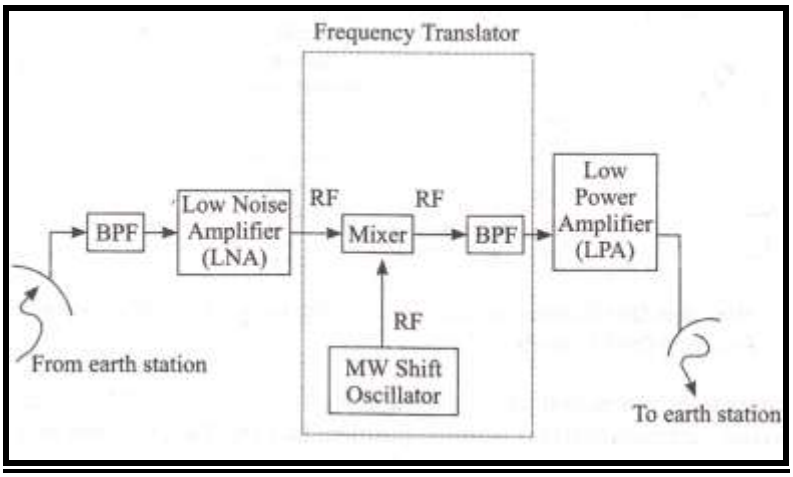


Fig: Transponder

Explanation:

It consists of receiving antenna (f = uplink frequency), a band limiting circuit band pass filter, an input low noise amplifier, frequency translator, output low power amplifier, and transmitting antenna (f = downlink frequency).

The frequency translator is basically an RF to RF repeater. The frequency of MW shift oscillator is equal to frequency shift required and hence it is equal to difference of uplink and downlink frequency (usually = 2GHz.)

(d) State the functions of (i) Hub (ii) Repeaters (iii) Gateway (iv) Routers.

Ans: (1M each)

- **Hub**: A common connection point for devices in a network. Hubs are commonly used to connect segments of a LAN. A hub contains multiple ports. When a packet arrives at b1 port, it is copied to the other ports so that all segments of the LAN can see all the packets.

- **Repeaters**: A repeater is the simplest facility used for network interconnection, whose major function is to receive a network signal from one LAN terminal cable segment and to regenerate and retransmit the signal as it is in its original strength over a one or more other cable segment. Basically repeater regenerates the strength of the signal before transmitting it.

- **Gateway**: A gateway is a network point that acts as an entrance to another network. On the Internet, a node or stopping point can be either a gateway node or a host (end-point) node. Both the computers of Internet users and the computers that serve pages to users are host nodes.

- **Routers**: A device that connects any number of LANs. Routers use headers and a forwarding table to determine where pkts go and they use ICMP to communicate with each other and configure the best route between any 2 hosts.

(e) Draw the block diagram of external modem and write the function of each block.

Ans: (Diagram 2M , Explanation 2 M)

Diagram:

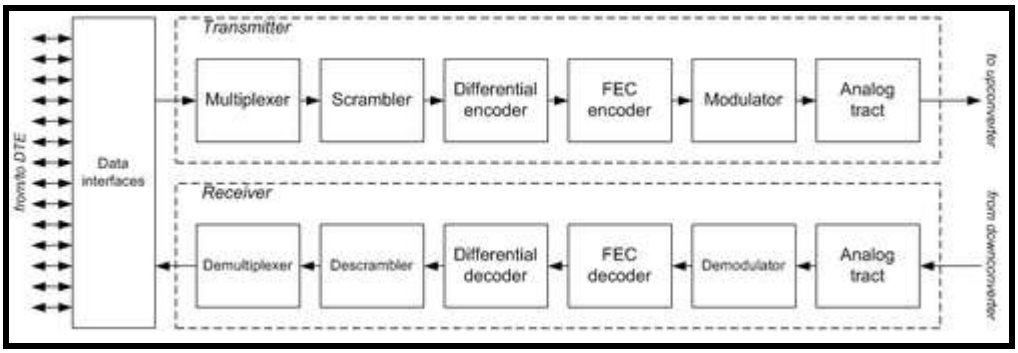


Fig: External modem

Explanation:

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..

(f) Write working principle of synchronous and Asynchronous data transmission with schematic diagram.

Ans: (**Diagram 2M ,Principle 1M each)**

Synchronous data transmission:

The technique of transmitting each data word one after another without start and stop bits is referred as synchronous data transmission.

Diagram:

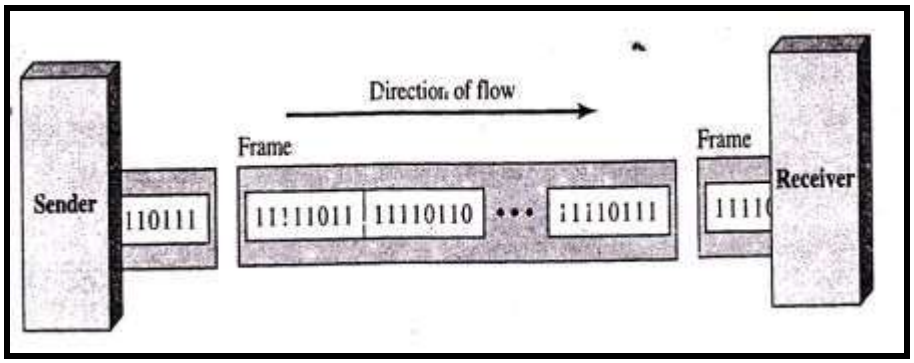


Fig. Synchronous data transmission

In synchronous transmission, the bit stream is combined into longer flames which may contain multiple bytes. Each byte, however, is introduced onto transmission link without a gap between it next one.
If is left to the receiver to separate the stream into bytes for decoding purposes.

Asynchronous data transmission:
In asynchronous communication each data word is accompanied by stop and start bits that identify the beginning and end of the word**.**

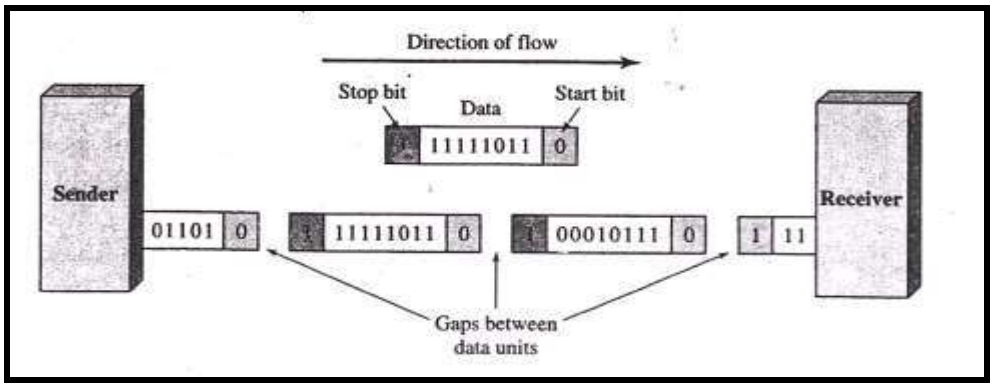


Fig. Asynchronous data transmission

- In this, the start bits are 0's the stop bits are 1's and the gap is represented by an idle line rather than by additional stop bits.
- The addition of stop and start bits and insertion of gaps into the bit stream make asynchrous transmission slower than forms of transmission.
- But it is cheap and effective.

Q.6 Attempt any FOUR: 16 M

(a) Explain the Working of delta modulation with the help of block diagram.

Ans: (**Diagram 2 Marks, Function 2 Marks)**

Diagram:

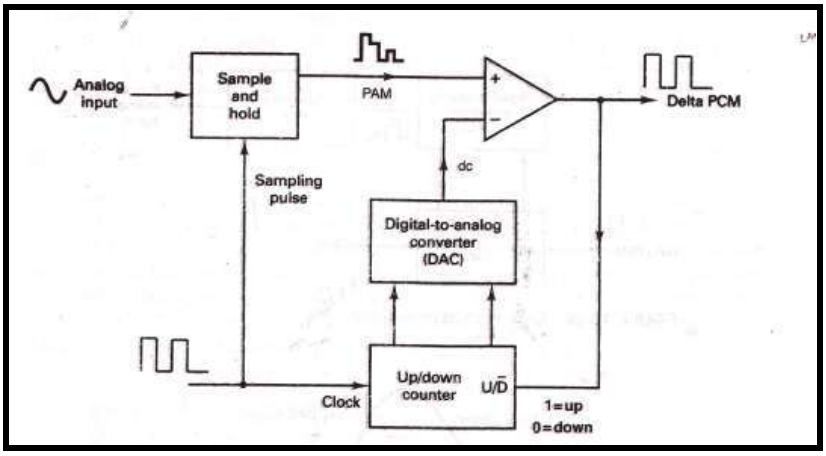


Fig. Delta modulation

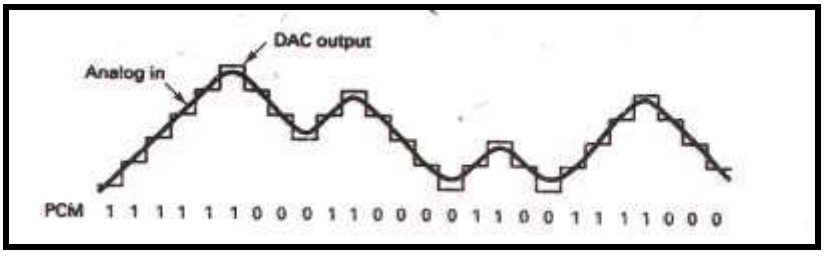


Fig. Operation of delta modulator

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.

(b) Draw the Constructional diagram of Avalanche photo diode. Write its working principle.

Ans: (**Diagram 2 Marks, Principle 2 Marks)**

Diagram:

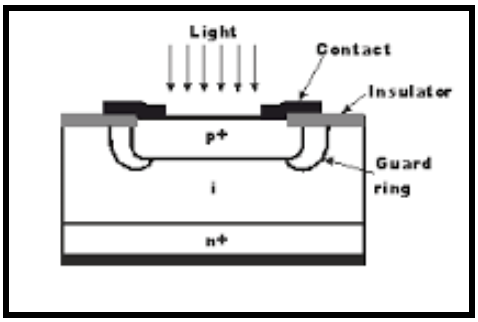


Fig. Avalanche photo diode.

Working principle:

The avalanche process means that a single electron produced by light in the un-doped region is multiplied several times by the avalanche process. As a result the avalanche photo diode is far more sensitive.

Light enters the un-doped region of the avalanche photodiode and causes the generation of hole-electron pairs. Under the action of the electric field the electrons migrate towards the avalanche region. Here the electric field causes their velocity to increase to the extent that collisions with the crystal lattice create further hole electron pairs. In turn these electrons may collide with the crystal lattice to create even more hole electron pairs. In this way a single electron created by light in the un-doped region may result in many more being created.

(c) Draw the diagram of SMSI and MMGI fibers and compare them.

Ans: **(Diagram: 2M ,Comparison 2M)**

Diagram:

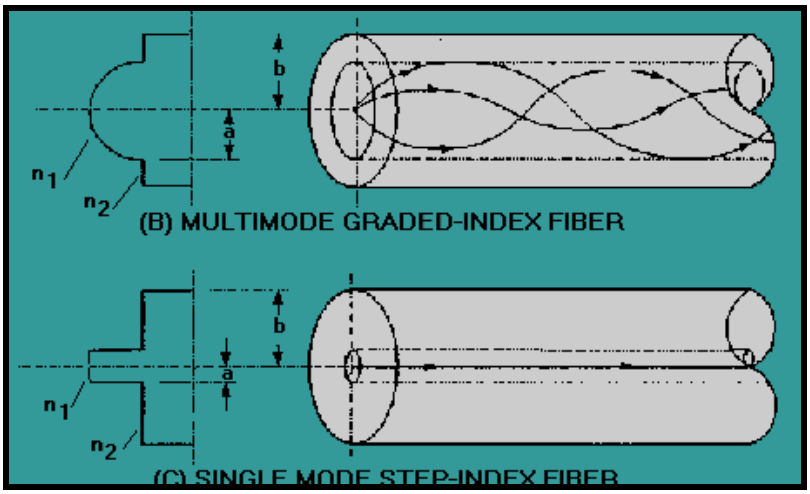


Fig. SMSI and MMGI fibers

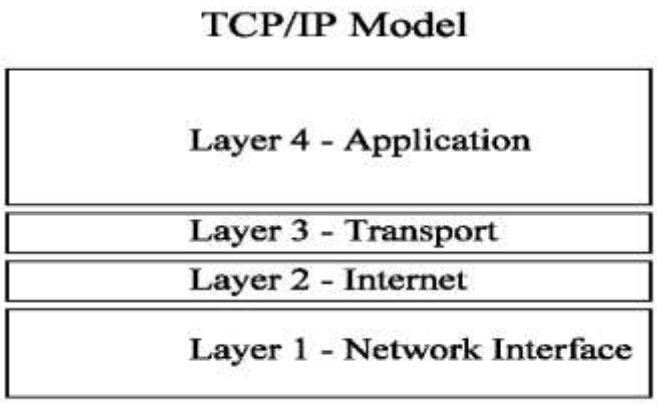
Comparison:

SMSI	MMGI
Only 1 mode of propagation	It may contains hundreds of modes of propagation
Small core diameter	Large core diameter
Excited through LASER diode	Excited through LED.
Intermodal dispersion does not arise	Intermodal dispersion problem is present

(d) Draw the Architecture of TCP/IP model. State function of each layer.

Ans: (**Architecture 2 Marks, Function 2 Marks)**

Architecture:



Functions:

Layer 1. Network Interface

Network Access Layer is the first layer of the four layer TCP/IP model. Network Access Layer defines details of how data is physically sent through the network, including how bits are electrically or optically signaled by hardware devices that interface directly with a network medium, such as coaxial cable, optical fiber, or twisted pair copper wire.

Layer 2. Internet Layer

Internet Layer is the second layer of the four layer TCP/IP model. The position of Internet layer is between Network Access Layer and Transport layer. Internet layer pack data into data packets known as IP

datagrams, which contain source and destination address (logical address or IP address) information that is used to forward the datagrams between hosts and across networks. The Internet layer is also responsible for routing of IP datagrams.

Layer 3. Transport Layer

Transport Layer is the third layer of the four layer TCP/IP model. The position of the Transport layer is between Application layer and Internet layer. The purpose of Transport layer is to permit devices on the source and destination hosts to carry on a conversation. Transport layer defines the level of service and status of the connection used when transporting data.

The main protocols included at Transport layer are TCP (Transmission Control Protocol)and UDP (User Datagram Protocol).

Layer 4. Application Layer

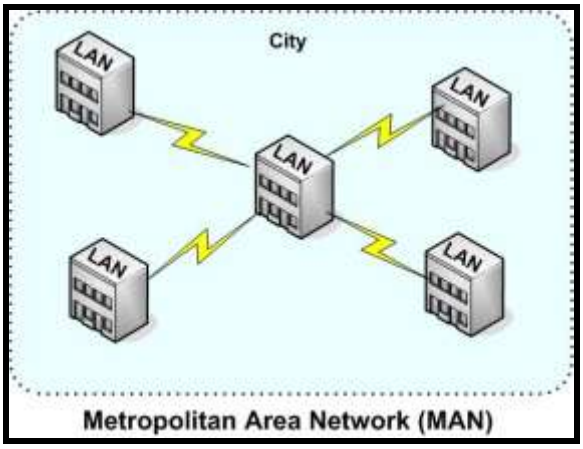
Application layer is the top most layer of four layer TCP/IP model. Application layer is present on the top of the Transport layer. Application layer defines TCP/IP application protocols and how host programs interface with Transport layer services to use the network.

Application layer includes all the higher-level protocols like DNS (Domain Naming System), HTTP (Hypertext Transfer Protocol), Telnet, SSH, FTP (File Transfer Protocol), TFTP (Trivial File Transfer Protocol), SNMP (Simple Network Management Protocol), SMTP (Simple Mail Transfer Protocol) , DHCP (Dynamic Host Configuration Protocol), X Windows, RDP (Remote Desktop Protocol) etc.

(e) Explain with example the concept of MAN.

Ans: (Explanation:4M) [Note: Diagram is not necessary]

A Metropolitan Area Network (MAN) is a large computer network that spans a metropolitan area or campus. Its geographic scope falls between a WAN and LAN. MANs provide Internet connectivity for LANs in a metropolitan region, and connect them to wider area networks like the Internet.



A network of fire stations in a suburban area would be an example. This network could cross jurisdictions, so every fire station could be apprised of engine status in the entire area, should an emergency arise.

So too, could a newspaper/media company employ a MAN. Branch offices in different counties could coordinate stories that appear in localized publications.

A chain of community colleges could be linked by a MAN. A single campus might use a CAN (Campus Area Network), but the entire academic institution would use a MAN to track students' progress across different classrooms and majors.

(f) Differentiate between FDMA, TDMA and CDMA on the basis of following parameters :

(i)Multiplexing

(ii)Power Efficiency

(iii)Synchronization

(iv)Guard Band

Ans: **(1M each)**

Parameter	FDMA	TDMA.	CDMA
Multiplexing Tech.	frequency	time	Code division
Power efficiency	less	full	full
Synchronization	Not require	require	require
Guard band	Guard band require	Guard time require	Both band require