PHYSICAL LAYER

Multiple Choice Type Questions

1. Frame relay operates in the [WBUT 2013]
a) physical layer
b) data link layer
c) physical and data link layer
d) physical, data link & network layer

Answer: (a)

2. The total number of links required to connect *n* devices using Mesh topology is [WBUT 2015, 2017]
a) $2n$
b) $\frac{n(n+1)}{2}$
c) $\frac{n(n-1)}{2}$
d) n^2

Answer: (c)

3. What is the central device in Star topology? [WBUT 2017]
a) STP server
b) Hub / Switch
c) PDC
d) Router

Answer: (b)

4. X.25 is an example of .... network. [WBUT 2017]
a) circuit switched
b) packet switched
c) message switched
d) virtual circuit switched

Answer: (b)

5. Which connector STP uses? [WBUT 2017]
a) BNC
b) RJ-11
c) RJ-45
d) RJ-69

Answer: (a)

6. Bandwidth of a signal with range 40 KHz to 4 MHz is [MODEL QUESTION]
a) 3-96 MHz
b) 36 MHz
c) 360 KHz
d) 396 KHz

Answer: (c)

7. A bridge has access to the .... address of a station on the same network. [MODEL QUESTION]
a) Physical (MAC)
b) Network
c) Service access point
d) all of these

Answer: (a)

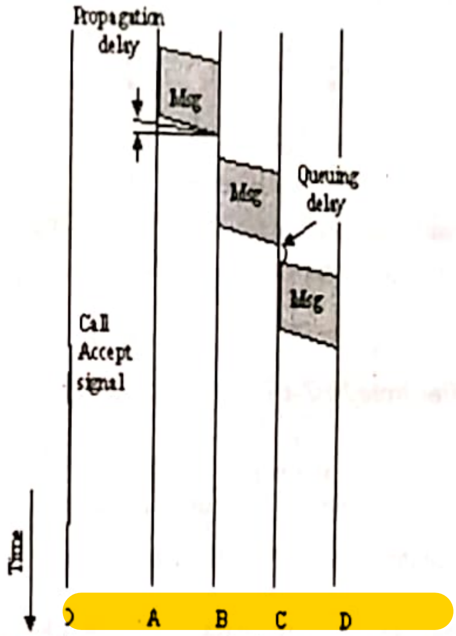
Short Answer Type Questions

1. Explain about message switching with proper diagram. [WBUT 2013]

Answer:
Message Switching is the precursor of packet switching, where messages were routed in their entirety, one hop at a time. Message switching systems are nowadays mostly

implemented over packet-switched or circuit-switched data networks. Hop-by-hop Telex forwarding and UUCP are examples of message switching systems.

Since message switching stores each message at intermediate nodes in its entirety before forwarding, messages experience an end to end delay which is dependent on the message length, and the number of intermediate nodes. Each additional intermediate node introduces a delay which is at minimum the value of the minimum transmission delay into or out of the node.



Note that nodes could have different transmission delays for incoming messages and outgoing messages due to different technology used on the links. The transmission delays are in addition to any propagation delays which will be experienced along the message path.

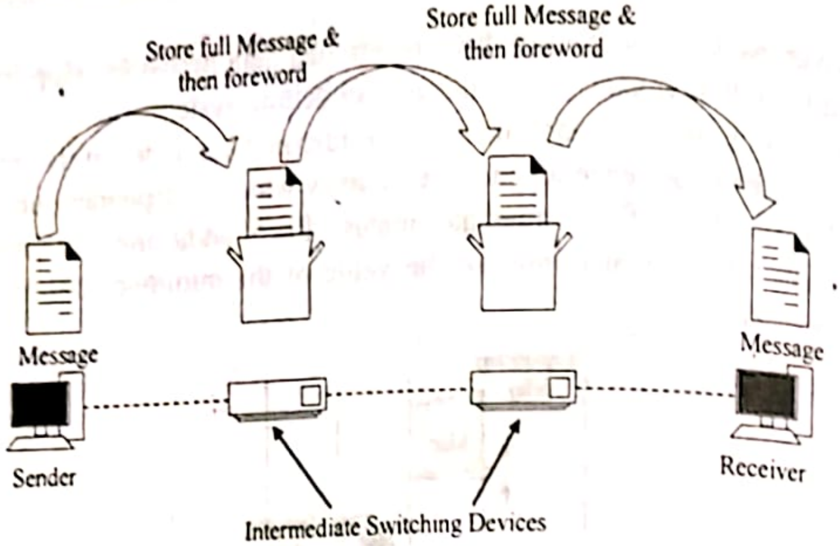
In a message-switching centre an incoming message is not lost when the required outgoing route is busy. It is stored in a queue with any other messages for the same route and retransmitted when the required circuit becomes free. Message switching is thus an example of a delay system or a queuing system. Message switching is still used for telegraph traffic and a modified form of it, known as packet switching, is used extensively for data communications.

2. a) In which case and why message switching is better than circuit switching? **[WBUT 2014]**

Answer:

Message switching was somewhere in middle of circuit switching and packet switching. In message switching, the whole message is treated as a data unit and is switching / transferred in its entirety.

A switch working on message switching first receives the whole message and buffers it until there are resources available to transfer it to the next hop. If the next hop is not having enough resource to accommodate large size message, the message is stored and switch waits.



This technique was considered substitute to circuit switching. As in circuit switching the whole path is blocked for two entities only. Message switching is replaced by packet switching.

b) How does NRZ-I differ from NRZ-L? **[WBUT 2014]**

Answer:

In the NRZ-L sequence, positive and negative voltages have specific meanings: positive for 0 and negative for 1. in the NRZ-I sequence, the voltages are meaningless. Instead, the receiver looks for changes from one level to another as its basis for recognition of 1s.

3. What is difference between circuit switching and packet switching? **[WBUT 2014, 2015]**

Answer:

Circuit switching	Packet switching
Circuit switching establishes fixed bandwidth circuit/channel between nodes and terminals before the users may communicate	Packet switching is a communication in which packet are routed between node over data links shared with other traffic. In each network node, packets are queued in buffered, resulting in variable delay.

4. What is transmission impairment? Explain the basic concepts (Attenuation, distortion and noise) of transmission impairment. **[WBUT 2016]**

Answer:

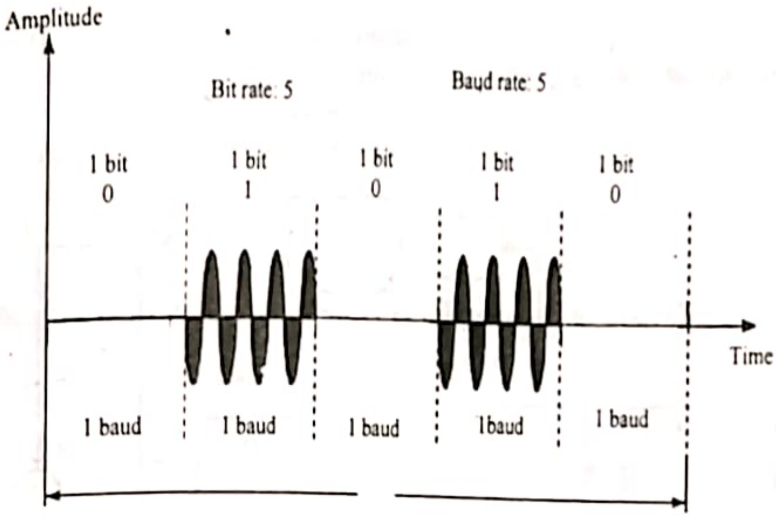
Transmission Impairments is a condition that causes information to be lost in a signal. The following are some aspects of transmission impairments: (1) Attenuation. Signals loose power in time. (2) Dispersion. Signals tend to spread as they travel, with the amount of spreading dependent on the frequency. (3) Delay distortion. Due to velocity of propagation that varies with frequency. Thus, various frequency components of a signal arrive at the receiver at different times. (4) Noise; sources from Thermal, Inter-modulation, Crosstalk.

5. Describe BASK (Binary ASK) and QPSK encoding technique with proper diagram. **[WBUT 2017]**

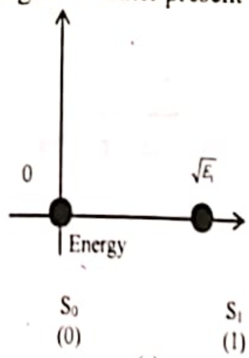
Answer:

Binary Amplitude Shift Keying

Amplitude Shift Keying (ASK) is a type of digital modulation in which the amplitude of the carrier is varied with respect to the digital message. If we send one bit/symbol, we call it as Binary Amplitude Shift Keying (BASK), in which case the carrier amplitude is assumed to have 2 values (one corresponding to 1 and other corresponding to 0). Figure below shows this type of modulation.



This type of BASK is also called On-Off Keying (OOK) when one state is represented by absence of the carrier (0 amplitude), the corresponding constellation diagram is shown in Figure below, in which a signal is either present or absent.



(a)

Bit rate represents the No. of bits/sec whereas baud rate represents the No. of symbols sent per second. Baud rate is less than or equal to the bit rate. Modulated symbol waveform are represented as:

$$S_0 = \sqrt{\frac{2E_0}{T}} \cos(2\pi f_0 t) \rightarrow represents '0'$$

$$S_1 = \sqrt{\frac{2E_1}{T}} \cos(2\pi f_0 t) \rightarrow represents '1'$$

QPSK

Quadrature phase shift keying (QPSK) is another modulation technique, and it's a particularly interesting one because it actually transmits two bits per symbol. In other words, a QPSK symbol doesn't represent 0 or 1—it represents 00, 01, 10, or 11. In QPSK, the carrier varies in terms of phase, not frequency, and there are *four* possible phase shifts.

QPSK transmitter

The QPSK transmitter, shown in Figure, is implemented as a matlab function *qpsk_mod*. In this implementation, a splitter separates the odd and even bits from the generated information bits. Each stream of odd bits (quadrature arm) and even bits (in-phase arm) are converted to NRZ format in a parallel manner.

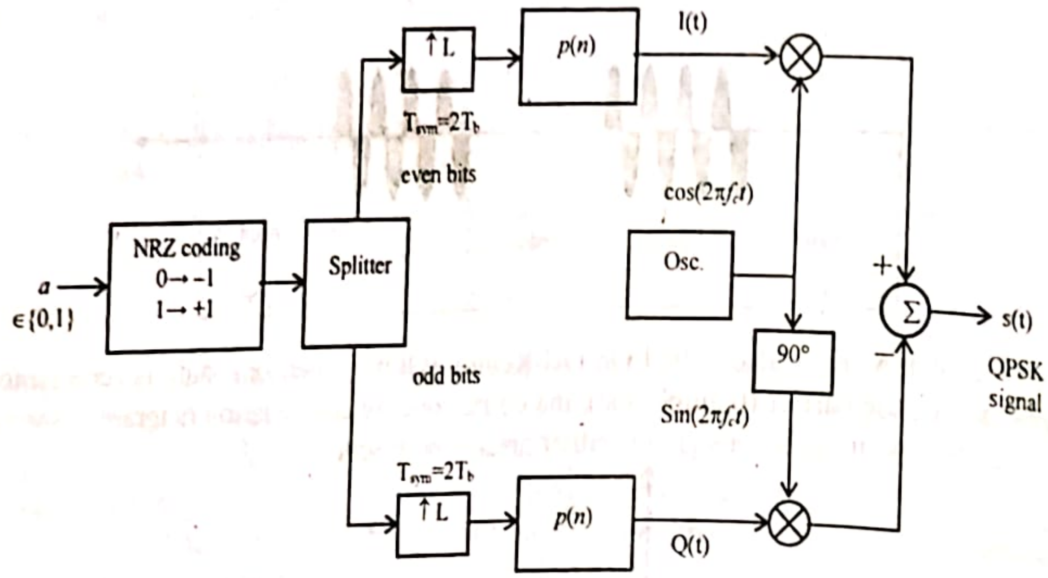


Fig: Waveform simulation model for QPSK modulation

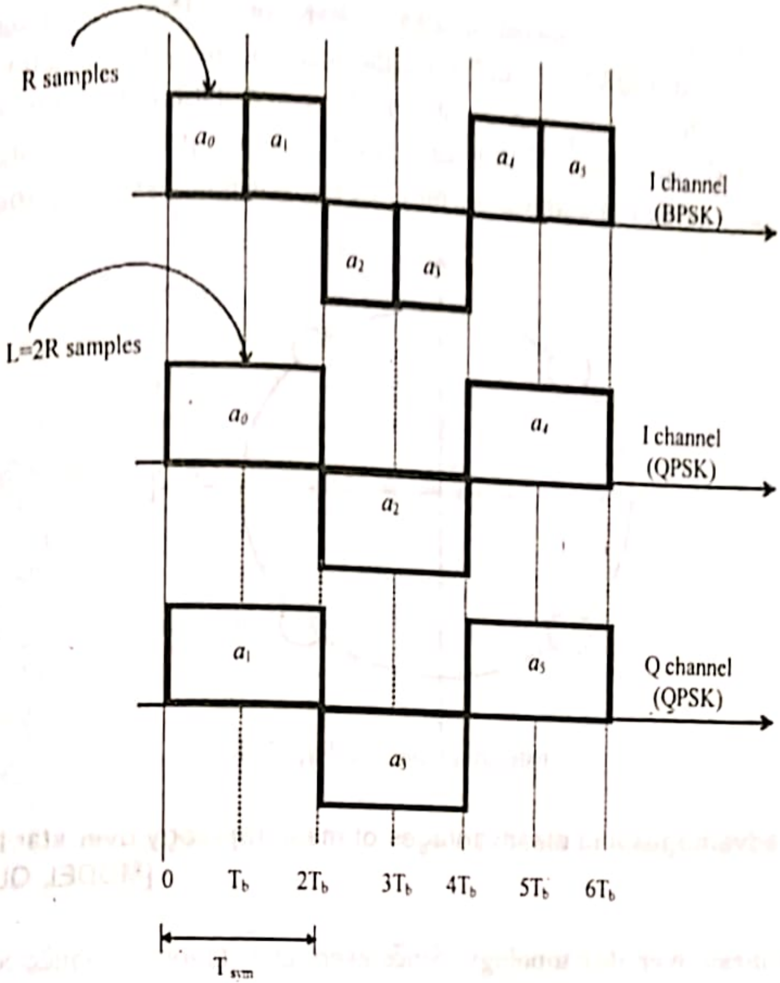


Fig: Timing diagram for BPSK and QPSK modulations

Due to its special relationship with BPSK, the QPSK receiver takes the simplest form as shown in Figure. In this implementation, the I-channel and Q-channel signals are individually demodulated in the same way as that of BPSK demodulation.

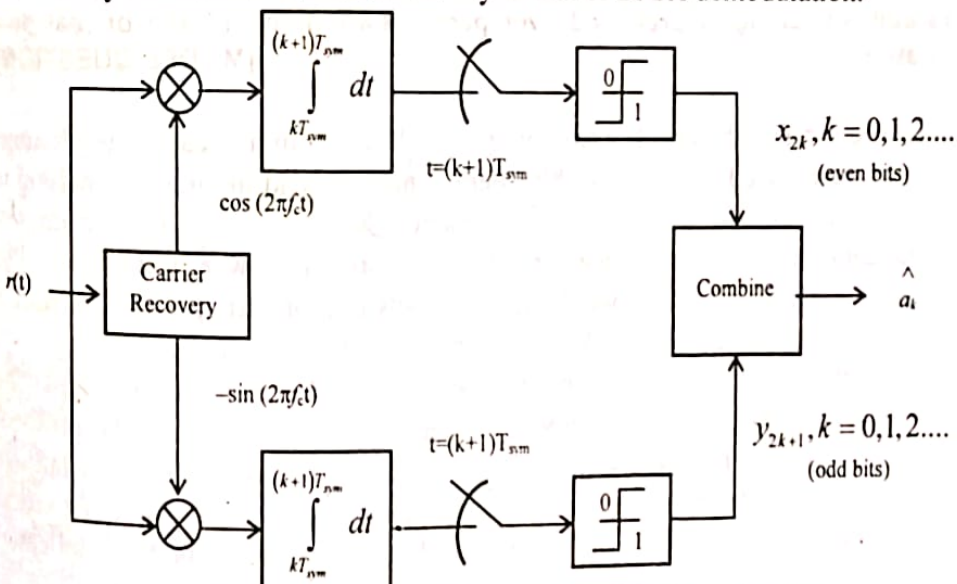


Fig: Waveform simulation model for QPSK demodulation

Sometimes this is known as *quadriphase PSK*, 4-PSK, or 4-QAM. (Although the root concepts of QPSK and 4-QAM are different, the resulting modulated radio waves are exactly the same.) QPSK uses four points on the constellation diagram, equispaced around a circle. With four phases, QPSK can encode two bits per symbol, shown in the diagram with Gray coding to minimize the bit error rate (BER) - sometimes misperceived as twice the BER of BPSK.

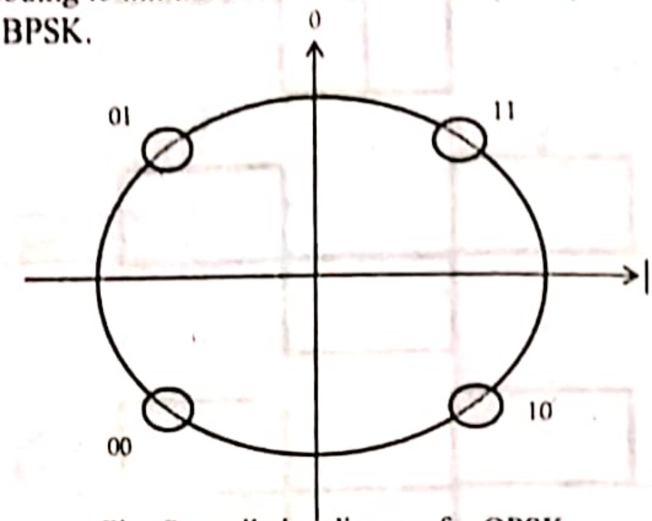


Fig: Constellation diagram for QPSK

6. Explain the advantages and disadvantages of mesh topology over star topology. [MODEL QUESTION]

Answer:

Advantages of mesh over star topology: Since every end station is connected to every other directly, the communication path between any pair is dedicated and unhampered by the traffic in the rest of the network.

Disadvantage: Requires much more cabling. Also, fallback strategies when a link goes down, is not very well-defined.

7. Why circuit switching is preferred over packet switching in case of real time communication? [MODEL QUESTION]

Answer:

Circuit switching is faster than packet switching since during communication, the channel always remains established. Because of this, there is no overhead in circuit switching to either packetize data or use other means to guarantee delivery of the data. In circuit-switching, the data bits arrive at the receiver in the same order they were transmitted. The same can not be assured in packet switching. This leads to more computation in packet switching for re-arranging received packets to get back the transmitted stream.

While packet switching can not overcome the speed disadvantage, it can overcome the "guaranteed delivery" and "in-order" delivery of data using protocols. Several protocol features like sequencing numbering and ACK mechanisms using sliding windows protocols at different layers (mostly used in transport and data-link layers) can be used to ensure guaranteed in-order deliver. For example, TCP achieves this using a complicated protocol.

Long Answer Type Questions

1. Describe circuit switch, message switch and packet switch. **[WBUT 2016]**

Answer:

Circuit Switch:

Circuit switching is the most familiar technique used to build a communications network. It is used for ordinary telephone calls. It allows communications equipment and circuits, to be shared among users. Each user has sole access to a circuit (functionally equivalent to a pair of copper wires) during network use. Consider communication between two points A and D in a network. The connection between A and D is provided using (shared) links between two other pieces of equipment, B and C.

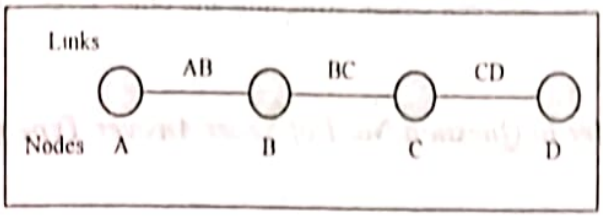


Fig: A connection between two systems A & D formed from 3 links

Network use is initiated by a connection phase, during which a circuit is set up between source and destination, and terminated by a disconnect phase. These phases, with associated timings, are illustrated in the figure below.

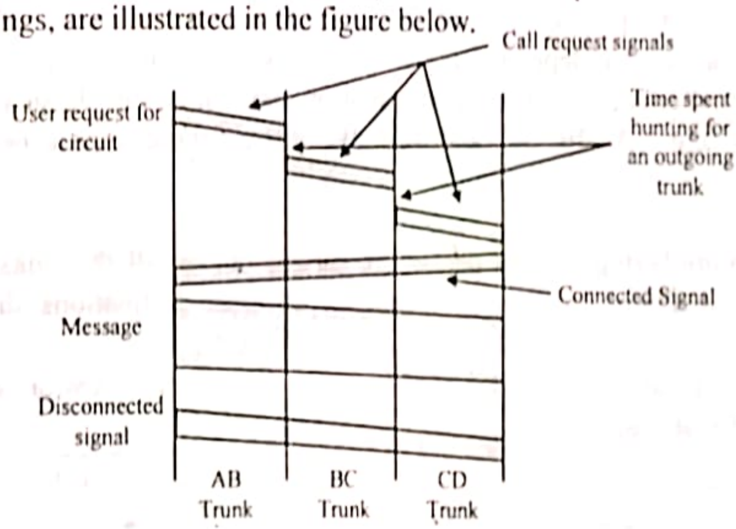


Fig: A circuit switched connection between A and D

After a user requests a circuit, the desired destination address must be communicated to the local switching node (B). In a telephony network, this is achieved by dialing the number.

Node B receives the connection request and identifies a path to the destination (D) via an intermediate node (C). This is followed by a circuit connection phase handled by the switching nodes and initiated by allocating a free circuit to C (link BC), followed by transmission of a call request signal from node B to node C. In turn, node C allocates a link (CD) and the request is then passed to node D after a similar delay.

The circuit is then established and may be used. While it is available for use, resources (i.e. in the intermediate equipment at B and C) and capacity on the links between the equipment are dedicated to the use of the circuit.
After completion of the connection, a signal confirming circuit establishment (a connect signal in the diagram) is returned; this flows directly back to node A with no search delays since the circuit has been established. Transfer of the data in the message then begins. After data transfer, the circuit is disconnected; a simple disconnect phase is included after the end of the data transmission.
Delays for setting up a circuit connection can be high, especially if ordinary telephone equipment is used. Call setup time with conventional equipment is typically on the order of 5 to 25 seconds after completion of dialing. New fast circuit switching techniques can reduce delays. Trade-offs between circuit switching and other types of switching depend strongly on switching times.

Message Switch: ***Refer to Question No. 1 of Short Answer Type Questions.***

Packet Switch:
A packet switched network consists of interconnected packet switching nodes (Figure. below). The packet switching nodes are based on store-and-forward technology.
The end system sends data packets containing addressing information in their header to the entry node. The packet switch uses the addressing information to determine the outgoing port and puts the packet in the queue for further transmission. The addressing information in the header depends on the type packet switching approach deployed, datagram, or virtual circuit. Addressing information may not be the physical addresses of the end systems (e.g. 1A, 2B, 3C, and 4D). We discuss these approaches in the next section.
Note that:

- Statistical multiplexing of data packets is carried out on all the links, i.e. packets belonging to different sources and meant for different destinations share the same link.
- An end station can have several simultaneous data communication sessions with different end systems.

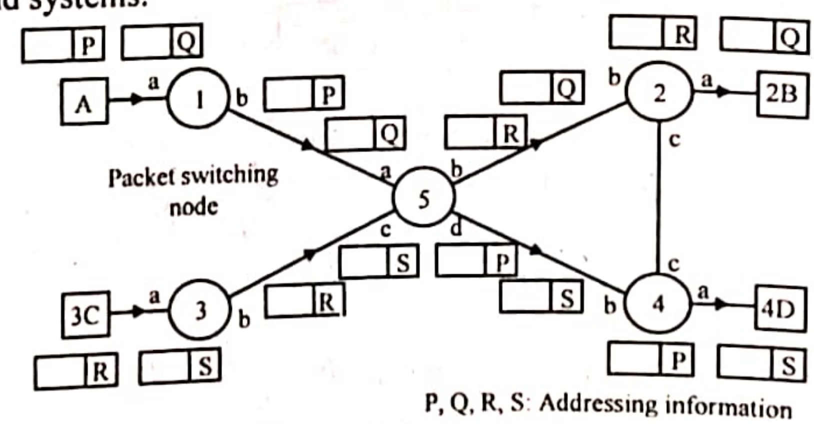


Fig: Packet switched network

Packet switched data networks can be of two types:

- Datagram switching
- Virtual circuit packet switching

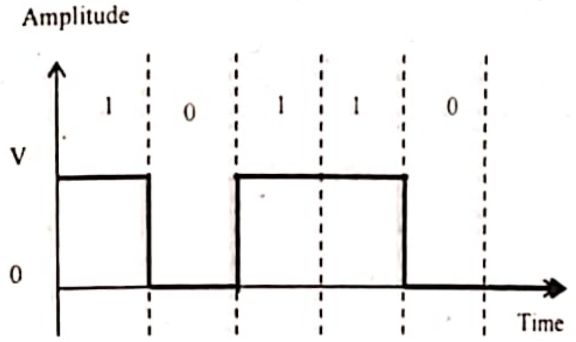
Datagram switching network is similar to message switching network. Each data packet is an independent entity. It carries source and destination addresses in the header. The packet switching nodes are store-and-forward nodes and they route the data packets to the destination based on the address on the packets. A packet with source and destination address is called a datagram.

Virtual circuit packet switching network is similar to circuit switching network. A virtual connection is set up between the communicating end systems. All the data packets carry identity of the virtual connection they belong to and follow the path of the virtual connection across the packet switching network.

2. Describe the following line coding techniques with suitable diagram:
i) Unipolar
ii) Polar
iii) Bipolar **[WBUT 2017]**

Answer:

i) Unipolar: In a unipolar scheme, all the signal levels are on one side of the time axis, NRZ (Non-Return-to-Zero): Traditionally, a unipolar scheme was designed as a non-return-to- zero (NRZ) scheme in which the positive voltage defines bit 1 and the zero voltage defines bit O. It is called NRZ because the signal does not return to zero at the middle of the bit. The following figure shows a unipolar NRZ scheme.



$$\frac{1}{2}V^2 + \frac{1}{2}(0)^2 = \frac{1}{2}V^2$$

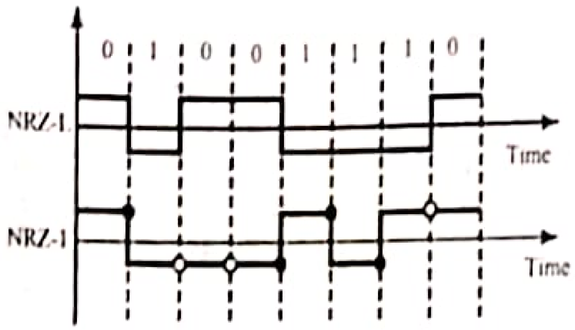
Normalized power

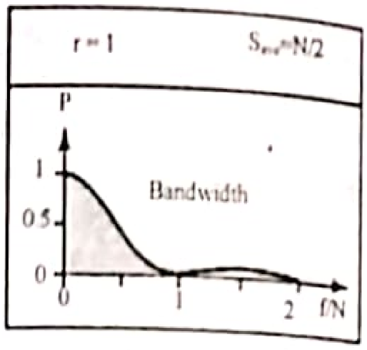
Compared with its polar counterpart, the normalized power (power needed to send 1 bit per unit line resistance) is double that for polar NRZ. For this reason, this scheme is normally not used in data communications today.

ii) Polar: In polar schemes, the voltages are on the both sides of the time axis. For example, the voltage level for 0 can be positive and the voltage level for 1 can be negative.

a) Non-Return-to-Zero (NRZ):

In polar NRZ encoding, we use two levels of voltage amplitude. We can have two versions of polar NRZ: NRZ-Land NRZ-I, as shown in the following Figure. The figure also shows the value of r, the average baud rate, and the bandwidth.





O No version Next bit is O ● No version Next bit is 1

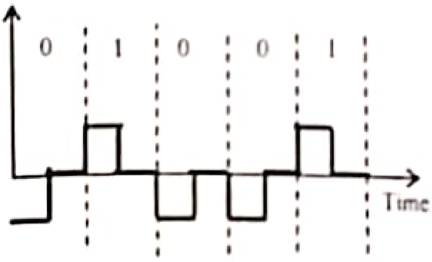
In the first variation, NRZ-L (NRZ-Level), the level of the voltage determines the value of the bit. In the second variation, NRZ-I (NRZ-Invert), the change or lack of change in the level of the voltage determines the value of the bit. If there is no change, the bit is 0; if there is a change, the bit is 1.

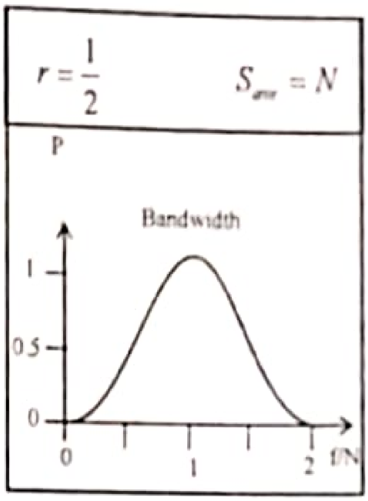
Drawbacks:

1. Baseline wandering is a problem for both variations; it is twice as severe in NRZ-L. If there is a long sequence of Os or Is in NRZ-L, the average signal power becomes skewed. The receiver might have difficulty discerning the bit value.
In NRZ-I this problem occurs only for a long sequence of O s. If we eliminate the long sequence of Os, we can avoid baseline wandering.
2. The synchronization problem (sender and receiver clocks are not synchronized) also exists in both schemes. Again, this problem is more serious in NRZ-L than in NRZ-I. While a long sequence of as can cause a problem in both schemes, a long sequence of Is affects only NRZ-L.
3. Another problem with NRZ-L occurs when there is a sudden change of polarity in the system. For example, if twisted-pair cable is the medium, a change in the polarity of the wire results in all Os interpreted as I s and all I s interpreted as Os. NRZ-I does not have this problem. Both schemes have an average signal rate of NI2.

b) Return to Zero (RZ):

The main problem with NRZ encoding occurs when the sender and receiver clocks are not synchronized. The receiver does not know when one bit has ended and the next bit is starting. One solution is the return-to-zero (RZ) scheme, which uses three values: positive, negative, and zero. In RZ, the signal changes not between bits but during the bit. In the following figure, we see that the signal goes to 0 in the middle of each bit. It remains there until the beginning of the next bit.





Drawbacks:

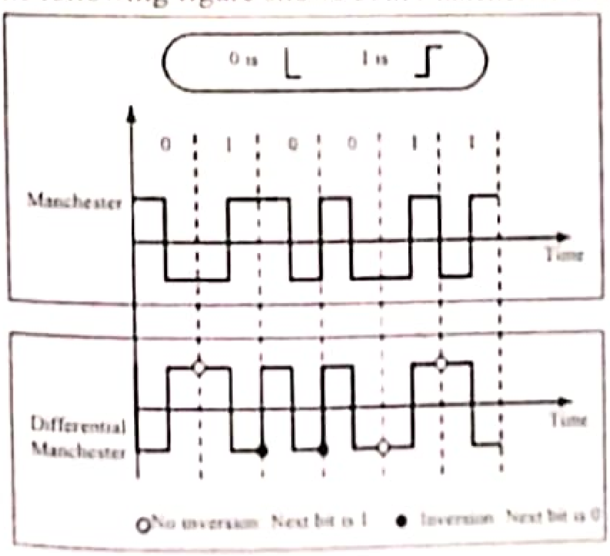
1. The main disadvantage of RZ encoding is that it requires two signal changes to encode a bit and therefore occupies greater bandwidth.
2. Sudden change of polarity resulting in all 0s interpreted as 1s and all 1s interpreted as 0s, still exist here, but there is no DC component problem.
3. Another problem is the complexity: RZ uses three levels of voltage, which is more complex to create and discern. As a result of all these deficiencies, the scheme is not used today.

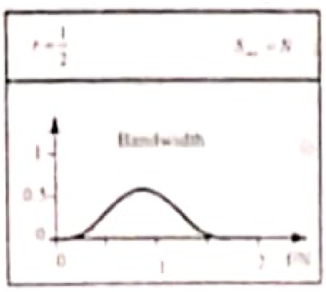
c) Biphase Manchester and Differential Manchester:

The idea of RZ (transition at the middle of the bit) and the idea of NRZ-L are combined into the Manchester scheme.

In Manchester encoding, the duration of the bit is divided into two halves. The voltage remains at one level during the first half and moves to the other level in the second half. The transition at the middle of the bit provides synchronization.

Differential Manchester, on the other hand, combines the ideas of RZ and NRZ-I. There is always a transition at the middle of the bit, but the bit values are determined at the beginning of the bit. If the next bit is 0, there is a transition; if the next bit is 1, there is none. The following figure shows both Manchester and differential Manchester encoding.

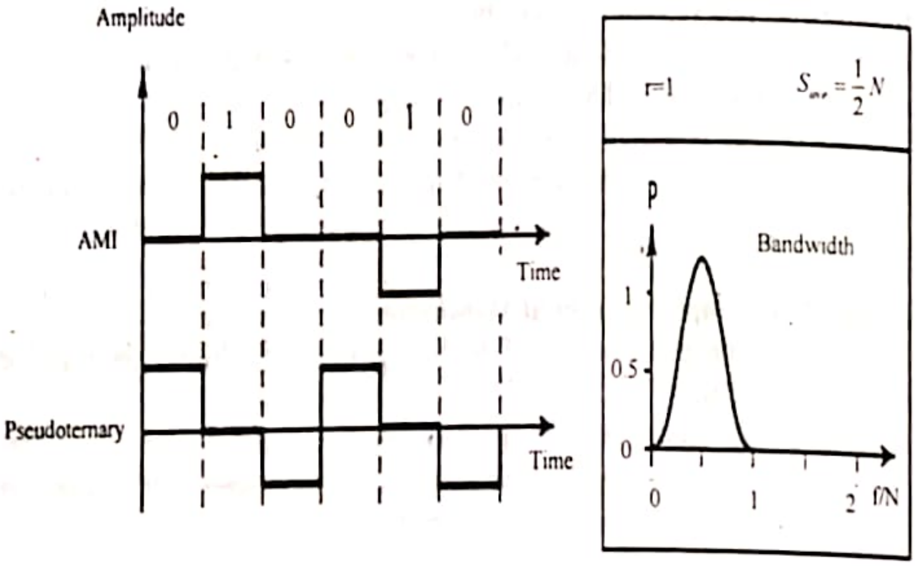




The Manchester scheme overcomes several problems associated with NRZ-L, and differential Manchester overcomes several problems associated with NRZ-I. First, there is no baseline wandering. There is no DC component because each bit has a positive and negative voltage contribution. The only drawback is the signal rate. The signal rate for Manchester and differential Manchester is double that for NRZ. The reason is that there is always one transition at the middle of the bit and maybe one transition at the end of each bit.

iii) Bipolar Schemes

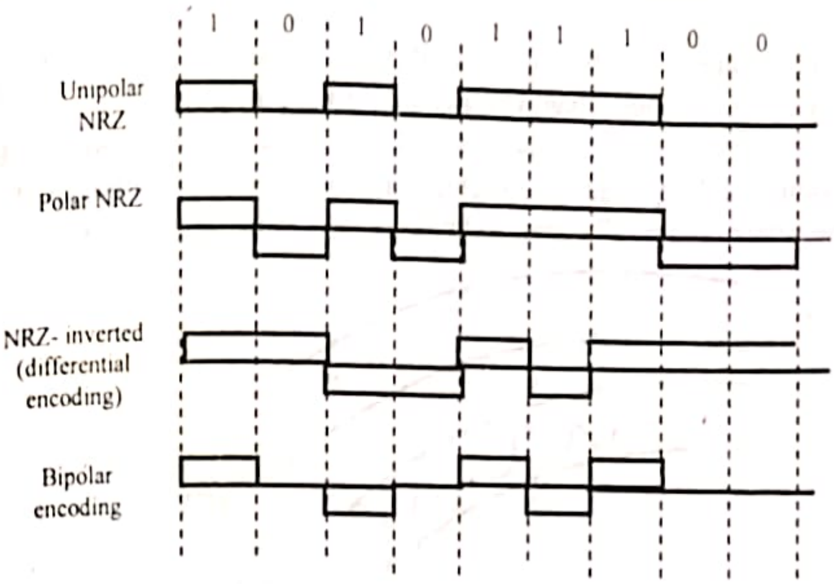
In bipolar encoding (sometimes called multilevel binary), there are three voltage levels, positive, negative, and zero. The voltage level for one data element is at zero, while the voltage level for the other element alternates between positive and negative.AMI and Pseudoternary: The following figure shows two variations of bipolar encoding: AMI and pseudo ternary.



A common bipolar encoding scheme is called bipolar alternate mark inversion (AMI). In alternate mark inversion, a neutral zero voltage represents binary O. Binary ls are represented by alternating positive and negative voltages.

A variation of AMI encoding is called Pseudoternary in which the 1 bit is encoded as a zero voltage and the 0 bit is encoded as alternating positive and negative voltages. The bipolar scheme was developed as an alternative to NRZ. The bipolar scheme has the same signal rate as NRZ. but there is no DC component. The NRZ scheme has most of its energy concentrated near zero frequency, which makes it unsuitable for transmission over channels with poor performance around this frequency. The concentration of the energy in bipolar encoding is around frequency N/2.

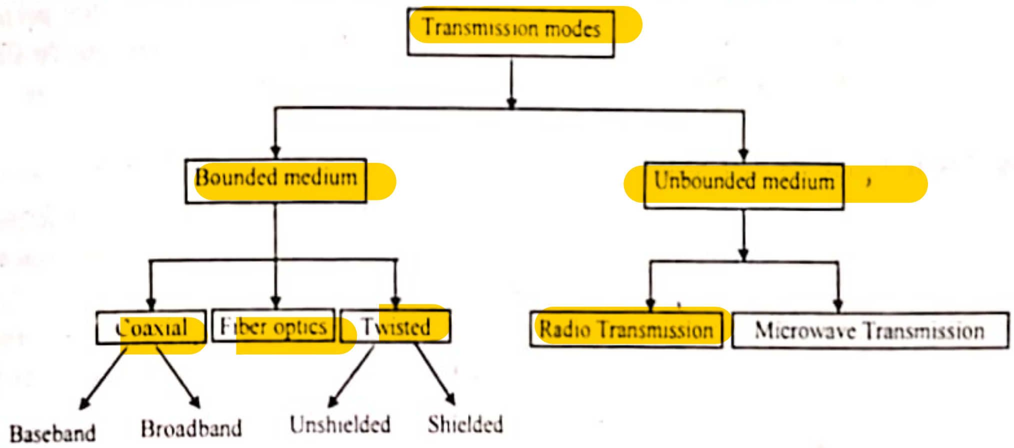
Line coding examples



3. a) Define transmission medium? **[WBUT 2017]**

Answer:

Transmission medium is the means through which we send our data from one place to another. The first layer (physical layer) of Communication Networks OSI Seven layer model is dedicated to the transmission media, we will study the OSI Model later.



b) What is fiber-optic cable? Explain briefly. **[WBUT 2017]**

Answer:

A technology that uses glass (or plastic) threads (fibers) to transmit data. A fiber optic cable consists of a bundle of glass threads, each of which is capable of transmitting messages modulated onto light waves.

Fiber optics has several advantages over traditional metal communications lines:

Fiber optic cables have a much greater bandwidth than metal cables. This means that they can carry more data.

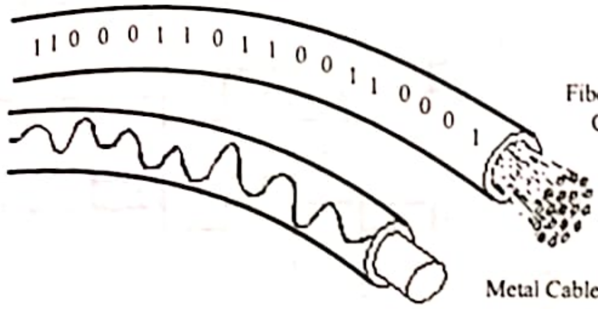
Fiber optic cables are less susceptible than metal cables to interference.

Fiber optic cables are much thinner and lighter than metal wires.

Data can be transmitted digitally (the natural form for computer data) rather than analogically.

The main disadvantage of fiber optics is that the cables are expensive to install. In addition, they are more fragile than wire and are difficult to splice.

Fiber optics is a particularly popular technology for local-area networks. In addition, telephone companies are steadily replacing traditional telephone lines with fiber optic cables. In the future, almost all communications will employ fiber optics.



c) Explain the propagation modes of a fiber-optic cable? **[WBUT 2017]**

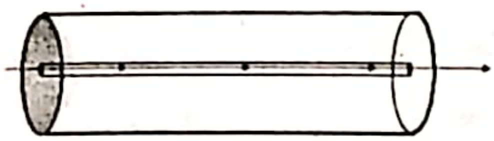
Answer:

Propagation Modes:

Fiber-optic cable has two propagation modes: multimode and single mode. They perform differently with respect to both attenuation and time dispersion. The single-mode fiber-optic cable provides much better performance with lower attenuation.

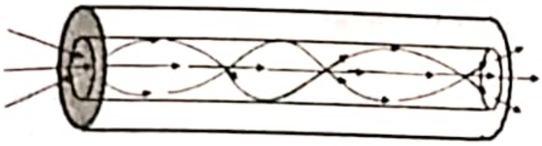
Single Mode Fiber Optic Cable

The "mode" in fiber optic cable refers to the path in which light travels. Single mode fiber has a smaller core diameter 9 micron (8.3 microns to be exact) and only allows a single wavelength and pathway for light to travel, which greatly decreases light reflections and lowers attenuation. Single mode fiber optic cable is slightly more expensive than its multimode counterparts, which is often used in network connections over long lengths.



Multimode Optic Fiber

Multimode optical fiber has a larger core diameter than that of single mode fiber optic cable, which allows multiple pathways and several wavelengths of light to be transmitted. Multimode optical fiber is available in two sizes, 50 micron and 62.5 micron. It is commonly used for short distances, including patch cable applications such as fiber to the desktop or patch panel to equipment, data and audio/video applications in LANs.



d) What are the advantages and disadvantages of optical fiber? **[WBUT 2017]**

Answer:

Advantages and Disadvantages of Optical Fiber

Given the speed and bandwidth advantages optical fiber has over copper cable, it also contains some drawbacks. Here are advantages and disadvantages of optical fiber cable.

Advantages of Optical Fiber

Greater Bandwidth & Faster Speed—Optical fiber cable supports extremely high bandwidth and speed. The amount of information that can be transmitted per unit of optical fiber cable is its most significant advantage.

Cheap—Several miles of optical fiber cable can be made cheaper than equivalent lengths of copper wire. With numerous vendors swarm to compete for the market share, optical cable price would sure to drop.

Thinner and Light-weighted—Optical fiber is thinner, and can be drawn to smaller diameters than copper wire. They are of smaller size and light weight than a comparable copper wire cable, offering a better fit for places where space is a concern.

Higher carrying capacity—Because optical fibers are much thinner than copper wires, more fibers can be bundled into a given-diameter cable. This allows more phone lines to go over the same cable or more channels to come through the cable into your cable TV box.

Less signal degradation—The loss of signal in optical fiber is less than that in copper wire.

Light signals—unlike electrical signals transmitted in copper wires, light signals from one fiber do not interfere with those of other fibers in the same fiber cable. This means clearer phone conversations or TV reception.

Long Lifespan—Optical fibers usually have a longer life cycle for over 100 years.

Disadvantages of Optical Fiber

Limited Application—Fiber optic cable can only be used on ground, and it cannot leave the ground or work with the mobile communication.

Low Power—Light emitting sources are limited to low power. Although high power emitters are available to improve power supply, it would add extra cost.

Fragility—Optical fiber is rather fragile and more vulnerable to damage compared to copper wires. You'd better not to twist or bend fiber optic cables.

Distance—The distance between the transmitter and receiver should keep short or repeaters are needed to boost the signal.

e) Write down the applications of optical fiber. **[WBUT 2017]**

Answer:

Fiber optical cables have made excellent mediums for telecommunication networks due to their flexibility and durability. Optics fiber is used by many telecommunication companies to transmit telephone signals, Internet communication, and cable television signals. Fiber is laid and used for transmitting and receiving purposes. Unlike electrical cables, signals transmitted using fiber optics experience relatively little loss of intensity, allowing them to transport information far distances with few repeaters. Fiber optic cables can carry a large number of different signals simultaneously through a technique called wavelength division multiplexing. This increases their efficiency and makes them ideal for transporting large quantities of independent signals. Their effectiveness is further helped by their immunity to electrical interference.

Optical fibers are ideally suited for carrying digital information, which is especially useful in computer and cellular networks. Higher carrying capacity, Less signal degradation, low power, lightweight and flexible make the fiber optics ideal media for telecommunications.

in medicine, optical fibers enable physicians to look and work inside the body through tiny incisions without having to perform surgery. They are used for endoscope instruments for viewing the interior of hollow organs in the body. Most endoscopes have two sets of fibers: an outer ring of incoherent fibers that supplies the light, and an inner coherent bundle that transmits the image. Endoscopes may be designed to look into specific areas. For example, physicians use an arthroscopic to examine knees, shoulders and other joints. In some models, a third set of fibers transmits a laser beam that is used to stop bleeding or to burn away diseased tissue. Body temperatures can be measured using optical fiber. They can also be used for insertion into blood vessels to give a quick accurate analysis of blood chemistry.

Fiber optic cables are found in hospitals and doctor's offices around the world. They form the backbone of advanced imaging techniques used in digital diagnostics since they can efficiently transport large quantities of sensitive data. Since fiber optical cables are inert they introduce no risk of infection. Their flexibility make fiber optic cables the natural choice for endoscopes used in minimally invasive surgical procedures. The rise of endoscopy has replaced invasive exploratory surgery in diagnosing difficult medical conditions.

4. a) What is composite signal? **[MODEL QUESTION]**

b) We measure decibel in logarithmic forms. What is the actual reason behind this?

c) Suppose transmission channels become virtually error-free. Is the data link layer still needed? Explain.

Answer:

a) A Composite Signal is a signal which actually carries multiple other signals that are often related to each other. On the most common examples of a composite signal is the "composite video" signal that is fed to an analog television set. Composite video is usually available in standard formats such as NTSC, PAL, and SECAM. It is a composite of three source signals called Y, U and V (together referred to as YUV) with sync pulse

Y represents the brightness or luminance of the picture and includes synchronizing pulses, so that by itself it could be displayed as a monochrome picture. U and V represent hue and saturation or chrominance.

b) The decibel (dB) is a logarithmic unit of measurement that expresses the magnitude of a physical quantity (usually power or intensity) relative to a specified or implied reference level. Since it expresses a ratio of two quantities with the same unit, it is a dimensionless unit.

The use of the decibel has a number of merits:

The decibel's logarithmic nature means that a very large range of ratios can be represented by a convenient number, in a similar manner to scientific notation. This allows one to clearly visualize huge changes of some quantity.

The mathematical properties of logarithms mean that the overall decibel gain of a multi-component system (such as consecutive amplifiers) can be calculated simply by summing the decibel gains of the individual components, rather than needing to multiply amplification factors.

The human perception of, for example, sound or light, is, roughly speaking, such that a doubling of actual intensity causes perceived intensity to always increase by the same amount, irrespective of the original level. The decibel's logarithmic scale, in which a doubling of power or intensity always causes an increase of approximately 3 dB, corresponds to this perception.

c) Even if the transmission channels become error free, there would still be a need for the data link layer. The data link layer is responsible for breaking up the data it receives from a higher layer into frames and decide upon the most appropriate time to put such a frame on the network through the physical layer. Address management of network interfaces is also the responsibility of the data link layer. In other words, the absence of errors in the network possibly does away with the LLC functionality but the MAC . layer responsibilities remain. Without the MAC layer functionalities, the network layer cannot become independent of the physical nature of the transmission medium. For example, without a data link layer, an IP layer for Ethernet (CSMA/CD protocol) would be different from the IP layer for WLAN (CSMA/CA).

5. Distinguish among the working principles of circuit switching, message switching and packet switching techniques. [MODEL QUESTION]

Answer:

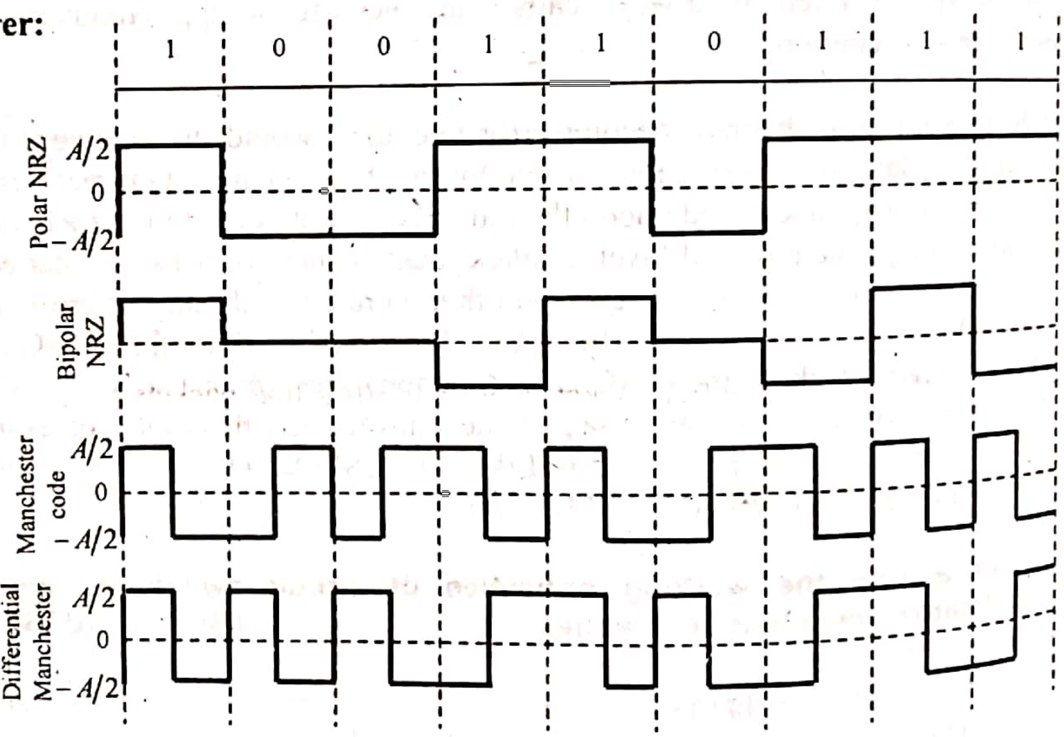
Different types of switching techniques are employed to provide communication between two computers. These are: Circuit switching, message switching and packet switching.

Circuit Switching: In this technique, first the complete physical connection between two computers is established and then data are transmitted from the source computer to the destination computer. That is, when a computer places a telephone call, the switching equipment within the telephone system seeks out a physical copper path all the way from sender telephone to the receiver's telephone. The important property of this switching

technique is to setup an end-to-end path (connection) between computer before any d
can be sent.
Message Switching: In this technique, the source computer sends data or the message the switching office first, which stores the data in its buffer. It then looks for a free link another switching office and then sends the data to this office. This process is contin until the data are delivered to the destination computers. Owing to its working princip it is also known as store and forward. That is, store first (in switching office), forw later, one jump at a time.
Packet Switching: With message switching, there is no limit on block size, in contr packet switching places a tight upper limit on block size. A fixed size of packet wh can be transmitted across the network is specified. Another point of its difference fr message switching is that data packets are stored on the disk in message switchi whereas in packet switching, all the packets of fixed size are stored in main memo This improves the performance as the access time (time taken to access a data packet reduced, thus, the throughput (measure of performance) of the network is improved.

6. a) Find the NRZ-I, Manchester and Differential Manchester encoding for t binary Data 100110111.
b) Suppose that a signal has 2^n times the power as a noise signal that is added it. Find the SNR (Signal to Noise Ratio) in decibels. **[MODEL QUESTIO**

Answer:
a)



b) $\text{SNR} = 10\log_{10} 2^n = 10n\log_{10} 2 = 3.01n\text{dB}$