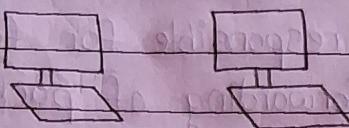
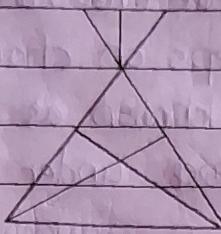
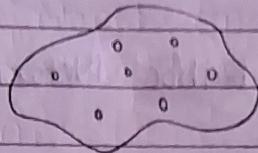


WSN Notes

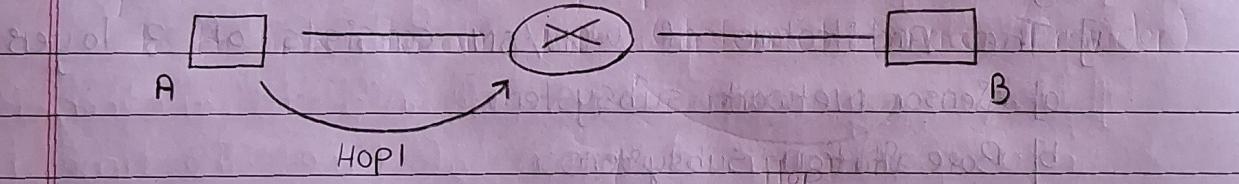
- Q1] Working of Wireless Sensor Network (Architecture)



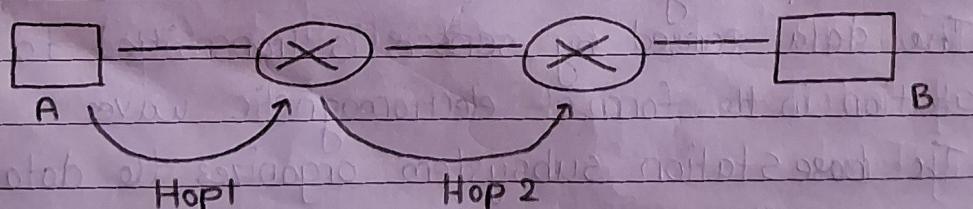
- 1] Sensor is a device which senses parameters such as temperature, humidity, depth of the sea, etc.
- 2] Sensor network is a collection/group of sensors which monitors the data.
- 3] Sensor units are different for different parameters and Bandwidth matters while sensing.
- 4] Sensor nodes are unpredictable as prediction is done by human based on the data sensed.
- 5] The Architecture of WSN/SN consists of 3 layers.
 - a] Sensor Network subsystem
 - b] Base station subsystem
 - c] User subsystem
- 6] In the Sensor Network subsystem, clustering of sensor nodes is done and these sensor nodes captures information.
- 7] After capturing info it sends values to the Base station.
- 8] The data sensed by sensors is transmitted to the base station in the form of electromagnetic waves.
- 9] The base station subsystem organizes the data & also processes it.
- 10] At last, the user subsystem makes the processed data available for the users.

Q2] MANET.

-
- 1] Manet is Mobile Adhoc Network where Adhoc means Temporary.
 - 2] Here, the network structure is never fixed.
 - 3] The network setup keeps on changing due to mobility of the device. This is known as Manet.
 - 4] The devices which comes under Manet are autonomous.
 - 5] In a manet, the nodes act as both hosts and routers and are responsible for forwarding packets.
 - 6] Routing means forwarding of packets from one devices to another depending on structure.
 - 7] Manets are useful in military operation, disaster relief operations, etc.
 - 8] Routing in Manet consists of 2 ways:
 - a] Intradomain
 - b] Interdomain
 - 9] Every Router Maintains a Routing table
 - 10] Single hop -
Router
A → () → B



Multi hop



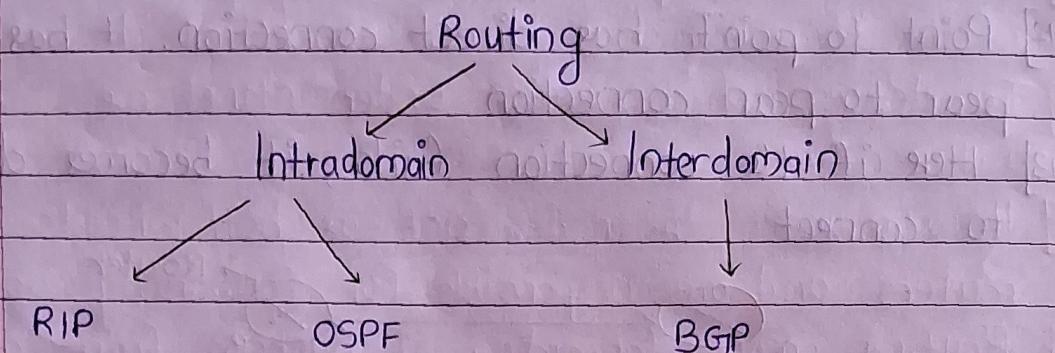
[Q3] Routing in Manet.

→ 1] Routing in Manet consists of 2 ways

a] Interdomain

b] Intradomain

which further consists sub-types as follows:



RIP → 2] RIP stands for Routing info protocol and is also known as distance vector protocol.

3] Here, the hop count is important.

4] Every Routing table here has 3 columns as

a] Destination Network

b] Hop count

c] Next hop

5] The Next hop will always have a router.

6] RIP says that if there is any change it will inform its neighbouring routers.

7] Here, every router shares the info to another Router in a particular duration of time. The time here is measured in seconds or milliseconds.

8] If immediate change has occur , it will not wait for the particular time & share the data to neighbouring routers immediately.

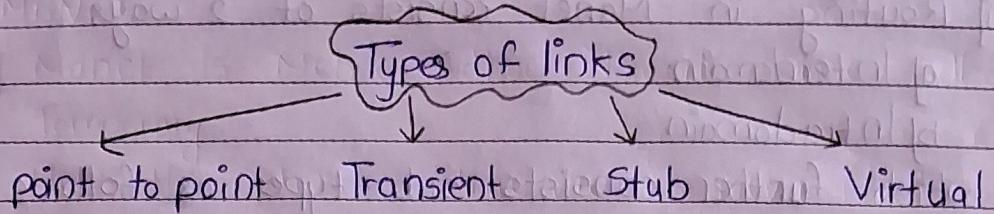
9] Also, RIP table consists of 2 stages

a] Initial

b] Final

OSPF → 10] OSPF stands for open shortest path first and is also known as linked state.

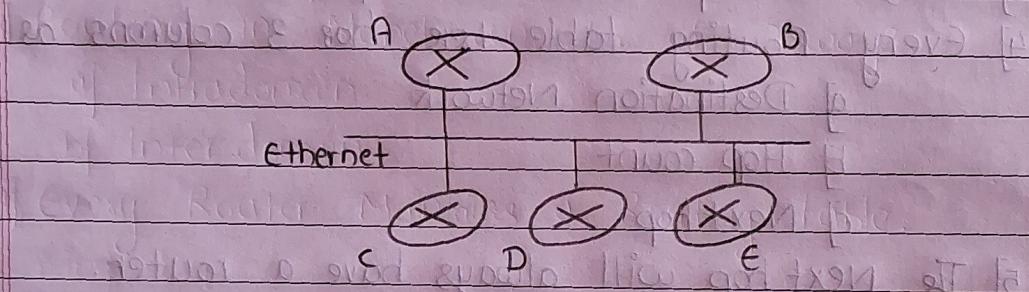
iii) OSPF contains different types of links as :



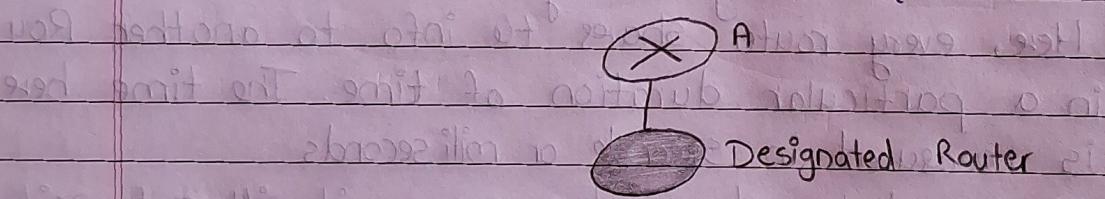
12] Point to point has direct connection. It has peer to peer connection.

13] Here if link connection fails, it becomes difficult to connect.

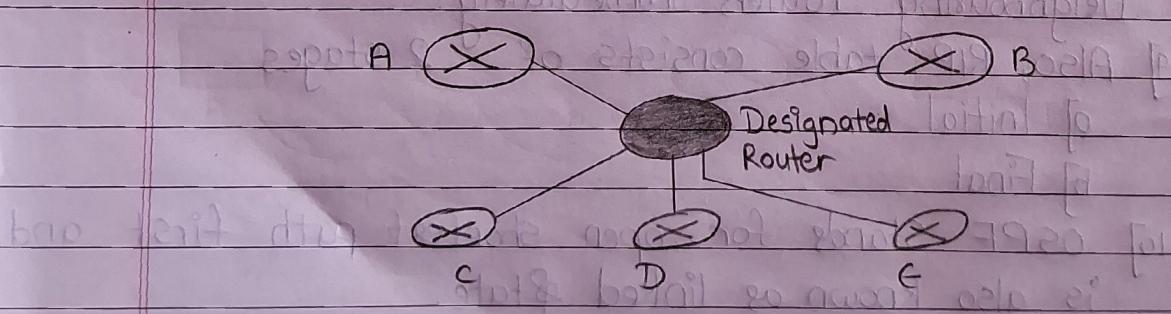
14] Transient consists of Bus topology where it becomes difficult if any one cable does not work.



15] Stub means a group that uses only one router to link to an ISP (Internet Service Provider).



16] Virtual link means a temporary type of network.



BGP →

- 17] BGP stands for Border Gateway Protocol
- 18] BGP implements path vector Routing
- 19] It contains a speaker node which advertises the path.
- 20] The Routers in BGP are external & the Routing table contains 2 columns :
 - a] Network
 - b] Path

Q4] Challenges in WSN design.

→

- i] The challenges in WSN design consist of some point like
 - a] Area Coverage
 - b] Placement of the sensor nodes
 - c] Selection of cluster head.
 - d] Sense → Collect → Communicate
- 2] Always select cluster head which is close to Base station
- 3] The sensor nodes which are far from cluster head can pass the data & then it can reach CH.
- 4] Energy is consumed to pass the data to cluster head.
- 5] If direct Route is not working to reach CH then by spending more energy take another route to nearest node.
- 6] If cluster Head itself is down due to more energy consumption, we need to keep second cluster head ready.

Q5]

Applications of Manet.

→

Refer Q2]

- i] The advanced features of manet includes data rates compatible with multimedia applications, global roaming capability & coordination with other networks.

Q) Some applications of manet are :

- a) Military operations
- b) Emergency & disaster Response
- c) Outdoor events
- d) Transportation
- e) Sensor Networks, etc.

3) Basically, manets are useful in situations where communication is damaged or non-existent.

Q6] Application of Sensor Network

→ Refer Q1] SN are used to monitor & collect data.

Q) Some applications of SN are :

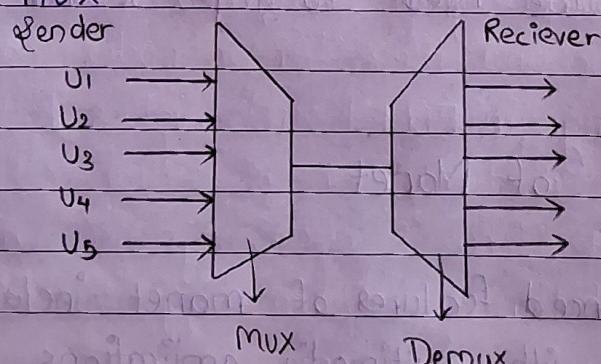
- a) Environment monitoring
- b) Industrial monitoring
- c) Healthcare monitoring
- d) Agriculture monitoring
- e) Smart Home automation
- f) Traffic monitoring

3) Basically, SN are useful where large no. of data need to be collected & monitored in real-time.

Q7] Multiplexing (FDM, TDM)

→ 1] Multiplexing is a process where we combine more signals to one signal.

2] Multiplexing is done with the help of a device known as MUX



3) This figure represents Multiplexing & Demultiplexing.

4) Multiplexing are categorized into 3 types

a) FDM → Frequency division Multiplexing

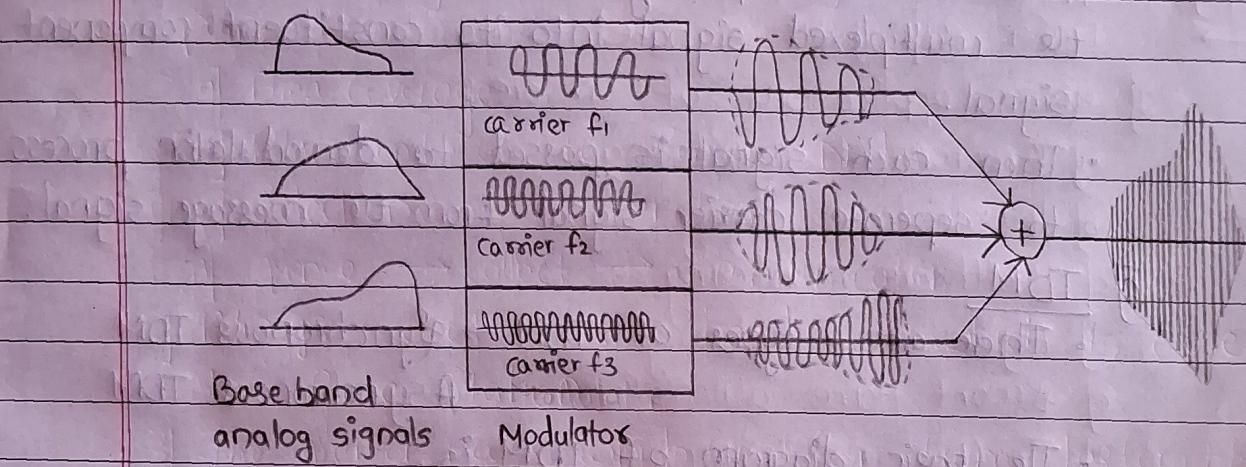
b) TDM → Time division Multiplexing

c) SDM → Space division Multiplexing.

5) FDM :

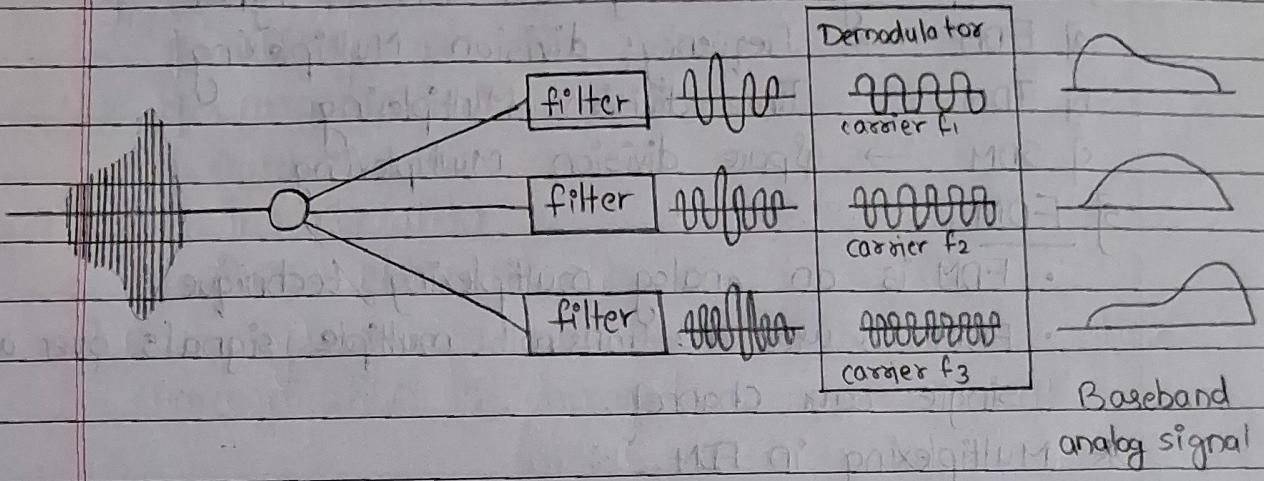
- FDM is an analog multiplexing technique
- FDM is used to transmit multiple signals over a single ~~each~~ channel.

* Multiplexing in FDM.



- Here the original signal is known as the base band analog signal.
- After that, comes the modulated signal (ie the carrier signal).
- These signals will go to channel & then it will go receivers side.
- The filter in receivers end is for disturbance in signal.
- Atlast a single signal is formed known as multiplexed signal.

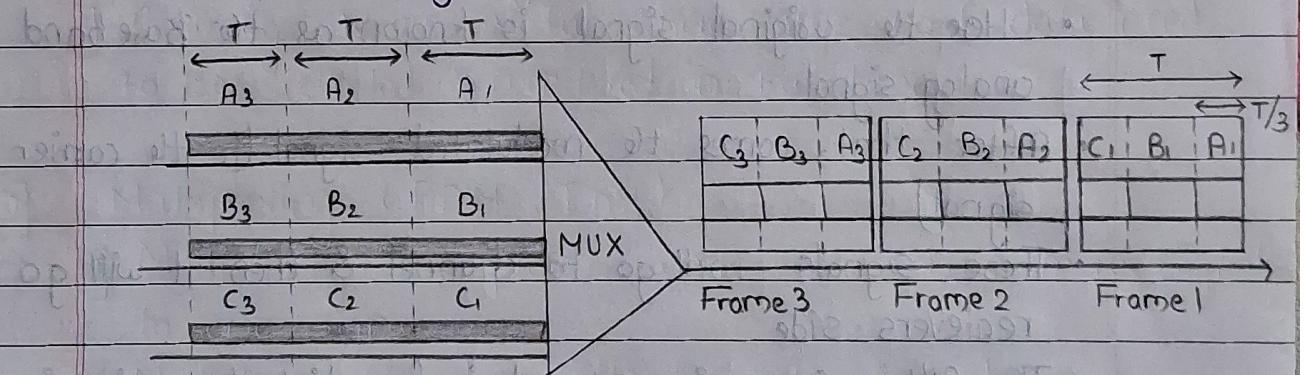
* Demultiplexing in FDM.



- Here in demultiplexing we use filters to decompose the multiplexed signal into its constituent component signal.
- Then each signal is passed to demodulation process to separate carrier signal from the message signal.

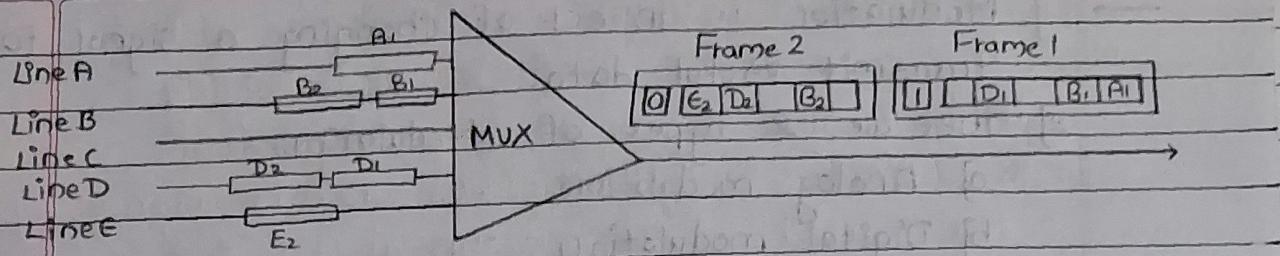
g) TDM

- There are 2 types of TDM → asynchronous TDM
Synchronous TDM.
- The basic diagram of TDM is:



- Data are taken from each line every T .
- TDM uses digital signals.

g) asynchronous TDM

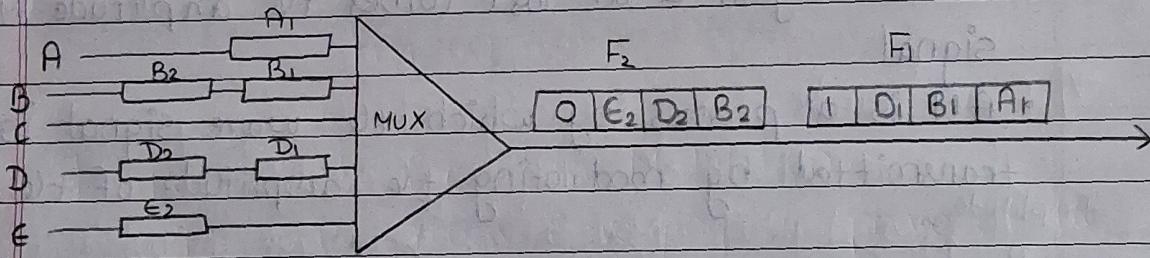


- Here, a particular time slot is used, signals transmitted in the time slot is 1 & those who are not transmitted is 0.
- A single singl signal is divided into slots
- After multiplexing of slots, frames are created.
- $\boxed{[\text{No. of frames} = \text{No. of slots}]}$
- Here every frame contains a column in the last with either 1 or 0,

Here 1 depicts it is not the last frame

0 depicts it is the last frame.

b] Asynchronous TDM



- The ASynchronous TDM is a method in which time slots are not permanent
- Slots are assigned to only those which have data to send.
- The frames here only has the data which is sent by the slots

Q8]

Modulation

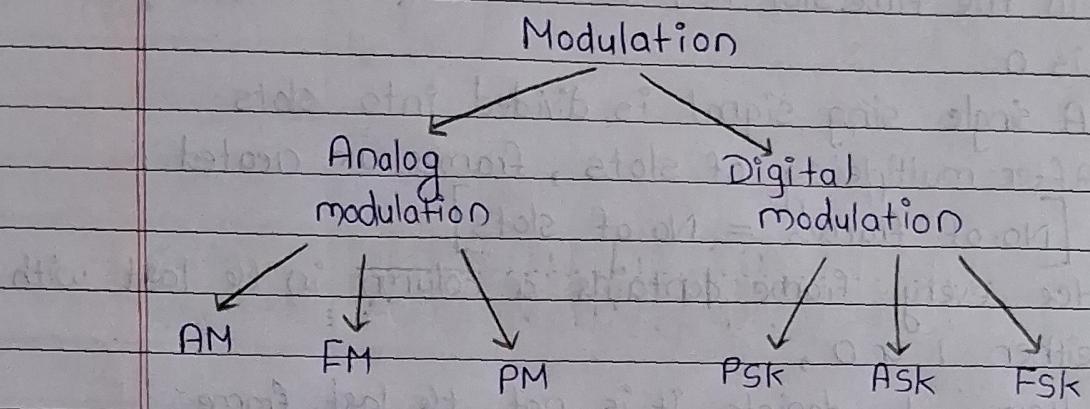
→ 1] Modulation is an act of changing a signal to transmit useful data.

2] There are 2 types of Modulation

a) Analog modulation

b) Digital modulation

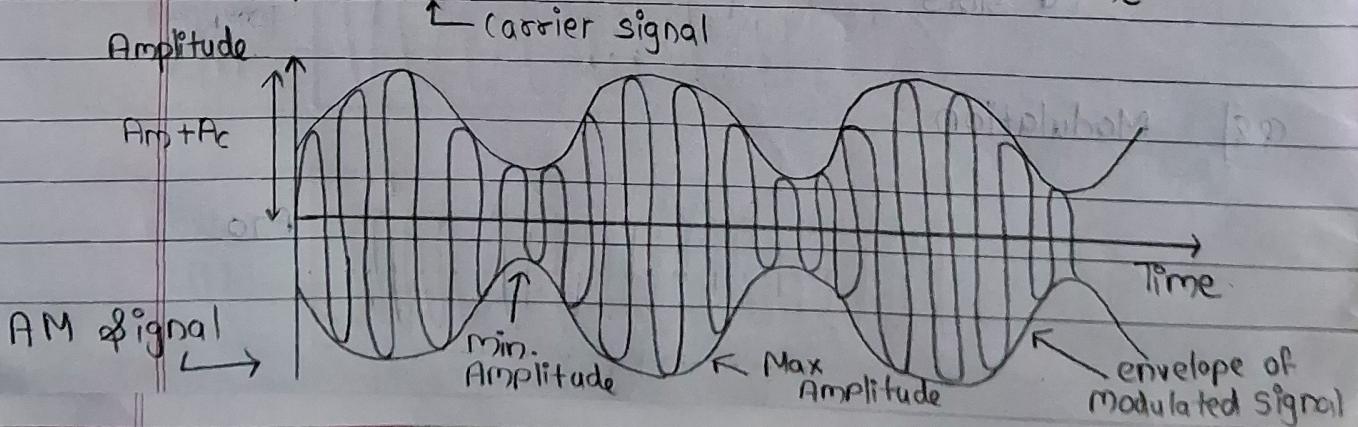
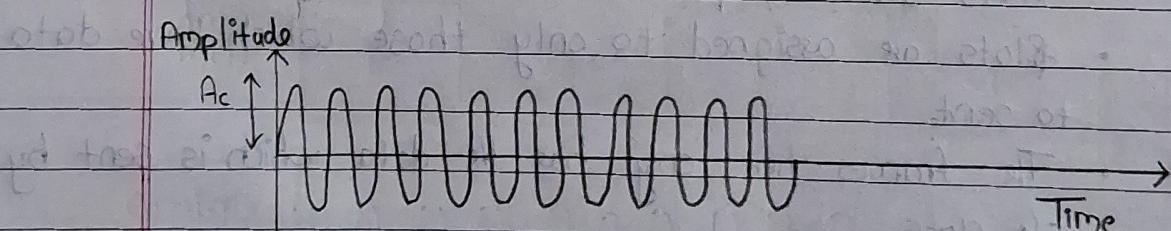
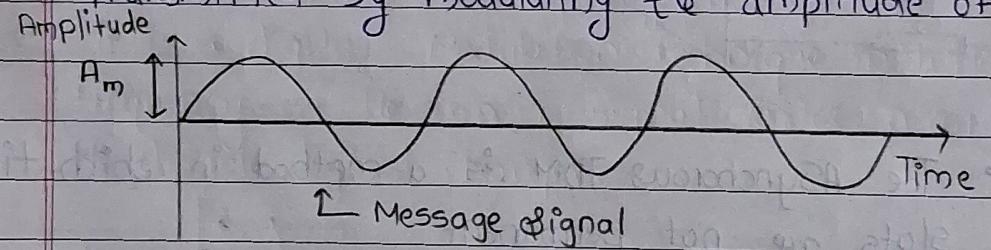
which further consists of sub-types as follows:



3] • AM stands for Amplitude Modulation.

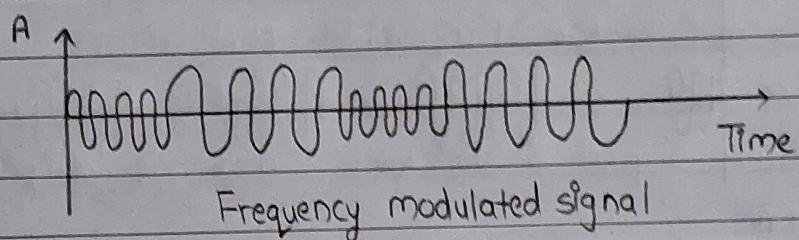
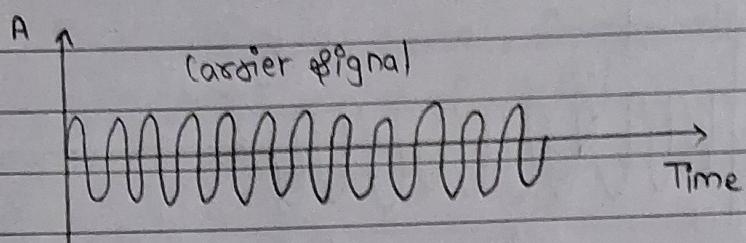
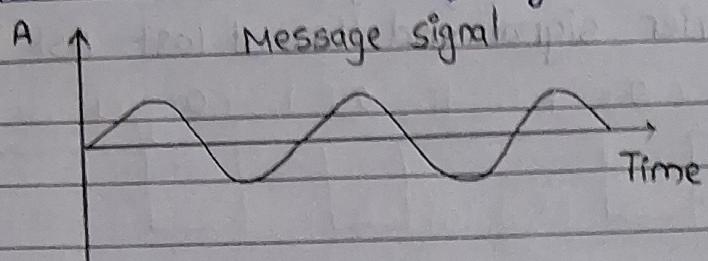
• It consists of Message signal, then comes the carrier signal & at last comes the amplitude modulated signal.

• AM is a process by which the wave signal is transmitted by modulating the amplitude of the signal.



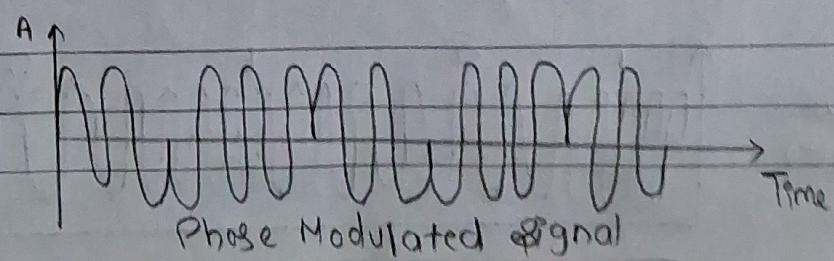
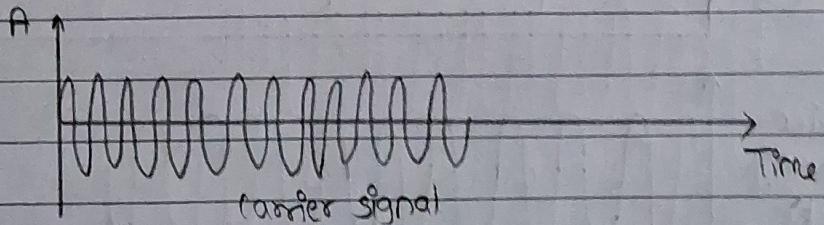
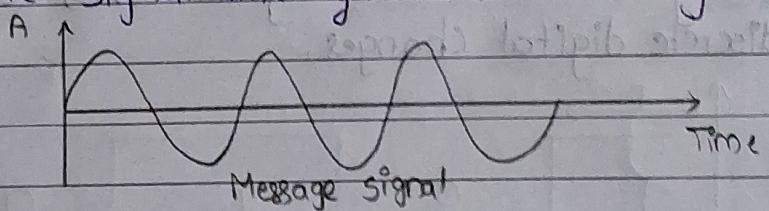
4] FM stands for frequency modulation

- FM is a process of encoding info on a particular signal by varying the carrier wave frequency in accordance with the frequency of modulated signal.



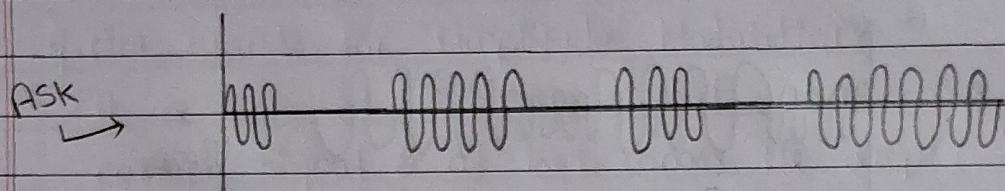
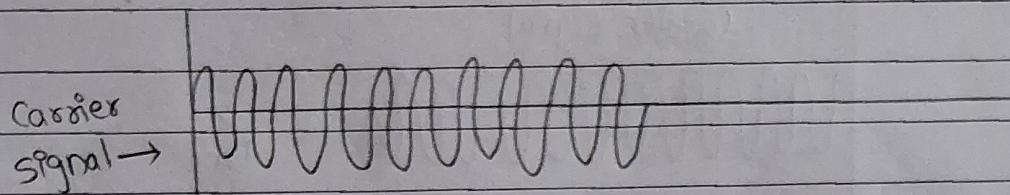
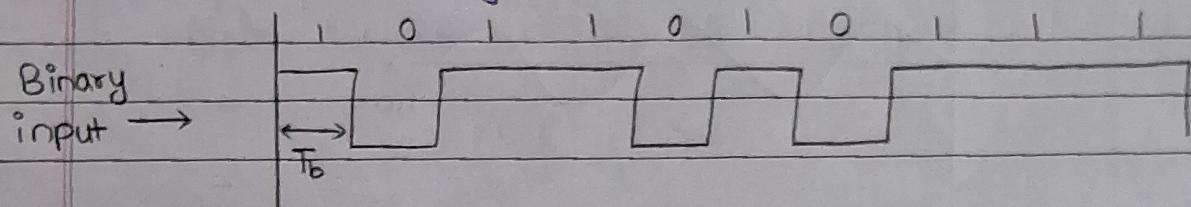
5] • PM stands for Phase Modulation

- PM is the process of varying the phase of the carrier signal linearly with the message signal.



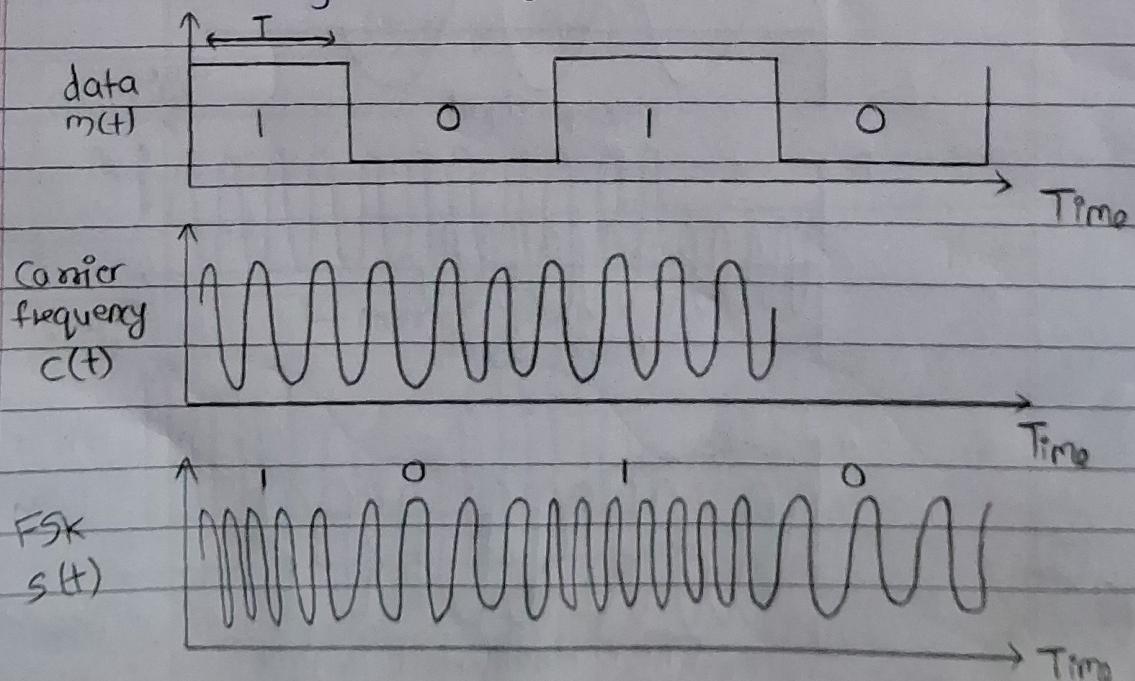
6] Now comes the digital modulation.

- ASK stands for Amplitude Shift keying
- It is a type of amplitude modulation
- It consists of Message signal which is Binary input, then carrier signal and then at last ASK is formed.



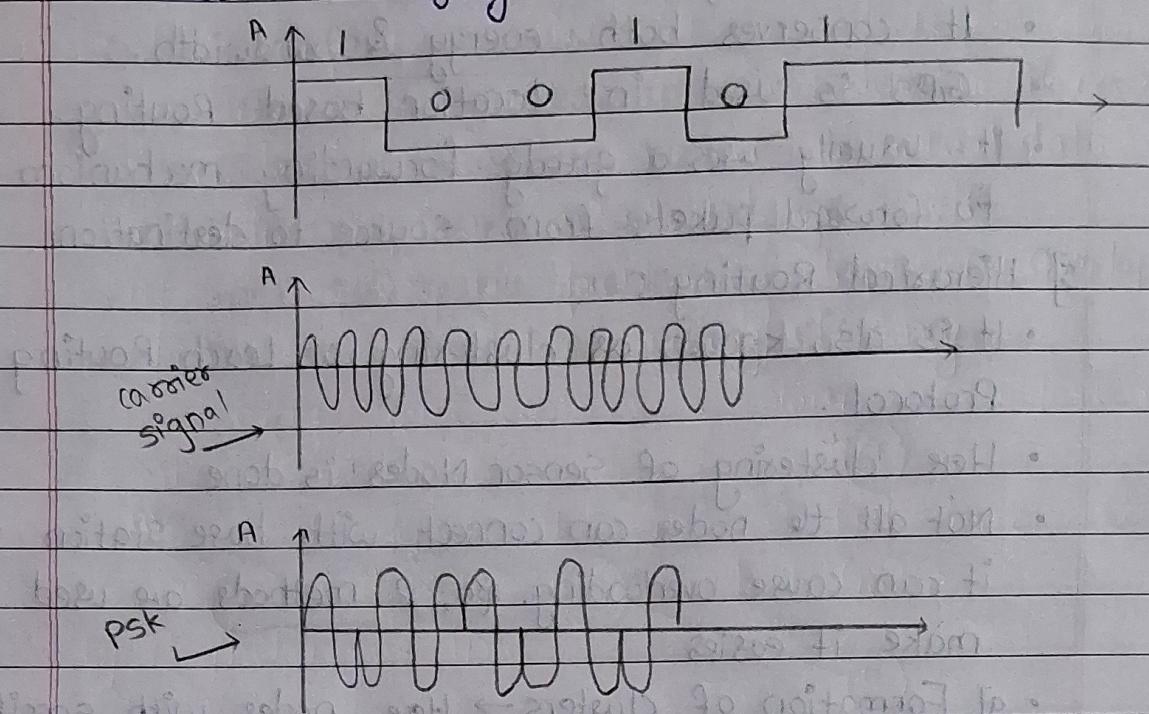
7] FSK stands for frequency shift keying.

- It is a scheme of frequency modulation
- It is a digital Modulation technique in which the frequency of the carrier signal varies according to the discrete digital changes.



8] PSK stands for phase shift keying.

- It is the process which conveys data by changing the phase of a constant frequency reference signal.
- It also includes binary signal, carrier signal & at last Phase shift keying.



9] Routing Protocols in WSN.

- 1] Routing protocols in WSN are algorithms that determine the optimal path for data transmission from a source node to destination node.
- 2] Routing protocols play a critical role in ensuring efficient & reliable data transmission between sensor nodes.
- 3]

Routing Protocols in WSN

Flat architecture
(Gossiping)

Data
Centric
(SPIN)

Hierarchical
(Clustering)

Location
based
Routing
(GPS)

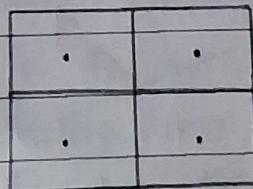
4] Location based Routing :

- Location based Routing uses the location info for nodes to provide higher efficiency & scalability.
- It uses the network topology you define for network, region, site & subnet
- It conserves both energy & bandwidth.
- GPS is used in Location based Routing.
- It usually uses a greedy forwarding mechanism to forward packets from source to destination

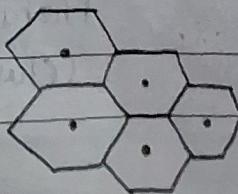
5] Hierarchical Routing :

- It is also known as clustering or Leach Routing Protocol.
- Here clustering of Sensor Nodes is done.
- Not all the nodes can connect with base station as it can cause overloading. So, 2 methods are used to make it easier
- a) Formation of clusters → Here nodes with specific similarities are formed in clusters.
- b) Selection of cluster head → It makes the data transfer to base station more easy.
- While clustering there are some rules to take care of :
 - a) Any 2 sensor node's coverage area should never overlap
 - b) No area should be left unsensed / missing.
 - c) Coverage area need not to be in circular motion & it can be of different shapes like rectangle, square, triangle, etc.

correct way

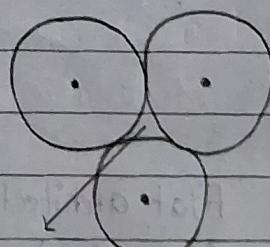


Here area is sensed completely



incorrect way

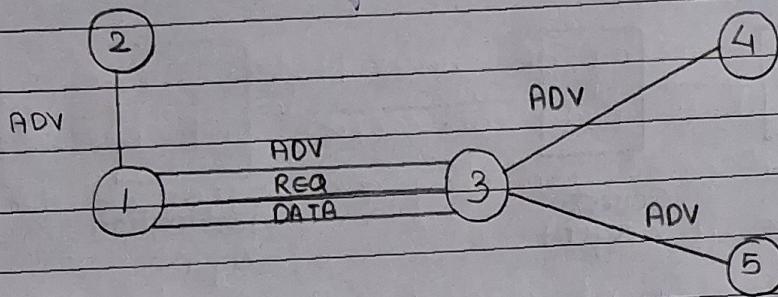
way



Here it cannot sense the gap

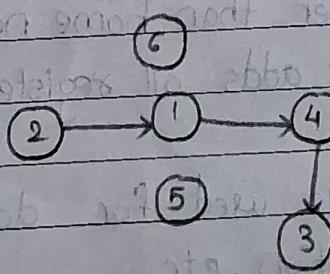
6] Data Centric :

- It is also known as Spin Routing protocol
- It focuses on reducing the amount of data transmission in the network.
- Three messages namely ADV, REQ, DATA are used in spin
- ADV → It is used to advertise the new data
- REQ → It is used to receive the actual data
- DATA → It is the actual message itself.
- Spin solves the problem of Implosion, Overlap & thus achieve a lot of energy efficiency.



7] Flat architecture and inborn error control

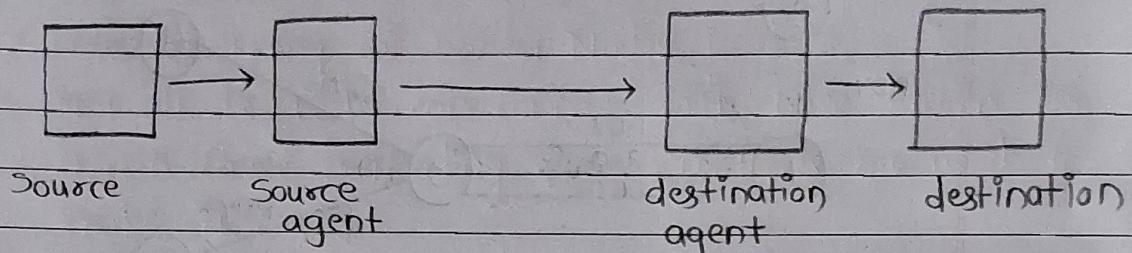
- It is also known as Gossiping.
- It is similar to flooding
- It reduces the no. of packets in the network but the delay to reach destination in some cases may be very large.
- Here instead of broadcasting, a node randomly selects the neighbour which further randomly selects another neighbour node until it reaches the destination.



Q10] A scenario where phone is in home network or phone is not in home Network: (OR)

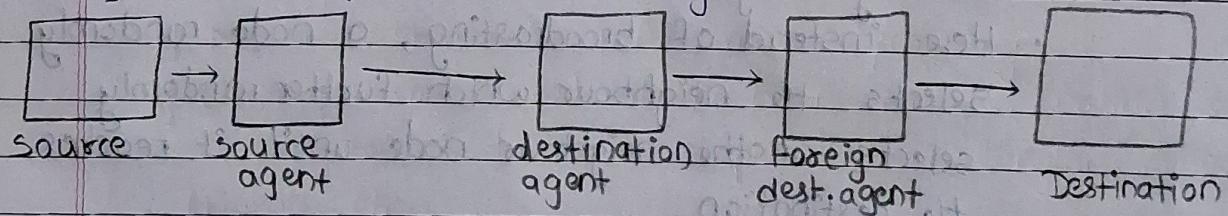
Mobile IP.

- i] Mobile IP enables the transfer of information to and from mobile networks (computers) such as laptops & wireless communication.
- ii] In Mobile IP there comes 2 scenario:
- When phone is in home Network
 - When phone is in foreign Network.
- iii] When the phone is in home Network →



- The router used in home Network is home agent.
- It serves as the anchor point for communication with the Mobile Node.
- Home Network is the base station Network to which the mobile node originally belongs to.

ii] When the phone is in foreign Network.



- Any networks other than home network is called foreign N.
- The foreign agent adds all registered mobile nodes to its visitor table.
- Foreign network is used for data transfer, Internet connectivity, localization, etc.