ANNA UNIVERSITY , CHENNAI
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
Part A Questions & Answers

SUB.NAME : WIRELESS NETWORKS

UNIT I MULTIPLE RADIO ACCESS

1. **Define uplink and Down link**

    Uplink – Communication Between mobile terminal to base station (Reverse Channels)
    Downlink - Communication Between base station to mobile terminal (Forward Channels)
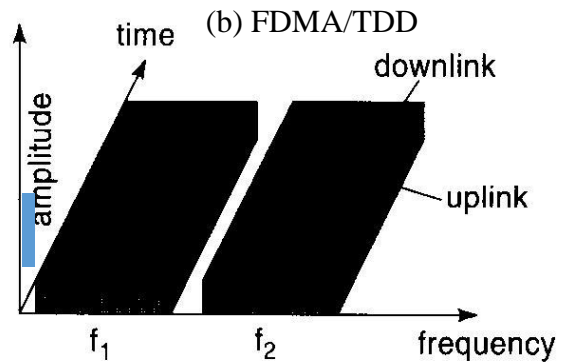
2. **Define FDD and TDD**

    FDD – Duplexing scheme in which the forward and reverse channels use different carrier frequencies

    TDD - Duplexing scheme in which the forward and reverse channels use different time slots but one frequency

3. **Draw FDMA/FDD, FDMA/TDD, TDMA/ FDD & TDMA/TDD systems**
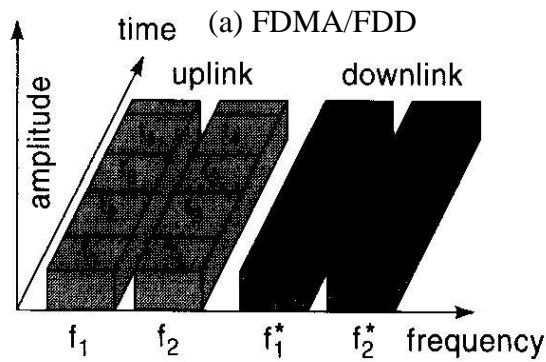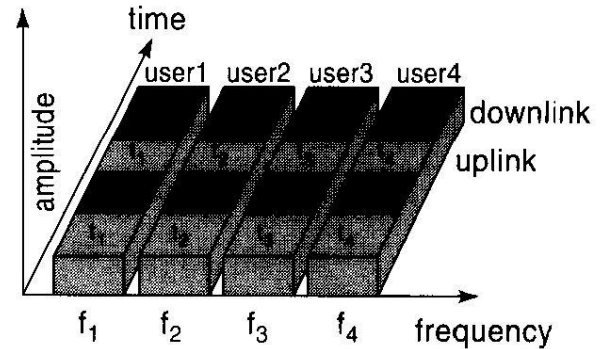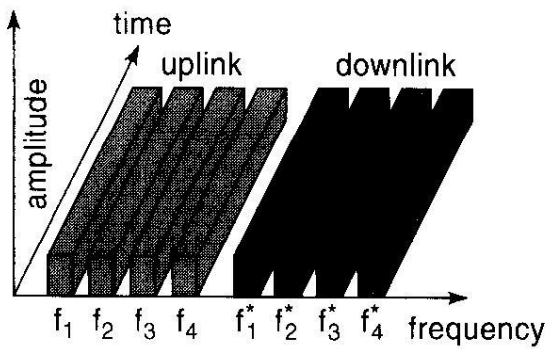
(a) FDMA/FDD

(b) FDMA/TDD

(a) TDMA/FDD

(b) TDMA/TDD

4. **Disadvantages of FDMA**
    *   Tight RF filtering circuits
    *   Adjacent Channel Interference
    *   Near-far problems
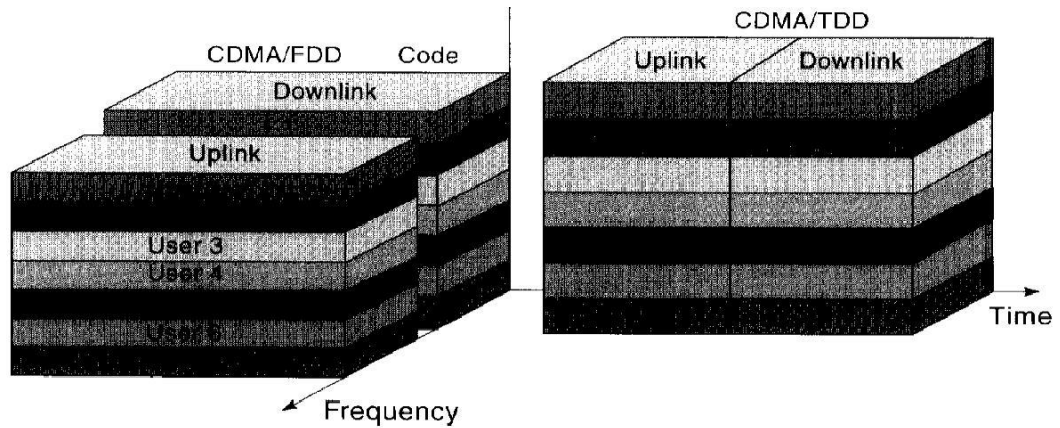   *   Low spectrum efficiency
    *   Low capacity

5. Define performance Improvement factor It is defined as

$$K = \frac{G_A \cdot G_v}{n_c}$$

Where G_A – Sectorization Gain Factor

G_v – Voice Activity Interference Reduction Factor and it is defined as the ratio of the total connection to the active talk spurt time.

6. Draw CDMA/FDD & CDMA/TDD systems

(a) CDMA/FDD   (b) CDMA/TDD.

7. Reasons for call blockage

Type 1- Calling number is not available results in a response of Busy Tone

Type 2- Resources not available with message that" All circuits are busy at this time, Please try after sometime"

8. Define blockage rate

It is a function of number of subscribers, number of initiated calls and length of conversation

9. Differentiate Fixed assignment access and random access

Fixed assignment access suitable for digitized voice traffic, data file transfer and facsimile transmission where study flow of information, setup time is large, access to network by users depends on services subscribed

Random access – bursty data applications in computer communications where information transmission is intermittent, contention among the users to access the network

10. What are types of Random Access methods

Two groups of Random Access Methods are (a) ALOHA – based access methods in which the mobile terminals transmits their contention packet without any coordination between them. (b) the carrier sense based technique in which the terminal senses the availability of the channel before it transmits its packets.

11. What are the popular access schemes for data networks? Classify them

i. Different ALOHA Techniques, ii. CSMA Techniques, iii CSMA/CD, iv.CSMA/CA, v. RTS/CTS

12. **What is the difference between the access technique of IEEE802.3 and IEEE802.11**? IEEE802.3 uses CSMA/CD but IEEE802.11 uses CSMA/CA protocol. Because when CSMA/CD is used in IEEE802.11, collision cannot be identified.

13. **What is the difference between performance evaluations of voice oriented fixed assignment and data oriented random access?**

In voice oriented fixed assignment network, circuit switching is used and delay cannot be tolerated, but packet loss can be accepted. In data oriented random access networks, packet switching is used. Here delay can be tolerated but packet loss cannot be tolerated. As the requirements of data and voice networks differ their performance evaluations also differ.

14. **What is the difficulty of implementing CSMA /CD in a wireless environment?**

When we use CSMA/CD in wireless applications collision cannot be detected because of multipath effect and near far problem.

15. **Explain about CSMA.**

CSMA - it is also called as Listen Before Talk. This technique reduces collision considerably compared to ALOHA, because it senses the availability of the channel first and then transmits.

16. **Explain about hidden terminal problem**.

In wireless networks, when two terminals are not within the radio range to each other then they cannot transmit directly. This is called hidden terminal problem.

17. **Explain about capture effect.**

In FM reception, when we have more than one signal the stronger signal is selected that is called capture effect.

18. **Write down the formula for N**
    idle. N idle = N − ρ (1- B(N, ρ))

19. **Define: a. persistent, b. non persistent, c. 1-persistent, d. p-persistent**
    a. After sensing a busy channel, if the terminal continues sensing the channel until the channel becomes free the protocol is called Persistent CSMA.
    b. If After sensing the channel, the terminal attempts another sensing only after a random waiting period, the protocol is called Non Persistent CSMA .
    c. In Persistent operation, after the channel becomes free, if the terminal transmits immediately then the protocol is called 1- Persistent.
    d. In Persistent operation, if it runs a random number generator and based on outcome transmit its packet with a probability p, it is called p- Persistent.

UNIT II   WIRELESS WANS

1.What are the characteristics of AMPS?

AMPS uses the frequency band from 824MHz to 849MHz for transmissions from MSs to the BS (reverse link or uplink) and the frequency band between 869MHz to 894MHz from the BS to the MS (forward link or downlink). The 3 kHz analog voice signal is modulated onto 30 kHz channels. In transmitting data, the system uses **Manchester** frequency modulation at the rate of 10 kbps, while the control parameters remain the same as in voice transfer.Separate channels are used for transmitting control information and data.Frequency allocation in AMPS is done by dividing the entire frequency spectrum into two bands— Band A and Band B. A total of 666 channels (which was later increased to 832 channels) is divided among these two bands, and a cluster of seven cells allows many users to employ the same frequency spectrum simultaneously.

2.Define ESN, SID, MIN

1. Electronic serial number (ESN): A 32-bit binary number uniquely identifies a cellular unit or a MS and is established by the manufacturer at the factory. Since it is unique, any MS can be precisely identified by this number. For security reasons, this number should not be alterable and should be present in all MSs.

2. System identification number (SID): A unique 15-bit binary number assigned to a cellular system. The Federal Communications Commission (FCC) assigns one SID to every cellular system, which is used by all MSs registered in the service region. A MS should first transmit this number before any call can be handled. The SID serves as a check and can be used in determining if a particular MS is registered in the same system or if it is just roaming.

3. Mobile identification number (MIN): A digital representation of the MS's 10-digit directory telephone number.

3.What is GSM

GSM (Global System for Mobile communications or Groupe Speciale Mobile) communications, initiated by the European Commission, is the second-generation mobile cellular system aimed at developing a Europe-wide digital cellular system. The main objective of GSM is to remove any incompatibility among the systems by allowing the roaming phenomenon for any cell phone. It also supports speech transmissions between MSs, emergency calls, and digital data transmissions

4. Define Subscriber identity module (SIM)

Subscriber identity module (SIM): Every time the MS has to   communicate with a BS, it must correctly identify itself. A MS does this by storing the phone number (or the number used to contact the MS), personal identification number for the station, authentication parameters, and so on in the SIM card. The SIM card is the heart of a GSM phone, and the MS is unusable without it.

5.Difference between registration and call establishment?

Registration	Call establishment
During a registration procedure, network provides the MS with a channel for separate preliminary signaling	In mobile environment we have two separate call establishment procedure for mobile to fixed and fixed to mobile Calls.

6. What are the reasons to perform handoff?

Signal strength deterioration, ii Traffic balancing, iii. Mobility of the terminal

7. What is the importance of the framing hierarchy in GSM?

A framing hierarchy is needed to identify the location of certain bursts among the large stream of bursts that are directed toward different terminals.

8. Name three sub systems in the GSM architecture.

Connection management, Mobility management, radio resource management

7. What are VLR and HLR and why we need them?

VLR- Visitor Location Register, HLR – Home Location Register They are used for mobility management

8. Mention the different types of handoffs.

Mobile assisted hand off, ii. Network assisted hand off.

9. Difference between logical and physical channel?

Logical Channel	Physical channel
Similar to computers, we need a set of instructions and ports to instruct different elements of the network to perform specific duties. In telecommunications, these ports are called as logical channels.	The physical layer specifies how the information from different voice and data services are formatted into packets and sent through the radio channel

10. Name five most important logical channels in GSM

Traffic Channels & 2. pilot channels Types of Traffic channels:

i. Full rate traffic channel & Half traffic channel Types of Control channels:

i.Broadcast channels (BCH). ii. Common control Channels (CCCH) &

ii.   Dedicated control channels(DCCH).

11. Mention the types of bursts.

Normal burst,
Frequency correction burst,
Synchronization burst, iv. Random access burst.

12. Name the three types of services provided by the GSM

Teleservices – it provide communication between two end users applications according to a standard protocol

Bearer Services – it provide capabilities to transmit information among user- network- interfaces or APs Supplementary Services – supplement a bearer or tele services.

13. **What is IS-95?**

IS –95 is Interim Standards developed by TIA. Forward channel: 824-849 Mhz Reverse channel: 869-894 MHz .1.25 MHz/channel.

14. What is the chip rats used in WCDMA?

WCDMA – Chip rate = 3.84 Mcps

15. How many physical channels are available in each IS-95 carrier? What type of coding separates these channels from one another?

In IS – 95, we have 64 physical channels. Walsh code is used to separate the channels.

16. Name the forward and reverse channels used in IS-95? Forward Channels:

i. Pilot channel, ii. Synchronization channel, iii. Paging channel and Traffic channel Reverse channels:

i. Access Channel, ii. Traffic channel, iii. Synchronization channel, iv. Paging channel

17. Difference between Walsh codes used in the forward and reverse channels of cdma

In reverse channels there is no spreading of the code. In reverse channel orthogonal codes are used for waveform encoding.

18. What are the bit rates of the data services supported by IS-95?
19. RS1: 9.6, 4.8, 2.4, & 1.2 kbps RS2: 14.4, 7.2, 3.6, &1.8 kbps

20. Why is power control important in CDMA?

In CDMA the interference is from other users transmitting in the same frequency band at the same time. So in order to avoid near far effect and to maintain a good link quality it is necessary to control power in CDMA.

20. What forward channels are involved in IS-95 for power control?
    Traffic channel and control channel.

21. Why are several pilot channels monitored in IS-95?

When does a pilot channels from a base station move from an active set to a candidate set? Several pilot channels are monitored in IS –95 in order to perform handoff. When the signal strength of the pilot exceeds T-ADD it is transferred to a candidate set.

22. What are the new elements added to the GSM infrastructure to support GPRS?
    GPRS uses the same physical radio channels and only new logical GPRS radio channels are defined.

23. What are different services offered by GPRS?
  i. Point to multi point, ii. Point to point

24. Name the connectionless and connection oriented services provided by the GPRS.

In GPRS Point to point communication, there are two types, i. IP – connection less service, and ii. CLNP Connection oriented onX.25.

25. What is GPRS-136? How does it differ from GPRS?

The adaptation of GPRS to the IS –136 TDMA cellular standard is called GPRS-136.It uses 30kHz physical channel instead of 200 KHz.

Unit III WIRELESS LAN

1. **Name three categories of unlicensed bands used in U.S and compare them in terms of size of the available band coverage**.
   ISM is unlicensed band used in U.S.ISM Frequencies of operation : 902 –928 MHz, 2.4- 2.4835 GHz, 5.725 – 5.875 GHz & 24.0– 24.5GHz

2. **What is IEEE 802.11 standard**

   IEEE 802.11 is a set of standards for the wireless area network (WLAN), which was implemented in 1997 and was used in the industrial, scientific, and medical (ISM) band. The aim of IEEE 802.11 is to provide wireless network connection for fixed, portable, and moving stations within tens to hundreds of meters with one medium access control (MAC) and several physical layer (PHY) specifications. The major protocols include IEEE 802.11a, IEEE 802.11b, IEEE 802.11g, and IEEE 802.11n; their most significant differences lie in the specification of the PHY layer.

3. **Name the five major challenges for implementation of wireless LANs compare with one another**?.
   - Single mac to support multiple physical layers.
   - Mechanisms to allow multiple overlapping network in the same area.
   - Provisions to handle the interference from other ISM band radios and microwave ovens.
   - Mechanism to handle 'Hidden Terminals'.
   - Options to support time bounded services.
   - Provision to handle privacy and access control.

4. **Explain the difference between wireless inter-LAN bridges and WLANs**

   A wireless bridge is a hardware component used to connect two or more network segments (LANs or parts of a LAN) which are physically and logically (by protocolseparated.

   A wireless local area network (WLAN) links devices via a wireless distribution method (typically spread-spectrum or OFDM radio), and usually provides a connection through an access point to the wider internet

4. **What are the other IEEE.802.11**
   prtocols802.11a High speed physical layer in 5 GHz band

   802.11b Higher speed physical layer extension of wireless in 2.4 GHz band 802.11d Local and metropolitan area wireless802.11g Broadband wireless802.11i Security802.11n Wideband service

6. **List some applications of WLAN**
   - **Public**Coffee Shop Airport Convention Center
   - **Semi-Public**University Hospital
   - **Private**Government Enterprise Manufacturing Facility Hom.

7. **List the features of WLAN**
   - WLANs are flexible data communications systems using radio frequency (RF) technology, WLANs transmit and receive data over the air, thus it combine data connectivity with user mobility
   - WLANs provide high-speed, reliable data communications in a building or campus environment as well as coverage in rural areas. WLANs are simple to install.
   - The range of a WLAN depends on the actual usage and environment of the system. It may vary from 100 feet inside a solid walled building to several thousand feet in an outdoor environment with direct line-of-sight.
   - An important feature of WLANs is that they can be used independently of wired networks

- The network communications take place in a part of the radio spectrum that is designed as *license free*.
- ☐ Standard WLANs are capable of operating at speeds in the range of 1–2 Mbps depending on the actual

8. what are the advantages in deploying WLAN

The following are a few advantages of deploying WLANs:

- Mobility improves productivity with real-time access to information, regardless of worker location, for faster and more efficient decision making
- Cost-effective network setup for hard-to-wire locations such as older buildings and solid wall structures
- Reduced cost of ownership, particularly in a dynamic environment requiring frequent modification due to minimal wiring and installation costs per device and per user

9. What are the technologies available for use in a WLAN

The technologies available for use in a WLAN include infrared, UHF (narrowband), and spread spectrum implementation

10. List the Advantages and disadvantages of Infrared WLAN technology Advantages

- No government regulations controlling use
- Immunity to electro-magnetic (EM) and RF interference Disadvantages
- Generally a short-range technology (30–50 ft radius under ideal conditions)

- Signals cannot penetrate solid objects
- Signal affected by light, snow, ice, fog
- Dirt can interfere with infrared

11. What are the responsibilities of the MAC management sub layer in 802.11?

The responsibilities of the MAC management sub layer are to define the access mechanisms and packet format, also it provides roaming support, power management and security.

12. Why collision detection mechanisms cannot be used on a WLAN environment? There are two main reasons:

Implementing a collision detection mechanism would require the implementation of a full duplex radio capable of transmitting and receiving at the same time, an approach that would increase the cost significantly.

In a wireless environment we cannot assume that all stations hear each other (which is the basic assumption of the collision detection scheme), and the fact that a station wants to transmit and senses the medium as free does not necessarily mean that the medium is free around the receiver area.

13. Why it is preferable to use smaller packets in a WLAN environment

- Due to higher BER of a radio link, the probability of a packet getting corrupted increases with packet size.
- In case of corrupted packets (either due to collision or interference), smaller packets cause less overhead.
- On an FHSS system the medium is interrupted periodically for hopping. With smaller packets the chance that the transmission will be postponed after dwell time is reduced.

14. L**ist The limitations of original 802.11 standard**

- Low data rate: The 802.11 protocol imposes very high overhead to all packets that reduce real data rate significantly
- No QoS guarantees

15. Compare the IEEE 802.11 protocols

	802.11a	802.11b	802.11g	802.11n
Approval date	July 1999	July 1999	June 2003	August 2006
Maximum data rate	54 Mbps	11 Mbps	54 Mbps	600 Mbps
Modulation	OFDM	DSSS or CCK	DSSS or CCK or OFDM	DSSS or CCK or OFDM
RF band	5 GHz	2.4 GHz	2.4 GHz	2.4 GHz or 5 GHz
Number of spatial streams	1	1	1	1, 2, 3, or 4
Channel width	20 MHz	20 MHz	20 MHz	20 MHz or 40 MHz

16. What are the differences between IEEE802.11 and HIPERLAN standards?

17. What are the purpose of scrambler and interleaver in the HIPERLAN-2 modem?
In HIPERLAN – 2 modems, Scrambler is used to perform whitening process and interleaver is used to improve the reliability over temporal fading.

19**. What is the purpose of guard time?**
Guard time is to avoid overlapping of adjacent frames.

20. **Similarities between the Medium access control of the HIPERLAN-2 and DECT**.
Both MAC layer of HIPERLAN- 2 and DECT use TAMA/TDD access method. MT –MT peer to peer transmission is also similar in both HIPERLAN- 2 and DECT.

21. **Specify requirements for HiperLAN1?** 1.Data rates of 23.529Mbps

3.Multihop Adhoc Networking capability 4.Support of time bounded services 5.Support of power saving

22. What does HiperLAN stands for?
High performance Radio LAN.It was initiated by RES10 group of ETSI as a PAN European standard for high speed wireless local network.

23. **What are the services provided by the radio link control (RLC) protocol by**

HiperLAN? The radio link control (RLC) protocol provides the following services:
- Association control with feature negotiation
- Encryption algorithms and convergence layers, authentication, key negotiation, and convergence layer negotiation
- Radio resource control to support handoff capability, to perform radio measurements in assisting the APs in selecting an appropriate radio channel, and to run the power-saving algorithm
- Connection control for the establishment and release of user connections

24. **How many transport channels and logical channels are implemented in the HIPERLAN-2 DLC layer?**
HIPERLAN-2 DLC layer has four transport channels and five logical channels.

25. What is HAN?

HAN(Home Area Network) provides an infrastructure to interconnect a variety of home applications and enable them to access the Internet through a central home gateway.

26. What is WiMax technology?

Operational Spectrum 10-66GHz TDMA based uplink Coverage – Large city

Unit IV ADHOC AND SENSOR NETWORKS

1. Define MANNET

A MANET mobile ad hoc networks consists of a number of mobile devices that come together to form a network as needed, without any support from any existing Internet infrastructure or any other kind of fixed stations. MANET can be defined as an autonomous system of nodes or MSs (also serving as routers) connected by wireless links, the union of which forms a communication network modeled in the form of an arbitrary communication graph.

2. List the salient features of MANNET
   1. Dynamic topologies:
   2. Bandwidth-constrained and variable capacity links:
   3. Energy-constrained operation:
   4. Limited physical security

3. List some applications of MANNET
1. Dynamic topologies
2. Bandwidth-constrained and variable capacity links
3. Energy-constrained operation
4. Limited physical security
5. Vehicular area network.
6. Virtual navigation.
7. Education via the Internet

4. What are the three major goals for selecting a routing protocol?
   1. Provide the maximum possible reliability by selecting alternative routes if a node connectivity fails.

   2. Route network traffic through the path with least cost by minimizing the actual length between the source and destination through use of the lowest number of intermediate nodes.
   3. Give the nodes the best possible response time and throughput. This is especially important for

5. What are the need for routing in MANNET?

   1. Route computation must be distributed, because centralized routing in adynamic network is impossible, even for fairly small networks.

   2. Route computation should not involve maintenance of a global state, or even significant amounts of volatile nonlocal state. In particular, link state routing is not feasible due to the enormous state propagation overhead when the network topology changes.

   3. As few nodes as possible must be involved in route computation and state propagation, as this involves monitoring and updating at least some states in the network. On the other hand, every host must have quick access to the routes
   on demand.

   4. Each node must care only about the routes to its destination and must not be involved in frequent topology updates for those portions of the network that have no traffic.
   5. Stale routes must be either avoided or detected and eliminated quickly.

   6. Broadcasts must be avoided as much as possible, because broadcasts can be time consuming for MANETs. The simpler function of multicasting is observed to be even more complex than uncontrolled broadcasting.
   7. If the topology stabilizes, then routes must converge to the optimal routes.

6. **Classify the routing protocol in MANNETs**

   The routing protocols may also be categorized as follows:
   - Table-driven protocols
   - Source-initiated on-demand protocols

7. **How the routing loops can be avoided in** DSDV?

   The sequence numbers allow the mobile node to distinguish stale routes from new ones, and help avoid formation of routing loops.

8. **What are the four tables maintained in wireless routing protocol (WRP)?:**

   In wireless routing protocol (WRP), each node maintains four tables,
   - Distance table
   - Routing table
   - Link-cost table
   - Message retransmission list (MRL) table

9. **Differentiate Source-initiated on-demand routing and table driven routing**

   Source-initiated on-demand routing is essentially reactive in nature, unlike table driven routing. The source-initiated approach generates routes only when a source demands it. In other words, when a source requires a route to a destination, the source initiates a route-discovery process in the network. This process finishes when a route to the destination has been discovered or all possible routes have been examined without any success. The route thus discovered is maintained by a route maintenance procedure, until it is no longer desired or the destination becomes inaccessible.

10. **RREQ includes what?**

    The initiator node includes in the RREQ the following:
    - Its own sequence number
    - The broadcast ID
    - The most recent sequence number the initiator has for the destination
    - What is DSR protocol

    Dynamic source routing (DSR) is an on-demand routing protocol based on source routing. The mobile nodes maintain all source routes that they are aware of in cache. As the new routes are discovered, the cache is updated. The protocol works in two main phases: route discovery and route maintenance. When a mobile has a message to send, it consults the route cache to determine whether it has a route to the destination. If an active route to destination exists, it is used to send the message. Otherwise, the mobile initiates a route discovery by broadcasting a route-request packet.

    - What are the salient features of the ABR protocol

    The associatively-based routing (ABR) protocol is free from loops, deadlocks, and packet duplicates. A fundamental objective of ABR is to discover longer lived routes. To this end, the protocol uses a new routing metric for MANETs. The metric is called the degree of association stability which is characterized by connection stability of one node with respect to another node over time and space.

    - What is TORA

    One of the main advantages of TORA is that it can operate smoothly in a highly dynamic mobile environment. It provides multiple routes for any source-destination pair. For this

purpose, the mobile nodes must maintain routing information about their one-hop neighbors.

11. What are the advantages of power Aware Routing on MANNET?

The power aware routing protocol uses power aware metrics to determine routes in a MANET. Using such metrics can result in huge energy and cost savings for the entire network.

12. What is Wireless Sensor Network

A wireless sensor network contains a large number of tiny *sensor nodes* that are densely deployed either inside the phenomenon to be sensed or very close to it. Sensor nodes consist of sensing, data processing, and communicating components. Sensor network protocols and algorithms must possess self-organizing capabilities. Another unique feature of sensor networks is the cooperative effort of sensor nodes. Wireless sensor network applications require wireless ad hoc networking techniques.

13. List the advantages of wireless sensor networks over wired ones
1. Ease of deployment
2. Extended range
3. Fault tolerance
4. Mobility

14. Challenges posed by WSN in design of applications

1. In traditional wired and wireless networks, each node is given a unique ID, used for routing. This cannot be used effectively in sensor networks; since these networks are data centric, routing to and from specific nodes is not required.

2. Adjacent nodes may have similar data. Therefore, rather than sending data separately from each node to the requesting node, it is desirable to aggregate similar data and then respond. he requirements of the network change with the application and hence are application specific. For example, in some applications the sensor nodes are fixed and not mobile, whereas others may need data based only on a single selected attribute (i.e., the attribute is fixed in the net

18. Draw the general architecture of a fixed sensor node.
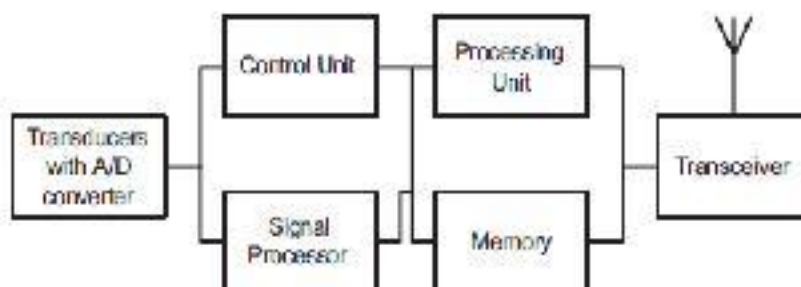
19. Classify WSN

Sensor networks can be classified on the basis of their mode of operation or functionality and the type of target applications. Accordingly, sensor networks are classified into two types:

1. Proactive networks: The nodes in this network periodically switch on their sensors and transmitters, sense the environment, and transmit data of interest. Thus, they provide a snapshot of the relevant parameters at regular intervals and are well suited for applications requiring periodic data monitoring.

Reactive networks: In this scheme, the nodes react immediately to sudden and drastic changes in the value of a sensed attribute. As such, these are well suited for time-critical applications

20. List the differences between wireless sensor networks and traditional wireless ad hoc networks ● The number of sensor nodes in a wireless sensor network can be several orders of magnitude

higher than the nodes in a wireless ad hoc network.

- In a wireless sensor network, sensor nodes are densely deployed.
- Sensor nodes are prone to failure.
- The topology of a wireless sensor network changes very frequently.
- Sensor nodes mainly use broadcast communication paradigms whereas most traditional ad hoc networks are based on point-to-point communications.
- Sensor nodes are limited in power, computational capabilities, and memory.
- Sensor nodes may not have global identification because of the large amount of overhead and large number of sensors.
- The end goal of the WSN is the detection/estimation of some event(s) of interest, and not just communication.

21. **Give some examples in which implementing WSN is useful**

- **Environmental observations.** Wireless sensor networks can be used to monitor environmental changes.
- **Military monitoring.** The military uses sensor networks for battlefield surveillance. Sensors can monitor vehicular traffic, track the position of the enemy, or even safeguard the equipment of side deploying sensors.

- **Building monitoring.** Wireless sensor networks can also be used in large buildings or factories to monitor climate changes. Thermostats and temperature sensor nodes are deployed all over the building's area. In addition, sensors can be used to monitor vibration that can damage the structure of a building.

- **Health care.** Sensors can be used in biomedical applications to improve the quality of provided care. Sensors are implanted in the human body to monitor medical problems such as cancer and help patients maintain their health.

22. W**hy routing in WSN is different from other wireless network**

Routing in wireless sensor networks is very different from the traditional wired or wireless networks. Sensor networks are data centric, requesting information satisfying certain attributes, and thus do not require routing of data between specific nodes. Also, since adjacent nodes have almost similar data and might almost always satisfy the same attributes, rather than sending data separately from each node to the requesting node, it is desirable to aggregate similar data in a certain region before sending it.

23. **Suggest why hierarchical clustering scheme is the most suitable for wireless sensor networks T**

he network is assumed to consist of a BS, away from the nodes, through which the end user can access data from the sensor network. All the nodes in the network are homogeneous and begin with the same initial energy. The BS, however, has a constant power supply and so has no energy constraints. It can transmit with high power to all the nodes, and there is no need for routing from the BS to any specific node. However, the nodes cannot always reply to the BS directly due to their power constraints, resulting in asymmetric communication. The BS can also be used as a database to hold da

1. What are the advantages of WiMax?

With its large range and high transmission rate, WiMAX can serve as a backbone for 802.11 hotspots for connecting to the Internet. Alternatively, users can connect mobile devices such as laptops and handsets directly to WiMAX base stations without using 802.11. Mobile devices connected directly can achieve a range of 4 to 6 miles, because mobility makes links vulnerable. The WiMAX technology can also provide fast and cheap broadband access to markets that lack infrastructure (fiber optics or copper wire), such as rural areas and unwired countries. WiMAX can be used in disaster recovery scenes where the wired networks have broken down. It can be used as backup links for broken wired links.

2. What is the IEEE standard used for WiMax?

WiMAX is a family of technologies based on IEEE 802.16 standards. There are two main types of WiMAX today, *fi xed WiMAX* (IEEE 802.16d — 2004), and *mobile WiMAX* (IEEE 802.16e — 2005). Fixed WiMAX is a point-to- multipoint technology, whereas mobile WiMAX is a multipoint-to-multipoint technology, similar to that of a cellular infrastructure.

3. **What is home RF?**

Home RF working group is to provide the foundation for a broad range of interoperable consumer devices by establishing an open industry specification for wireless digital communication between PC's and consumer electronic devices anywhere in and around the home.

4. What is the IEEE 802.15 and what is the relation to the Bluetooth and homeRF?

The IEEE 802.15 WPAN group is focused on development of standards for short distance wireless networks used for networking of portable and mobile computing devices such as PC's, PDA's, cell phones, printers, speakers, microphones, and other consumer electronics. Home RF has a higher data rate than Bluetooth.

5. **Name the three air interface of WiMax**

The three air interfaces for the 2–11 GHz range areWireless MAN — SCa uses single carrier modulation

Wireless MAN — OFDM uses a 256-carrier OFDM. This air interface provides multiple access to different stations through time-division-multiple access.Wireless MAN — OFDM uses a 2048-carrier OFDM scheme. The interface provides multiple access by assigning a subset of the carriers to an individual receiver.

6. . **Name the four states that a Bluetooth terminal.**
   1. Master. (M)
   2. Slave. (S)
   3. Stand By. (SB)
      Parked or hold. (P)
   4.

7. Name the three classes of application that are considered for Bluetooth technology?
   1. Cable replacement.
   2. Ad hoc personal network.
   3. Integrated AP.

8. **Difference between 802.11 and 80**

IEEE 802.11	IEEE 802.15

It is an independent standard to define PHY and MAC layers of WLAN.	It is focused on the standards for short distance Wireless networks used for networking of portable and mobile computing devices.

9. **What is the maximum data rate of an overlay blue tooth network?**
It allows a *maximum data rate* of 11 Mbit/s

10. . **Difference between the implementation of paging and inquiry algorithms in blue tooth?**
With the paging procedure, an actual connection can be established. The paging procedure takes a very short time (at most 20 ms) while the inquiry procedure might cause a significant delay (up to a few seconds on average) The inquiry message is typically used for finding Bluetooth devices including public printers, fax machines and similar devices with an unknown address.

11.What is WPAN?

WPAN is a short distance wireless network used for networking of portable and mobile computing devices such as PCs, PDAs, cell phones, printers speakers…etc and other consumer electronics.

12.What is Bluetooth?

Bluetooth is an open specification for short range wireless voice and data communication that was originally developed for cable replacement in personal area networking to operate in unlicensed bands and inexpensive technology.

13.What are the requirements of WPAN or what are the characteristics of WPAN?
- Power management: Low current consumption.
- Range:0-10m
- Speed:19.2-100kbps
- Small size 0.5 cubic in without antenna
- Low cost relative to target device
- Should allow overlap of multiple networks in the same area
- Network supports a minimum of 16 devices

14.What is SWAP?
Shared wire access protocol it defines a new common interface that supports wireless voice and data networking in the home. The SWAP specification is an extension of DECT for voice and relaxed 802.11 for high speed data applications.

15.Name the topology for blue tooth architecture?
The topology of blue tooth is referred to as scattered adhoc topology. In scattered hoc environment a number of small network supports a few terminals to coexist or possibly interoperate with one another.

16. How many different voice services does Bluetooth support? Network supports a minimum of 16 devices