

UNIT - I: WIRELESS LAN

PART – A (2 Marks)

1. What is infrared (IR) transmission?

Infrared light transmission is one of the important technologies used in wireless LAN. It is based on the transmission of infrared light at 900 nm wavelength.

2. What is the principle behind infrared technology?

Infrared technology uses diffuse light reflected at walls, furniture etc. Or directed light when line of sight (LOS) exists between sender and receiver.

3. What are the advantages of infrared technology?

Shielding is easy and no need for license for infrared technology.

Electrical devices do not interfere with infrared transmission.

4. What are the disadvantages of infrared transmission?

Low bandwidth

Cannot penetrate through walls or other obstacles.

5. Define – Spread Spectrum

Spread spectrum involves spreading the bandwidth needed to transmit data. The main advantage of using spread spectrum is the resistance to narrow interference.

6. What are the spread spectrum techniques?

There are two basic methods for spread spectrum transmissions.

Direct Sequence Spread Spectrum (DSSS)

Frequency Hopping Spread Spectrum (FHSS)

7. What is the principle behind FHSS?

Frequency Hopping Spread Spectrum is evolved in order to avoid jamming. Hence in this method, the transmitter shifts the center frequency of transmitted signal. The shifts in frequency or frequency hops, occur according to a random pattern is known only to the transmitter and receiver.

8. What are the major issues in WLAN?

Two major issues in WLAN are as follows

Hidden station problem

Exposed station problem

9. List out the applications of WLAN.

Transfer of medical images

Remote access to patient records

Remote monitoring of patients

Remote diagnosis of patients at home or in an ambulance

In telemedicine

Surveillance

Internet supporting database.

10. What is IEEE 802.11?

The IEEE 802.11 is the first WLAN standard that has secured the market in large extent. The primary goal of the standard was the specification of a simple and robust that offers time bounded and asynchronous services.

11. Define - Short Inter Frame Space (SIFS)

Short IFS is the shortest IFS used for the high priority frames like acknowledgement frames, CTS frames, poll response etc.

12. Define - Distributed coordination function Inter Frame Space (DIFS)

DCF-IFS is used for transmitting data frames. It is equal to SIFS plus two time slots and is the longest inter frame gap.

13. What are the functions of MAC layer in IEEE 802.11?

The functions of MAC layer are

Media Access Control Reliable delivery of data units

Management functions

Authentication encryption

14. What is the need for WATM?

WATM systems had to be designed for transferring voice, classical data, video, multimedia etc.

15. What is HIPERLAN?

The HIPERLAN stands for High PERFORMANCE Radio LAN is an initiation of RES-10 group of the ETSI as a PAN European standard for high speed wireless local networks.

16. Give any two requirements of HIPERLAN.

Data rates of 23.529 Mbps

Multi-hop and Ad-hoc networking

Support of time bounded services

17. What are the three phases in channel access in HIPERLAN-1?

Prioritization phase

Contention phase

Transmission

phase

18. Give any three differences between HIPERLAN 1 and HIPERLAN 2.

	HIPERLAN 1	HIPERLAN 2
Application	Wireless LAN	Access to ATM fixed networks
Range	50 m	50 – 100 m
Data rate	23.5 M bits/ sec	> 20 M bits / s

19. What is meant by BRAN?

The BRAN (Broadband Radio Access Networks (BRAN) is standardized by the European Telecommunications Standards Institute (ETSI). Primary motivation of BRAN is the deregulation and privatization of the telecommunication sector. BRAN technology is independent from the protocols of the fixed network. BRAN can be used for ATM and TCP/IP networks.

20. List the functional requirements of HIPERLANS.

The functional requirements of HIPERLAN are

- Data rates of 23.529 Mbps

- Support both synchronous and asynchronous traffic

- Power saving support

- Video at 2 Mbps, 100 ns latency and audio at 32 Kbps, 10 ns latency

- To coverage multihub features

- Low mobility of 1.4 m/s

- Support of time bound services

- Asynchronous file transfer at 13.4 Mbps

21. What is Bluetooth?

Bluetooth is an inexpensive personal area Ad-hoc network operating in unlicensed bands and owned by the user. It is an open specification for short range wireless voice and data communications that was developed for cable replacement in PAN (Personal Area Network).

22. What is the advantage of piconet /scatternet. ?

The advantage of the Piconet / Scatternet scheme is that it allows many devices to share the same physical area and make efficient use of bandwidth.

23. What are the states of Bluetooth?

Bluetooth specifies four states, they are

Master-M

Slave- S

Standby- SB

Parked- P

24. What is Piconet and Scatternet?

Bluetooth specification defines a small cell called as piconet which has upto 8 devices grouped together. Two or more piconets grouped together know as scatternet.

25. What type of modulation used in Bluetooth?

Bluetooth uses Gaussian-shaped Frequency Shift Keying (GFSK) modulation with a nominal modulation index of $K = 0.3$

26. What is the data rate of Bluetooth?

The maximum data rate is 721Mbps for asymmetric mode.

27. List the logical channels provided by L2CAP.

L2CAP provides three types of logical channels. They are:

Connectionless

Connection oriented

Signaling

29. What is the need for WIMAX?

The main reason for the development of WIMAX(World Interoperability Microwave Access) is the demand of high data rates not only the faster downloading but also for the use of new applications like Voip, Video, streaming multimedia conferencing and interactive gaming.

30. What is WIMAX?

WIMAX is the air interface for the actual radio interface network, where both fixed and mobile users can have access to the network. Its specification is IEEE 802.16.

31. Write the throughput feature in WIMAX.

WIMAX supports throughput up to 63 Mbps on the downlink and 28 Mbps on the uplink, assuming a 10 MHz bandwidth channel with TDD frames and with 64 QAM 5/6 as modulation scheme.

32. What are the frequency bands of IEEE 802.16?

The 802.16 standard defines a number of air interfaces that can be divided into,

10-66 GHz licensed band

Below 11 GHz licensed bands

Below 11 GHz unlicensed

Part – B (16 Marks)

1. Explain the architecture and reference model of HIPERLAN- 2 in detail. (May/June 2013)
2. Explain the physical and MAC layer details of Wi - Max in detail. (May/June 2013)
3. Compare the various parameters of WCDMA with CDMA2000. (Nov/Dec 2012)
4. Explain in detail, the MAC mechanism of IEEE 802.11 WLAN. (Nov/Dec 2012)
5. Design a WLAN for an office building based on statistical models with certain information provided. There is a constraint on where to place an access point on the wireless environment. Consider the following information for network design: there are 4 number of walls between an access point and a mobile terminal, transmission power possibility starts from 250 mW to 100mW, receiver sensitivity is - 80 dBm, distance of maximum access point to building edge is 30 m, and shadow fading margin is 8 db. (Nov/Dec 2012)
6. Explain any two MAC mechanism used in IEEE 802.11 WLAN systems. (May/June 2012)
7. Explain in detail the reference architecture of HIPERLAN -2. (May/June 2012)
8. Explain the services provided by IEEE 802.11.
9. Explain the architecture of IEEE 802.11.
10. Explain IEEE 802.11 standards.
11. Explain the interference details and the connection management procedure of Bluetooth in detail
12. Explain piconets and scatternets

UNIT II : MOBILE NETWORK LAYER

Part – A (2 Marks)

1. **What is a Mobile IP?**

Mobile IP is a protocol developed to allow internetwork mobility for wireless nodes without them having to change their IP addresses.

2. **What are the entities of Mobile IP?**

Mobile Node (MN)

Correspondent Node (CN)

Home Network (HN)

Foreign Network (FN)

Foreign Agent (FA)

Home Agent (HA)

3. **What are the benefits of Mobile IP?**

The major benefit of Mobile IP is that it frees the user from a fixed location. Mobile IP makes invisible the boundaries between attachment points, it is able to track and deliver information to mobile devices without needing to change the device's long-term Internet Protocol (IP) address.

4. **What is Care-Of Address (COA)?**

The Care of Address defines the current location of the MN from an IP point of view. All IP packets sent to the MN are delivered to the COA, not directly to the subnet.

5. **What is agent advertisement?**

Home Agent (HA) and Foreign Agent (FA) advertise their presence periodically using agent advertisement messages. These advertisement messages can be seen as a beacon broadcast into the subnet.

6. **What is the need for registration?**

The main purpose of the registration is to inform the HA of the current location for correct forwarding of packets.

7. **Define – Encapsulation and Decapsulation**

Encapsulation is the mechanism of taking a packet consisting of packet header and data and putting it into the data part of a new packet. The reverse operation, taking a packet out of the data part of another packet, is called decapsulation.

8. **What is triangular routing?**

Tunneling in its simplest form has all packets to Home Network and then sent to MN via a tunnel. The inefficient behavior of a non-optimized mobile IP is called triangular routing.

9. What is DHCP?

The Dynamic Host Configuration Protocol (DHCP) is based on the bootstrap protocol (BOOTP), which provides the framework for passing configuration information to hosts on a TCP/IP network. DHCP adds the automatically allocate reusable network addresses and configuration options to internet hosts.

10. What is SIP?

The Session Initiation Protocol (SIP) is an application-layer control (signaling) protocol for creating, modifying and terminating sessions with one or more participants. It is a IETF (Internet Standard) RFC 3261 protocol.

11. What are the functions of Session Initiation Protocol (SIP)? SIP has following major functions

- SIP allows for the establishment of user location
- SIP provides a mechanism for call management
- SIP provides feature negotiation, so that all the parties in the call can agree to the features supported among them.

12. What are the characteristics of MANET? (M/J - 12)

The characteristics of MANET are

- Dynamic Topologies
- Bandwidth Constraints and Variable Capacity Links
- Energy Constrained Operations
- Limited Physical Security

13. Differentiate an ad hoc network and a cellular network with respect to

- a) Bandwidth usage
 - b) Cost effectiveness
- (N/D - 12)

PARAMETER	CELLULAR NETWORK	AD HOC NETWORK
Bandwidth usage	Easier to employ bandwidth reservation	Bandwidth reservation requires complex medium access control protocols
	Guaranteed bandwidth (designed for	Shared radio channel (more suitable

	voice traffic)	for best-effort data traffic)
Cost effectiveness	Cost of network maintenance is high (backup power source, staffing, etc.)	Self-organization and maintenance properties are built into the network. Hence the cost of network maintenance is less.

14. What are the challenging issues in ad hoc network maintenance?

(M/J - 12)

The challenging issues in ad hoc network are

- Medium access scheme
- Routing
- Multicast routing
- Transport layer protocol
- Pricing Schemes
- Quality of Service Provisioning
- Self-Organization
- Security
- Addressing and Service Discovery

15. Why are ad hoc networks needed?

(M/J - 12)

Ad hoc networking is often needed where an infrastructure network cannot be deployed and managed. The presence of dynamic and adaptive routing protocols enables quick formation of ad hoc networks and is suitable for emergency situations like natural disasters, spontaneous meetings or military conflicts.

16. List out the applications of ad hoc networks.

Ad hoc networks are widely used in

- Military applications and battlefields
- Collaborative and distributed computing
- Emergency search and rescue operations
- Wireless sensor and mesh networks

17. Give the classifications of routing protocol in MANET.

The classifications of routing protocol in MANET are

a) Proactive protocols: This protocol attempt to evaluate continuously the routes within the network, so that when a packet needs to be forwarded, the router is already known and can be immediately used.

b) Reactive protocols:

This protocol invoke a route determination procedure only on demand.

The routing protocols may also be categorized as follows:

Table-driven protocols.

Source-initiated on-demand protocols.

18. List the Source-initiated On-Demand Routing Protocols.

The Source-initiated On-Demand Routing Protocols are

Ad-hoc On-Demand Distance Vector Routing (AODV)

Dynamic Source Routing (DSR)

Temporarily Ordered Routing Algorithm (TORA)

Associatively Based Routing (ABR)

Signal Stability Based Routing (SSR)

19. Differentiate proactive and reactive routing protocols. Write examples for each.

(M/J- 12)

S.No.	Proactive	Reactive
1	Route is pre-established	Route establishment is on-demand
2	Continuously discover the routes	Route discovery by some global search
3	Updates topology information(table) periodically	No information update is done
4	No latency in route discovery	longer delay due to latency of route discovery
5	Large capacity is needed to update network information	Large capacity is not needed
6	A lot of routing information may never be used	May not be appropriate for real-time communication
7	Eg: DSDV, WRP	Eg: AODV, ABR

20. What is DSDV?

Distance-Vector Routing (DSDV) is a table driven routing scheme for ad-hoc mobile networks. The main contribution of the algorithm was to solve the routing loop problem.

PART – B (16 Marks)

1. Explain the need for demand based routing protocol for wireless sensor networks. Explain the different types of wireless sensor networks in detail. (May/June 2013)
2. Explain in detail the MAC protocols of wireless sensor networks in detail. (May/June 2013)
3. Explain in detail, the source initiated routing protocols for ad hoc networks. (Nov/Dec 2012)
5. Explain in detail, the MAC layer challenges in wireless sensor networks and write the remedies to the challenges and issues. (Nov/Dec 2012)
6. Explain the architecture of wireless sensor network. (May/June 2012)
7. What are the key features of routing protocol in WSN and explain any two energy efficient routing protocols in detail. (May/June 2012)
8. Explain in detail, the source initiated on demand routing protocols in ad- hoc networks.
9. Explain any two table driven routing protocols in ad-hoc networks.
10. Explain in detail, the routing protocols of wireless sensor networks.

UNIT – III: MOBILE TRANSPORT LAYER

PART – A (2 Marks)

1. Define Traditional TCP?

The Traditional Control Protocol (TCP) is the most widely used transport protocol in the internet architecture

2. What are the services of TCP?

TCP provides connection-oriented, reliable, byte-stream service that is both flow and congestion control to the upper layers.

3. What are the algorithms used for congestion control in TCP?

The congestion control functionality of TCP is provided by four main algorithms namely

Slow start

Congestion avoidance Fast

transmit

Fast recovery

4. What is slow start mechanism?

Slow start is a mechanism used by the sender to control the transmission rate. The sender always calculates a congestion window for a receiver. The start size of the congestion window is one TCP packet.

5. What is Fast Retransmit algorithm in TCP?

During TCP congestion control, when three or more duplicate ACKs are received, the sender does not even wait for a retransmission timer to expire before retransmitting the segment. This process is called the Fast Retransmit Algorithm.

6. What is Congestion Avoidance algorithm?

In the Congestion Avoidance algorithm a retransmission timer expiring or the reception of duplicate ACKs can implicitly signal the sender that a network congestion situation is going on.

The sender immediately sets its transmission window to one half of the current window size, but to at least two segments. If congestion was indicated by a timeout, the congestion window is reset to one segment, which automatically puts the sender into Slow Start mode.

7. What are the techniques for classical improvements?

With the goal of increasing TCPs performance in wireless and mobile environments several scheme were proposed,

Some of them are:

1. Indirect TCP
2. Mobile TCP
3. Snooping TCP
4. Fast Transmit/ Fast Recovery
5. Transmission/ time-out freezing
6. Selective Retransmission

8. Write a short note on I- TCP.

Indirect TCP is a split connection solution that utilizes the resources of Mobility Support Routers (MSRs) to transport layer communication between mobile hosts and fixed hosts.

It uses the standard TCP for its connection over the wireless hop and like other split connection protocols, attempts to separate loss recovery over the wireless link from the wired link.

9. What are the advantages and disadvantages of I – TCP?

Advantages:

I-TCP does not require any changes in the TCP Protocol
Transmission errors on the wireless link cannot propagate into the fixed network.
Optimizing new mechanisms is quite simple because they only cover one single hop.

Disadvantages:

The loss of the end-to-end semantics of TCP might cause problems if the foreign agent partitioning the connection crashes.

10. What are the advantages and disadvantages of Mobile TCP?

Advantages

M-TCP maintains the TCP end-to-end semantics. The Supervisory Host (SH) does not send any ACK itself but forwards the ACKS from the MH.

If the MH is detached, it avoids useless transmissions, slow starts or breaking connections by simply shrinking the sender's window to zero.

11. What is Snooping TCP?

The main drawback of I-TCP is the segmentation of the single TCP connection into two TCP connections, which losses the original end-to-end TCP semantics. A new enhancement which leaves the TCP intact and is completely transparent, is Snooping TCP. The main function is to buffer data close to the mobile hast to perform fast local retransmission in the case of packet loss.

12. What is time-out freezing?

The MAC layer informs the TCP layer about an upcoming loss of connection or that the current interruption is not caused by congestion.

TCP then stops sending and freezes the current state of its congestion window and further timers. When the MAC layer notices the upcoming interruption early enough, both the mobile and correspondent host can be informed.

13. What are the advantages and disadvantages of time out freezing?

Advantages:

It offers a way to resume TCP connections even after long interruptions of the connections. It can be used together with encrypted data as it is independent of other TCP mechanisms such as sequence no or acknowledgements.

Disadvantages

TCP on mobile host has to be changed, mechanism depends on MAC layer. Need resynchronization after interruption.

14.What are the applications of TCP?

Some applications of TCP are www-browsing-mail and FTP

Part – B (16 Marks)

1. Explain in detail, the various algorithms to control the congestion in TCP.
2. Explain in detail, the various schemes to improve the performance of TCP.
3. Explain in detail, the various classical TCP improvement mechanisms.
4. Explain in detail, the TCP over 3G wireless network.
5. Compare the different approaches of “Mobile TCP”
6. Explain the various issues in 2.5G/3G wireless network
7. Explain the various T-TCP (Traditional TCP) in detail.

UNIT IV: WIRELESS WIDE AREA NETWORK

Part – A (2 Marks)

1. What are the applications of 3G?

Applications for a 3G wireless network range from simple voice-only communications to simultaneous video, data, voice and other multimedia applications.

2. Name some of the wireless technology services?

Some of the wireless technology services are

General Packet Radio Services (GPRS)

Enhanced Data for GSM evolution (EDGE) service

Wideband Code Division Multiple access (WCDMA)

Universal Mobile telecommunications Services (UMTS)

High-Speed Downlink Packet Access (HSDPA)

3. What is UMTS?

Universal Mobile telecommunications Services (UMTS) is a new radio access network based on 5 MHz WCDMA and optimized for efficient support of 3G services. UMTS can be used in both new and existing spectra.

4. What are the layers of UMTS?

The UMTS terrestrial radio access network (UTRAN) has an access layer and non access layer.

The access layer includes air interface and provides functions related to OSI layer 1, layer 2, and the lower part of layer 3.

The non-access layer deals with communication between user equipment (UE) and core network (CN) and includes OSI layer 3 (upper part) to layer 7.

5. What is radio resource control (RRC)?

The radio resource control (RRC) layer broadcasts system information, handles radio resources such as code allocation, handover, admission control, measurement/control report.

6. What are the duties of Radio network control (RNC)?

The major duties of RNC are

Intra UTRAN handover

Macro diversity combining/ splitting of Iub data systems.

Outer loop power control
IU interface user plane setup
Serving RNS (SRNS) relocation
Radio resource allocation

7. **What are the planes of UTRAN?**

There are three planes

Control plane
User plane
Transport network control plane.

8. **What are the functions provided by 3G-MSC?**

The following functionality is provided by the 3G-MSC:

Mobility management
Call management
Supplementary services
Short message services (SMS)

OAM (operation, administration, and maintenance) agent functionality.

9. **What is Transport Network Control Plane (TNCP)?**

Transport Network Control Plane (TNCP) carries information for the control of transport network used within UCN.

10. **What is 3G-SGSN?**

The 3G-SGSN (serving GPRS Support Node) provides the appropriate signaling and data interface that includes connection to an IP-based network toward the 3G-GGSN, SS7 towards the HLR/EIR/AUC and TCP/IP or SS7 toward the UTRAN.

11. **What is 3G-GGSN?**

The GGSN (Gateway GPRS Support Node) is connected with SGSN via an IP-based network. It provides interworking with the external PS network.

12. **What are the functions provided by 3G-GGSN?**

Macro-Mobility (maintaining information locations at SGSN level)
Gateway between UMTS packet network and external data networks
Initiate mobile terminate route Mobile Terminated Packets
User data screening/security.

13. What is SMS-GMSC?

The SMS-GMSC (gateway MSC) is a MSC which can receive a terminated short message

Part – B (16 Marks)

1. Explain the services of UMTS in detail.
2. Explain in detail, the logical interfaces of UTRAN.
3. Explain the LTE architecture and its protocol model in detail.
4. Explain the UMTS core network architecture with neat illustrations.
5. With neat illustration explain UMTS terrestrial radio access network.
6. Explain the IMT-2000 services in detail.
7. Explain the HSDPA objective and its operation in detail.
8. Write short notes on
 - (i)Firewall
 - (ii)DNS/DHCP

UNIT V: 4G NETWORKS

Part – A (2 Marks)

1. What are the main functions of Cognitive Radio?

The main functions of Cognitive Radio are Spectrum Sensing, Dynamic Spectrum Management and Adaptive Communications.

2. Define – Cognitive Radio

The Federal Communications Commission FCC defined Cognitive Radio as “A radio that can change its transmitter parameters based on interaction with the environment in which it operates.

3. Write a short note on time slot scheduler.

The time slot scheduler shares the spectrum efficiently between users by satisfying the QoS requirements. When the channel quality for each radio link can be predicted for a short duration into the future and accessible by the link layer, then ARQ with an adaptive modulation and coding system can be selected for each user to satisfy the Bit Error Rate (BER) requirement and offer throughput.

4. What is meant by MIMO?

MIMO means Multiple Input and Multiple Output that represents multiple individual, parallel data streams that are carried on the air interface.

5. What are the benefits of Smart Antenna Technology?

The benefits of Smart Antenna Technology are:

- a. Reduction in Co – Channel Interference
- b. Range Improvement
- c. Increase in Capacity
- d. Reduction in Transmitted Power
- e. Reduction in Handoff

6. What is meant by receiver diversity?

The Single Input Multiple Output (SIMO) configuration of the radio channel is known as receiver diversity. The input the channel is single transmitter signal that feeds two receiver paths. Depending on multipath fading and the correlation between two receiver gain is achieved in the form of fading resistance.

7. What is Smart Antenna?

A Smart Antenna is a multi- element antenna where the signals received at each antenna element are intelligently combined to improve the performance of the wireless system.

8. Define Multi Carrier Modulation (MCM)

Multi Carrier Modulation (MCM) is a baseband process that uses parallel equal bandwidth sub channels to transmit information and is normally implemented with Fast Fourier Techniques (FFT) techniques.

9. What are the types of MCM that are likely preferred for 4G?

The two different types of MCM that are likely preferred for 4G are:

- a. Multi Carrier Code Division Multiple Access
- b. Orthogonal Frequency Division Multiplexing (OFDM)

10. What are the technologies used in 4G?

The technologies used in 4G are

- a. Multi Carrier Modulation (MCM)
- b. Smart Antenna Techniques
- c. OFDM – MIMO Systems
- d. Adaptive Modulation and Coding with Time Slot Scheduler
- e. Cognitive Radio

12. List out the applications of 4G technologies.

The applications of 4G technologies are

- a. Virtual Presence
- b. Virtual Navigation
- c. Tele-Medicine
- d. Tele-Geo-Processing applications
- e. Gaming
- f. Cloud Computing
- g. Crisis detection and prevention
- h. Education

13. What are the techniques to improve network survivability in different layers?

The techniques to improve network survivability in different layers are

- a. Prevention
- b. Network design and capacity allocation
- c. Traffic Management and restoration

14. What are the challenges of 4G?

The main challenges are

- a. Multimode user terminals
- b. Wireless System Discovery and Selection
- c. Terminal Mobility
- d. Network Infrastructure and QoS Support
- e. Security and Privacy
- f. Fault tolerance and Survivability
- g. Multiple Operators and Billing Systems
- h. Personal Mobility

15. What are the main issues in terminal mobility

The two main issues in terminal mobility are

- a. Location Management
- b. Handoff Management

With location management, the system tracks and locates a mobile terminal for possible connection. Handoff management maintains ongoing communications when the terminal roams.

16. Define 4G

4G can be defined as MAGIC

MAGIC

- a. Mobile Multimedia
- b. Anytime Anywhere

- c. Global Mobility Support
- d. Integrated Wireless Solution
- e. Customized Personal Services
- f. Also known as Mobile Broadband Everywhere

17. What are the goals of 4G?

The ambitious goal of 4G is to allow everyone to access the Internet anytime and everywhere. The provided connection to Internet will allow users to access all types of services including text, databases and multimedia. Unlike 3G, 4G is IP based, that is every user connected to the Internet will have an IP address

18. Compare 3G with 4G.

Content	3G	4G
Switching Technique	Packet Switching	Packet Switching, Message Switching
Peak Download Rate	100 Mbps	1Gbps
Frequency Band	1.8 – 2.5 MHz	2-8 GHz
Access	Wideband CDMA	Multi-Carrier – CDMA or OFDM

19. What are the features of 4g wireless systems

- a. Support interactive multimedia, voice, video, wireless internet and other broadband services.
- b. High speed, high capacity and low cost per bit.
- c. Global mobility, service portability, scalable mobile networks
- d. Seamless switching, variety of services based on Quality of Services requirements.

20. Write a short note on security challenges in 4G.

- a. Platform hardening
- b. User/Operator authentication, authorization and auditing

- c. Secure protocols, communication and data storage
- d. Software and configuration integrity

Part – B (16 Marks)

1. Explain in detail, the 4G vision, features and challenges of 4G with applications.
2. Compare the key parameters of 3G with 4G.
3. Explain the various technologies used in 4G.
4. Explain the Cognitive Radio architecture, functions and its Network Applications.
5. Write short notes on
 - (i) SISO (ii)SIMO
 - (iii) MISO
 - (iv)MIMO
6. Write short notes on MIMO OFDM.
7. Explain smart antenna technologies in detail.
8. Explain Software Defined Radio in detail.