JEPPIAAR ENGINEERING COLLEGE

Jeppiaar Nagar, Rajiv Gandhi Salai – 600 119

DEPARTMENT OF

ELECTRONICS AND COMMUNICATION ENGINEERING

QUESTION BANK

VIII SEMESTER

EC6802 – Wireless Netowrks

Regulation – 2013(Batch: 2014-2018)

Academic Year 2017 – 18

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SUBJECT   : EC6802 – Wireless Networks

YEAR /SEM: IV /VIII

UNIT I	WIRELESS LAN

Introduction-WLAN technologies: Infrared, UHF narrowband, spread spectrum -IEEE802.11: System architecture, protocol architecture, physical layer, MAC layer, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, Radio Layer, Baseband layer, Link manager Protocol, security - IEEE802.16-WIMAX: Physical layer, MAC, Spectrum allocation for WIMAX.

PART – A

CO Mapping :   C410.1

Q.No	Questions	BT Level	Competence	PO
1	State the significance of Radio transmission over infrared. (April 2017)	BTL-4	Remembering	PO1,P06
2	OFDM uses a set of orthogonal sub-carriers for transmission of data. OFDM is used in WLANs. Consider an OFDM system that uses 52 sub-carriers out of which 48 are pilot sub-carriers. System bandwidth is 20MHz and OFDM symbol duration including cyclic prefix is 4µs. If code rate is 3/4 and 64 QAM is used, find the data rate.(April 2017)	BTL-3	Applying	PO1
3	Define wireless LAN	BTL-2	Understanding	PO1,PO2
4	Explain the Problems with Wireless Networks	BTL-2	Understanding	PO1
5	Differentiate Infra-red and Radio transmission	BTL-4	Analyzing	PO1
6	What is HIPERLAN?	BTL-1	Remembering	PO1
7	Give two types of data burst in HIPERLAN?	BTL-1	Remembering	PO1,PO2
8	Differentiate centralized mode and direct mode	BTL-4	Analyzing	PO1,PO2
9	Differentiate between WiFi and WiMAX.	BTL-4	Analyzing	PO1
10	What is WLL?	BTL-1	Remembering	PO1
11	What is Fresnel zone?	BTL-1	Remembering	PO1
12	What is NIC?	BTL-1	Remembering	PO1
13	Mention the design goals of WLANs	BTL-2	Understanding	PO1,PO2,PO3
14	What are the different features of MAC Protocols?	BTL-4	Remembering	PO1
15	What is wireless networking?	BTL-1	Understanding	PO1
16	What is meant by MAC Protocols?	BTL-1	Remembering	PO1
17	What is meant by spread spectrum?	BTL-1	Understanding	PO2
18	List out the types of spread spectrum?	BTL-1	Remembering	PO1
19	What is Frequency Hopping Spread Spectrum (FHSS)?	BTL-1	Remembering	PO1,PO2
20	Give the advantages of spread spectrum over a fixed-frequency transmission?	BTL-2	Creating	PO1,PO2
21	What is direct sequence spread spectrum (DSSS)?	BTL-1	Remembering	PO1,PO2
22	Give the features of DSSS?	BTL-2	Remembering	PO1,PO2
23	What is Time-Hopping spread spectrum (THSS)?	BTL-1	Remembering	PO1
24	List and explain the inter-frame spacing	BTL-1	Remembering	PO1,PO2
25	What is chirp spread spectrum (CSS)?	BTL-1	Understanding	PO1

26	What is scatternet?	BTL-1	Remembering	PO1
27	Explain the different types of services offered by Bluetooth?	BTL-4	Analyzing	PO1
28	List the functional requirements of HIPERLANS.	BTL-1	Remembering	PO1
29	What is Bluetooth?	BTL-1	Remembering	PO1
30	What is the advantage of piconet /scatternet. ?	BTL-4	Analyzing	PO1,PO2

<table>
<tr><td colspan="5" align="center">PART – B</td></tr>
<tr><td>1</td><td>Explain and compare the media access control mechanism of DCF methods adopted in IEEE 802.11 WLAN (April 2017)</td><td>BTL-4</td><td>Analyzing</td><td>PO1,PO2</td></tr>
<tr><td>2</td><td>Describe the architecture and protocol stack of Bluetooth technology. (April 2017)</td><td>BTL-2</td><td>Understanding</td><td>PO1,PO2</td></tr>
<tr><td>3</td><td>Briefly explain about the system and protocol architecture of 802.11.</td><td>BTL-2</td><td>Understanding</td><td>PO1</td></tr>
<tr><td>4</td><td>Explain in detail about Wifi and Wimax</td><td>BTL-2</td><td>Understanding</td><td>PO1</td></tr>
<tr><td>5</td><td>Discuss IEEE 802.15 Protocol in detail.</td><td>BTL-2</td><td>Understanding</td><td>PO1</td></tr>
<tr><td>6</td><td>a. Discuss IEEE 802.15 Protocol in detail.
b. Give the significance of BRAN</td><td>BTL-2</td><td>Understanding</td><td>PO1</td></tr>
<tr><td>7</td><td>Explain HiperLAN in detail</td><td>BTL-2</td><td>Understanding</td><td>PO1</td></tr>
<tr><td>8</td><td>Discuss in detail about spread spectrum techniques.</td><td>BTL-2</td><td>Understanding</td><td>PO1</td></tr>
</table>

UNIT II   MOBILE NETWORK LAYER

Introduction - Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6-Network layer in the internet- Mobile IP session initiation protocol - mobile ad-hoc network: Routing, Destination Sequence distance vector, Dynamic source routing.

PART – A

CO Mapping :   C410.2

Q.No	Questions	BT Level	Competence	PO
1	What is encapsulation and de-capsulation? (April 2017)	BTL-1	Remembering	PO1
2	What is a Care of address in Mobile–IP? (April 2017)	BTL-1	Remembering	PO1
3	Define wireless LAN	BTL-1	Remembering	PO1
4	Define an outer header and outer header.	BTL-1	Remembering	PO1
5	Define Home agent	BTL-1	Remembering	PO1
6	What are the different terminologies of mobile IP?	BTL-4	Analyzing	PO1
7	Mention the different entities in a mobile IP.	BTL-4	Understanding	PO1
8	What are the key mechanisms in mobile IP?	BTL-2	Understanding	PO1,PO2
9	What is the advantage of Infra-red technology?	BTL-4	Applying	PO1,PO2
10	What is meant by mobile IP?	BTL-1	Remembering	PO1
11	What is the different operation of mobile IP?	BTL-1	Remembering	PO1
12	What is meant by generic routing encapsulation?	BTL-1	Remembering	PO1
13	What are the general problems of mobile IP regarding security and support of quality of service?	BTL-2	Understanding	PO1,PO2,PO3
14	Define Tunnel?	BTL-1	Remembering	PO1
15	List out the features of Mobile IP?	BTL-1	Remembering	PO1
16	What are the types of care of address?	BTL-1	Remembering	PO1
17	Define Ad hoc wireless network with example?	BTL-1	Remembering	PO1
18	Differentiate wired networks and adhoc wireless networks based on routing.	BTL-1	Remembering	PO1
19	What is agent advertisement?	BTL-1	Remembering	PO1,PO2
20	What is tunneling?	BTL-1	Remembering	PO1,PO2

21	Give examples for mobile adhoc networks.	BTL-1	Remembering	PO1,PO2
22	What is DHCP?	BTL-2	Understanding	PO1,PO2
23	Differentiate infrastructure and ad-hoc networks.	BTL-4	Analyzing	PO1,PO2,PO3
24	What is roaming?	BTL-1	Remembering	PO1,PO2
25	What is SIP?	BTL-1	Remembering	PO1
26	What are the functions of Session Initiation Protocol (SIP)?	BTL-1	Remembering	PO1,PO2
27	Differentiate an ad hoc network and a cellular network .	BTL-4	Analyzing	PO1
28	Differentiate proactive and reactive routing protocols. Write examples for each	BTL-4	Analyzing	PO1
29	Give the classifications of routing protocol in MANET.	BTL-1	Remembering	PO1
30	Explain agent advertisement?	BTL-4	Remembering	PO1
PART – B				
1	Explain and compare the working mechanism of both Destination sequence distance vector (DSDV) and Dynamic source routing protocol when applied on a mobile ad-hoc network scenario. (April 2017)	BTL-4	Analyzing	PO1,PO2,PO3
2	State the entities and terminologies used in Mobile IP along with tunneling and also explain the three types of encapsulation mechanisms used in mobile IP. (April 2017)	BTL-4	Analyzing	PO1,PO2,PO3
3	Discuss in brief about the IP packet delivery	BTL-2	Understanding	PO1,PO2
4	Describe in detail the registration procedure.	BTL-2	Understanding	PO1
5	Briefly discuss about agent discovery in mobile-IP	BTL-2	Understanding	PO1
6	Explain in detail the Dynamic host configuration protocol.	BTL-2	Understanding	PO1,PO2
7	Discuss the routing protocols in MANET	BTL-2	Understanding	PO1
8	Describe IPV6 in detail with its extension headers. Explain Mobile IP-SIP in detail	BTL-2	Understanding	PO1,PO2
9	Discuss in detail how packets are routed in MANET using Dynamic source routing algorithm.	BTL-2	Understanding	PO1,PO2

UNIT III   MOBILE TRANSPORT LAYER

TCP enhancements for wireless protocols - Traditional TCP: Congestion control, fast retransmit/fast recovery, Implications of mobility - Classical TCP improvements: Indirect TCP, Snooping TCP, Mobile TCP, Time out freezing, Selective retransmission, Transaction oriented TCP - TCP over 3G wireless networks.

PART – A

CO Mapping :   C410.3

Q.No	Questions	BT Level	Competence	PO
1	What is M-TCP? Give the advantages of M-TCP. (April 2017)	BTL-4	Analyzing	PO1,P06
2	List the disadvantages of I-TCP. (April 2017)	BTL-1	Remembering	PO1
3	What is I-TCP?	BTL-1	Remembering	PO1,PO2
4	What are all the various flavor's of TCP available?	BTL-1	Remembering	PO1
5	What led to the development of Indirect TCP?	BTL-1	Remembering	PO1
6	What is BOOTP?	BTL-1	Remembering	PO1
7	What is Snooping TCP?	BTL-1	Remembering	PO1,PO2
8	Define Routers.	BTL-1	Remembering	PO1,PO2
9	What is the goal of M-TCP?	BTL-3	Applying	PO1
10	What are the different layers of TCP/IP?	BTL-1	Remembering	PO1

11	Differentiate types of Care of address.	BTL-1	Remembering	PO1
12	Define Agent solicitation	BTL-1	Remembering	PO1
13	What is selective re-transmission?	BTL-2	Understanding	PO1
14	What is meant by a binding cache?	BTL-2	Understanding	PO1
15	What is the basic purpose of DHCP?	BTL-2	Understanding	PO1
16	How does I-TCP isolate problems on the wireless link?	BTL-2	Understanding	PO1
17	What is time out freezing?	BTL-2	Understanding	PO2
18	What are the possible locations for care of address?	BTL-2	Understanding	PO1
19	What is triangular routing?	BTL-2	Understanding	PO1
20	What is slow start mechanism?	BTL-2	Understanding	PO1
21	What is Fast Retransmit algorithm in TCP?	BTL-2	Understanding	PO1
22	What is Congestion Avoidance algorithm?	BTL-2	Understanding	PO1
23	What are the techniques for classical improvements?	BTL-2	Understanding	PO1,PO2,PO3
24	What are the advantages and disadvantages of I – TCP?	BTL-2	Understanding	PO1,PO2
25	What are the advantages and disadvantages of Mobile TCP?	BTL-2	Understanding	PO1
26	What is Snooping TCP?	BTL-2	Understanding	PO1,PO2
27	What is time-out freezing?	BTL-2	Understanding	PO1
28	What are the advantages and disadvantages of time out freezing?	BTL-2	Understanding	PO1
29	What is Selective Retransmission	BTL-2	Understanding	PO1
30	What are the applications of TCP?	BTL-2	Understanding	PO1
PART B				
1	Write your understanding on indirect TCP, Snooping TCP, Mobile TCP and transaction oriented TCP. (April 2017)	BTL-2	Understanding	PO1
2	Describe the working mechanism of Traditional TCP. (April 2017)	BTL-2	Understanding	PO1
3	Explain the traditional TCP .What are the improvements that are made into the classical TCP?	BTL-2	Understanding	PO1
4	(a)Discuss how Snooping TCP acts as a Transparent TCP and explain the role of foreign agent in it in detail. (b)What happens in the case of I-TCP if the mobile is disconnected? Discuss	BTL-2	Understanding	PO1
5	Write notes on Mobile TCP and transaction oriented TCP in detail	BTL-2	Understanding	PO1

6	Discuss in brief the pros and cons of Snooping TCP	BTL-2	Understanding	PO1
7	Elaborate on classical enhancements to TCP for mobility	BTL-2	Understanding	PO1
8	Describe the benefits and shortcomings of Mobile TCP	BTL-2	Understanding	PO1
9	Explain in detail how TCP is optimized for 3G wireless networks?	BTL-2	Understanding	PO1
10	Write short notes on time-out freezing and selective re-transmission.	BTL-2	Understanding	PO1
11	Write your understanding on indirect TCP, Snooping TCP, Mobile TCP and transaction oriented TCP.	BTL-2	Understanding	PO1
12	Write short notes on time-out freezing and selective re-transmission.	BTL-2	Understanding	PO1

UNIT IV   WIRELESS WIDE AREA NETWORK
Overview of UTMS Terrestrial Radio access network-UMTS Core network Architecture: 3G-MSC, 3GSGSN, 3G-GGSN, SMS-GMSC/SMS-IWMSC, Firewall, DNS/DHCP-High speed Downlink packet access (HSDPA)- LTE network architecture and protocol.

PART – A

CO Mapping :   C410.4

Q.No	Questions	BT Level	Competence	PO
1	What is the role of firewall used in UMTS network? (April 2017)	BTL-2	Understanding	PO1,P06
2	Name the 3G radio access schemes identified to support different spectrum scenario. (April 2017)	BTL-1	Remembering	PO1
3	List the sub-systems of UMTS Terrestrial Radio Access Network (UTRAN).	BTL-1	Remembering	PO1,PO2
4	State the responsibilities of an RNC	BTL-1	Remembering	PO1
5	State the responsibilities of Node B	BTL-1	Remembering	PO1
6	What is the need for I_u interface?	BTL-2	Understanding	PO1
7	Draw the UTRAN logical architecture.	BTL-4	Analyzing	PO1,PO2
8	State the three different protocol planes of I_u interface	BTL-1	Remembering	PO1,PO2
9	List the functions of RNCP.	BTL-1	Remembering	PO1
10	What is the need for I_{ur} interface	BTL-2	Understanding	PO1
11	What are the functions carried out by I_{ur} interface?	BTL-2	Understanding	PO1
12	What is the need for I_{ub} interface?	BTL-2	Understanding	PO1
13	State the functionality of U_u interface.	BTL-1	Remembering	PO1,PO2
14	State the functions of 3G-MSC	BTL-1	Remembering	PO1
15	Write about 3G-SGSN	BTL-1	Remembering	PO1
16	Draw UMTS core network architecture	BTL-4	Analyzing	PO1
17	List the functions of 3G-GGSN	BTL-1	Understanding	PO2
18	What are the tasks carried out by SMS-GMSC?	BTL-2	Understanding	PO1
19	Why do we need Firewall in a network?	BTL-2	Understanding	PO1
20	Write about DNS.	BTL-1	Remembering	PO1,PO3
21	List out the need for DHCP.	BTL-1	Remembering	PO1,PO2
22	State the salient features of HSDPA.	BTL-1	Remembering	PO1,PO2
23	What is Transport Network Control Plane (TNCP)?	BTL-2	Understanding	PO1
24	What is 3G-SGSN?	BTL-2	Understanding	PO1
25	What are the functions provided by 3G-GGSN?	BTL-2	Understanding	PO1
26	What is SMS-GMSC?	BTL-2	Understanding	PO1
27	What is radio resource control (RRC)?	BTL-2	Understanding	PO1
28	What are the duties of Radio network control (RNC)?	BTL-2	Understanding	PO1
29	What are the planes of UTRAN?	BTL-2	Understanding	PO1
30	What are the functions provided by 3G-MSC?	BTL-4	Remembering	PO1
	PART B			
1	Elaborate on UMTS core network architecture with a neat sketch(April 2017)	BTL-2	Understanding	PO1

2	Explain the UMTS network architecture with GSM,3G and also explain the reference architecture (April 2017)	BTL-2	Understanding	PO1
3	Explain in detail about UTRAN Logical Architecture with a neat sketch	BTL-2	Understanding	PO1
4	Describe the distribution of UTRAN functions in RNC and Node B	BTL-2	Understanding	PO1
5	Discuss the salient features of HSDPA with respect to physical layer	BTL-2	Understanding	PO1
6	Explain LTE network architecture and associated protocols in detail.	BTL-2	Understanding	PO1
7	Explain the functions performed by 3G-SGSN and 3G-GGSN.	BTL-2	Understanding	PO1
8	Explain the concepts of UMTS network Qos Service and its management.	BTL-2	Understanding	PO1

UNIT V 4G NETWORKS

Introduction – 4G vision – 4G features and challenges - Applications of 4G – 4G Technologies:
Multicarrier Modulation, Smart antenna techniques, OFDM-MIMO systems, Adaptive Modulation and coding with time slot scheduler, Cognitive Radio

PART – A

CO Mapping : C410.5

Q.No	Questions	BT Level	Competence	PO
1	List the key features of 4G networks from the user point of view. (April 2017)	BTL-1	Remembering	PO1,P06
2	What is multi carrier modulation? Mention its advantages. (April 2017)	BTL-2	Understanding	PO1
3	Differentiate between 3G and 4G networks	BTL-4	Analyzing	PO1,PO2
4	What is the data rate offered by 4G systems?	BTL-2	Understanding	PO1
5	What are the applications of 4G technology?	BTL-2	Understanding	PO1
6	Mention the challenges faced by 4G networks	BTL-5	Evaluating	PO1
7	What are the types of multi carrier modulation?	BTL-1	Remembering	PO1,PO2
8	Explain the concept of Multiple Input Multiple Output (MIMO)?	BTL-2	Understanding	PO1
9	Give the capacity equation for Single Input Single output (SISO) system.	BTL-1	Remembering	PO1
10	Explain briefly the concept of MIMO-OFDM systems in detail.	BTL-2	Understanding	PO1
11	Explain briefly the concept of Bell Lab Layered Space Time (BLAST) architecture	BTL-2	Understanding	PO1
12	How efficient packet data transmission can be achieved in 4G networks?	BTL-4	Analyzing	PO1
13	What is Software Defined Radio (SDR)?	BTL-2	Understanding	PO1,PO2, PO3
14	List out the features of 4G networks?	BTL-1	Remembering	PO1
15	Sketch the block diagram of MIMO system	BTL-1	Analyzing	PO1
16	Sketch the architecture of BLAST system	BTL-4	Analyzing	PO1
17	List out the various advantages of SDR technology	BTL-1	Understanding	PO2
18	What is Cognitive Radio? Mention any one application	BTL-2	Understanding	PO1
19	Explain services provided by 4G?	BTL-2	Understanding	PO1,PO2
20	What are the main functions of Cognitive Radio?	BTL-2	Understanding	PO1,PO2
21	Define Cognitive Radio	BTL-1	Remembering	PO1,PO2
22	What is meant by MIMO?	BTL-2	Understanding	PO1,PO2
23	What are the benefits of Smart Antenna Technology?	BTL-2	Understanding	PO1
24	Mention the hardware components of Software Defined Radio?	BTL-1	Remembering	PO1
	PART B			
1	Write your understanding on behaviour of smart antenna techniques(April 2017)	BTL-2	Understanding	PO1
2	Explain in detail about Adaptive modulation and Coding with time slot scheduler in detail(April 2017)	BTL-2	Understanding	PO1

3	Explain motivation behind the evolution of 4G technology in detail	BTL-2	Understanding	PO1
4	Explain the key challenges faced by 4G networks and also propose solutions of how to mitigate those challenges.	BTL-2	Understanding	PO1
5	Explain the concept of Multi carrier modulation (MCM) in detail.	BTL-2	Understanding	PO1
6	With a neat block diagram explain the concept of BLAST architecture in detail	BTL-2	Understanding	PO1
7	Explain in detail about Software Defined Radio (SDR).	BTL-2	Understanding	PO1
8	Explain the concept of Cognitive Radio and enumerate in detail its role in field of spectrum sensing by highlighting its bottlenecks.	BTL-2	Understanding	PO1

UNIT I - WIRELESS LAN
PART A
1. State the significance of Radio transmission over infrared. (April 2017)

	Radio transmission	**Infrared**
(i) Coverage range	Upto 50m for LOS	Upto 10m
(ii) Data rate	100kbps	500bps-1kbps
(iii) Power consumption	5-20 mW during ON state	20-150 mW during ON state

2. OFDM uses a set of orthogonal sub-carriers for transmission of data. OFDM is used in WLANs. Consider an OFDM system that uses 52 sub-carriers out of which 48 are pilot sub-carriers. System bandwidth is 20MHz and OFDM symbol duration including cyclic prefix is 4μs. If code rate is 3/4 and 64 QAM is used, find the data rate. (April 2017)

$$\text{Data rate} = \frac{\text{No of } \frac{\text{bits}}{\text{symbol}} \text{for the carrier}}{\text{OFDM symbol duration}};$$

For 64-QAM Bits Per symbol =6
with ¾ code rate, No of bits / subcarrier=6*3/4=4.5
Total No. of bits for 48 sub carriers = 4.5 * 48 = 216 bits/symbol;
Data rate = 216/4μs = 54Mbps.

3. Define wireless LAN.

Local area and Built on exiting wireless communication networks and Allows cellular phone access to Internet services

4. Explain the Problems with Wireless Networks
- Operates in a less controlled environment, so is more susceptible to interference, signal loss, noise, and eavesdropping.
- Generally, wireless facilities have lower data rates than guided facilities.
- Frequencies can be more easily reused with guided media than with wireless media.

5. Differentiate Infra-red and Radio transmission.

Two different basic transmission technologies can be used to set up WLANs. One technology is based on the transmission of infra-red light the other one, which is much more popular, uses radio transmission Both technologies can be used to set up ad-hoc connections for work groups, to connect, e.g., a desktop with a printer without a wire, or to support mobility within a small area.The main advantages of infra-red technology are its simple and extremely cheap senders and receivers. Disadvantage of infra-red transmission is low bandwidth. Advantages of radio transmission include the long-term experiences made with radio transmission for wide area networks. The main advantage is also a big disadvantage of radio transmission. Shielding is not so simple.

6. What is HIPERLAN?

HIPERLAN is a set of wireless local area network communication standards primarily used in European countries. It has four specifications: HIPERLAN1, HIPERLAN2, HIPERLINK and HIPERACCESS.

7. Give two types of data burst in HIPERLAN?

The transmission format on the physical layer is a burst, which consists of a preamble and a data part. Five different PHY bursts have been defined: broadcast, downlink, uplink with short preamble, uplink with long preamble, and direct link (optional). The bursts differ in their preambles.

8. Differentiate centralized mode and direct mode.

Centralized mode is based on infrastructure based mode. APs are associated with mobile terminals and all data is transferred between the two terminals via AP.Direct mode is based on ad-hoc mode. Here data is directly exchanged between mobile terminals.

9. Differentiate between WiFi and WiMAX.

WiMAX and Wi-Fi are both wireless broadband technologies, but they differ in the technical execution. Wi-Fi was developed to be used for mobile computing devices, such as laptops, in LANs, but is now increasingly used for more services, including Internet and VoIP phone access, gaming, and basic connectivity of consumer electronics such as

televisions and DVD players, or digital cameras. On the other hand WiMAX was developed as a standards-based technology enabling the delivery of last mile wireless broadband access as an alternative to cable and DSL.

10. What is WLL?

Wireless local loop *(WLL)*, is a term for the use of a wireless communications link. As subscribers have demanded greater capacity, particularly to support internet use traditional twisted pair tech has become inadequate. Interest being shown in competing wireless technologies for subscriber access. These generally referred to as WLL or fixed wireless access. Mainly used in Urban and rural areas.

11. What is Fresnel zone?

For effective communication at millimeter wavelength, there should be an unobstructed line of sight between transmitter and receiver. In this, if there are any obstacles near the path then it will reduce the power of the received signal (i.e.) increases signal to *noise* ratio. Fresnel Zone provided a mean to calculate where the zones are, where a given obstacle will cause mostly in phase or mostly out of phase reflections b/w the transmitter and receiver.

12. What is NIC?

A PC or workstation uses a wireless NIC to connect to the wireless network. The NIC scans the available frequency spectrum for connectivity and associates it to an access point or another wireless client. The NIC is coupled to the PC/workstation operating system using a software driver.

13. Mention the design goals of WLANs.

- *Global operation*: LAN equipment may be carried from one country to another and this operation should be legal (frequency regulations national and international).
- *Low power***:** Take into account that devices communicating via WLAN are typically running on battery power. Special power saving modes and power management functions. Simplified spontaneous co-operation: no complicated setup routines but operate spontaneously after power.
- *Easy to use***:** WLANs are made for simple users; they should not require complex management but rather work on a plug-and-play basis.
- *Protection of investment***:** A lot of money has been invested for wired LANs, WLANs should be able to interoperate with existing network (same data type and services).
- *Safety and security:* Safe to operate. Encryption mechanism, do not allow roaming profiles for tracking people (privacy)
- *Transparency for applications:* Existing applications should continue to work.

14. What are the different features of MAC Protocols?

- It should implement some rules that help to enforce discipline when multiple nodes contend for a shared channel.
- It should help maximize the utilization of the channel
- Channel allocation needs to be fair.
- It should be capable of supporting several types of traffic having different maximum and average bit rates.

15. What is wireless networking?

Wireless refers to the method of transferring information between a computing device, and a data source, such as an agency database server, without a physical connection

16. What is meant by MAC Protocols?

When an IP packet reaches its destination (sub) network, the destination IP address (a layer 3 or network layer concept) is resolved with the Address Resolution Protocol for IPv4, or by Neighbor Discovery Protocol (IPv6) into the MAC address (a layer 2 concept) of the destination host.

17. What is meant by spread spectrum?

In telecommunication and radio communication, **spread**-**spectrum** techniques are methods by which a signal (e.g. an electrical, electromagnetic, or acoustic signal) generated with a particular bandwidth is deliberately **spread** in the frequency domain, resulting in a signal with a wider bandwidth.

18. List out the types of spread spectrum?

Frequency Hopping Spread Spectrum (FHSS), Direct-sequence spread spectrum (DSSS) , Time Hopping spread spectrum (THSS) and Chirp spread spectrum (CSS)

19. What is Frequency Hopping Spread Spectrum (**FHSS**)?

Frequency Hopping Spread Spectrum (FHSS) is a method of transmitting radio signals by rapidly switching a carrier among many frequency channels, using a pseudorandom sequence known to both transmitter and receiver. It is used as a multiple access method in the *frequency-hopping code division multiple access (FH-CDMA)* scheme.

20. Give the advantages of spread spectrum over a fixed-frequency transmission?

- Spread-spectrum signals are highly resistant to narrowband interference. The process of re-collecting a spread signal spreads out the interfering signal, causing it to recede into the background.
- Spread-spectrum signals are difficult to intercept. A spread-spectrum signal may simply appear as an increase in the background noise to a narrowband receiver. An eavesdropper may have difficulty intercepting a transmission in real time if the pseudorandom sequence is not known.
- Spread-spectrum transmissions can share a frequency band with many types of conventional transmissions with minimal interference. The spread-spectrum signals add minimal noise to the narrow-frequency communications, and vice versa. As a result, bandwidth can be used more efficiently.

21. What is direct sequence spread spectrum (DSSS)?

DSSS systems transmit the message bearing signals using a bandwidth that is in excess of the bandwidth that is actually needed by the message signal. This spreading of the transmitted signal over a large bandwidth makes the

resulting wide band signal to appear as a noise signal which allows greater resistance to intentional and unintentional interference with the transmitted signal.

22. Give the features of DSSS?

DSSS phase-shifts a sine wave pseudo randomly with a continuous string of pseudo-noise (PN) code symbols called "chips", each of which has a much shorter duration than an information bit. That is, each information bit is modulated by a sequence of much faster chips. Therefore, the chip rate is much higher than the information signal bit rate. DSSS uses a signal structure in which the sequence of chips produced by the transmitter is already known by the receiver. The receiver can then use the same *PN sequence* to counteract the effect of the PN sequence on the received signal in order to reconstruct the information signal.

23. What is Time-Hopping spread spectrum (THSS)?

Time-hopping (TH) is a communications signal technique which can be used to achieve anti-jamming (AJ) or low probability of intercept (LPI). It can also refer to pulse-position modulation, which in its simplest form employs 2^k discrete pulses (referring to the unique positions of the pulse within the transmission window) to transmit k bit(s) per pulse. To achieve LPI, the transmission time is changed randomly by varying the period and duty cycle of the pulse (carrier) using a pseudo-random sequence. The transmitted signal will then have intermittent start and stop times. Although often used to form hybrid spread-spectrum (SS) systems,

24. List and explain the inter-frame spacing.

- SIFS (Shortest inter-frame spacing) - It has the highest priority because it has the shortest waiting time for medium access. And it is defined for Short control messages.
- PIFS (PCF inter frame spacing)-It has medium priority because it has a waiting time between DIFS and SIFS. It is used for a time bounded service.
- DIFS (DCF inter frame spacing)-This parameter denotes the longest waiting time and has the lowest priority for medium access.

25. What is chirp spread spectrum (CSS)?

In digital communications, *chirp spread spectrum* (CSS) is a spread spectrum technique that uses wideband linear frequency modulated chirp pulses to encode information. A chirp is a sinusoidal signal whose frequency increases or decreases over time (often with a polynomial expression for the relationship between time and frequency). In the picture is an example of an up chirp—as you can see, the frequency increases linearly over time.

26. What is scatternet?

Bluetooth enabled devices are organized in groups called piconets. One device in the piconet can act as master; all other devices connected to the master must act as slaves. A master unit is the device that initiates the communication. As more users join the piconets, the throughput per user drops quickly. So they move on to scatternet. It consists of two piconets both having different hopping sequences.

27. Explain the different types of services offered by Bluetooth?

Basic profiles have been specified as: Generic access, service discovery, cordless telephony, intercom, serial port, headset, dialup networking, LAN access, generic object exchange, object push, file transfer, and synchronization. Additional profiles are: Advanced audio distribution, PAN, audio video remote control, basic printing, basic imaging, extended service discovery, generic audio video distribution, hands-free, and hardcopy cable replacement. Each profile selects a set of protocols.

28. List the functional requirements of HIPERLANS.

- 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

29. 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).

30. 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.

PART B

1. Explain and compare the media access control mechanism of DCF methods adopted in IEEE 802.11 WLAN **(April 2017).**

    Refer P.No.214, "Mobile Communications", by Jochen Schiller, Pearson Education 2012

2. Describe the architecture and protocol stack of Bluetooth technology. **(April 2017)**

Refer P.No.269, "Mobile Communications", by Jochen Schiller,Pearson Education 2012
3. Briefly explain about the system and protocol architecture of 802.11.
    Refer P.No.210, "Mobile Communications", by Jochen Schiller, Pearson Education 2012
    Refer P.No.211, "Mobile Communications", by Jochen Schiller, Pearson Education 2012.
4. Explain in detail about Wifi and Wimax.
    Refer P.No.231, "Mobile Communications", by Jochen Schiller, Pearson Education 2012.
5. Discuss IEEE 802.15 Protocol in detail.
    Refer P.No.291, "Mobile Communications", by Jochen Schiller, Pearson Education 2012.
6. (a) Describe spectrum allocation for WiMAX (b) Give the significance of BRAN.
    Refer P.No.231, "Mobile Communications", by Jochen Schiller, Pearson   Education 2012.
7. Explain HiperLAN in detail.
    Refer P.No.239, "Mobile Communications", by Jochen Schiller, Pearson Education 2012.
8. Discuss in detail about spread spectrum techniques.
    Refer P.No.54, "Mobile Communications", by Jochen Schiller, Pearson   Education 2012.

UNIT II MOBILE NETWORK LAYER
PART A

1. What is encapsulation and de-capsulation? (April 2017)
    Encapsulation is the mechanism of taking a packet consisting of packet header and data 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 de-capsulation.

2. What is a Care of address in Mobile–IP? (April 2017)
    Care-of address (COA): The COA 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 IP address of the MN. Packet delivery toward the MN is done using a tunnel. To be more precise, the COA marks the tunnel endpoint, i.e., the address where packets exit the tunnel.

3. Mention 3- types of address assignment policies used in DHCP.
- Manual configuration – manager can configure a specific address for a specific computer.
- Dynamic configuration – server loans an address to a computer for a limited time.
- Automatic configuration – DHCP server assigns permanent address when a computer first attaches to the network.

4. Define an outer header and outer header.
    The HA takes the original packet with the MN as destination, puts it into the data part of a new packet and sets the new IP header in such a way that the packet is routed to the COA. The new header is called the outer header. There is an inner header which can be identical to the original header as this case for IP-in-IP encapsulation, or the inner header can be computed during encapsulation.

5. Define Home agent
    It is located in home network and it provides several services for the Mobile Network (MN).Home agent maintains a location registry. The location registry keeps track of the node locations using the current care of address of the mobile network.

6. What are the different terminologies of mobile IP?
- Home Network
- Home address
- Foreign agent
- Foreign Network
- Mobile IP

7. Mention the different entities in a mobile IP.
    Mobile Node, Correspondent Node, Home Network, Foreign Network, Foreign Agent, Home Agent, Care-Of address, Foreign agent COA and Co-located COA.

8. What are the key mechanisms in mobile IP?
- Discovering the care of address
- Registering the care of address
- Tunneling to the care of address.

9. What is the advantage of Infra-red technology?
    The main advantages of infra-red technology are its simple and extremely cheap senders and receivers.

10. What is meant by mobile IP?
    Mobile IP communication protocol refers to the forwarding of Internet traffic with a fixed IP address even outside the home network. It allows users having wireless or mobile devices to   use the Internet remotely.

11. What is the different operation of mobile IP?
- The remote client sends a datagram to the MN using its home address it reaches the home agent as usual.
- The home agent encapsulates the datagram in a new packet and sends it to the foreign agent.

12. What is meant by generic routing encapsulation?
    Generic routing encapsulation allows the encapsulation of packets of one protocol suite into the payload portion of a packet of another protocol suite

13. What are the general problems of mobile IP regarding security and support of quality of service?

Mobility poses many security problems. A minimum requirement is the authentication of all messages related to the management of mobile IP. It must be sure for the IP layer if it forwards a packet to a mobile host that this host really is the receiver of the packet. The IP layer can only guarantee that the IP addresses of the receiver is correct. There are no ways of preventing faked IP address or other attacks

14. Define Tunnel?

Tunnel establishes a virtual pipe for data packets between a tunnel entry and a tunnel endpoint. Packets entering a tunnel are forwarded inside the tunnel and leave the tunnel unchanged. Sending a packet through a tunnel is achieved by using encapsulation.

15. List out the features of Mobile IP?

▪ Transparency : Mobile end system should continue to keep its IP address
▪ Compatibility : It should be compatible with existing internet protocol
▪ Scalability   : It should be scalable to support billions of moving host worldwide.
▪ Security   : provide users with secure communication over the internet

16. What are the types of care of address?

It is the address that is used to identify the present location of a foreign agent
▪ Foreign agent care of address
▪ Co-located care of address

17. Define Ad hoc wireless network with example?

An ad-hoc network is a local area network (LAN) that is built spontaneously as devices connect. Instead of relying on a base station to coordinate the flow of messages to each node in the network, the individual network nodes forward packets to and from each other. In Latin, ad hoc literally means "for this," meaning "for this special purpose" and also, by extension, improvised or impromptu. In the Windows operating system, ad-hoc is a communication mode (setting) that allows computers to directly communicate with each other without a router.

18. Differentiate wired networks and adhoc wireless networks based on routing.

For wired networks, generally the network is partitioned into two levels: intra-domain and inter-domain. These current routing protocols are mostly designed to deal with simple network failures (e.g., links going up and down, nodes crashing) and can have much vulnerability facing malicious intruders. The compromise of routing function can lead to the denial of network service, the disclosure or modification of sensitive routing information, the disclosure of network traffic, or the inaccurate accounting of network resource usage. For wireless Ad Hoc networks, the situation is even worse. Ad Hoc networks have no pre-deployed infrastructure available for routing packets end-to-end in a network. Nodes communicate with each other without the intervention of centralized access points or base stations, so each node acts both as a router and as a host. Securing Ad Hoc routing presents difficulties not present in traditional network: neither centrally administrated secure routers nor strict policy exist in an Ad Hoc network; the nodes in the networks can be highly mobile, thus rapidly changing the node constellation and the presence or absence of links. So the routing in ad hoc networks is an especially hard task to accomplish securely, robustly and efficiently.

19. What is agent advertisement?

Foreign and the home agents advertise their presence through periodic agent advertisement   messages. An agent advertisement message, lists one or more care of address and a flag indicating whether it is a home agent or a foreign agent.

20. What is tunneling?

A tunnel establishes a virtual pipe for data packets between a tunnel entry and a tunnel endpoint. Packets entering a tunnel are forwarded inside the tunnel and leave the tunnel unchanged. Tunneling, i.e., sending a packet through a tunnel is achieved by using encapsulation.

21. Give examples for mobile adhoc networks.

Another application example of a mobile ad-hoc network is Bluetooth, which is designed to support a personal area network by eliminating the need of wires between various devices, such as printers and personal digital assistants. A mobile ad-hoc network can also be used to provide crisis management services applications.

22. What is DHCP?

The dynamic host configuration protocol is mainly used to simplify the installation and maintenance of networked computers. If a new computer is connected to a network, DHCP can provide it with all the necessary information for full system integration into the network, e.g., addresses of a DNS server and the default router, the subnet mask, the domain name, and an IP address.

23. Differentiate infrastructure and ad-hoc networks.

Infrastructure network- In this communication typically takes place only between the wireless nodes and the access point. Any two wireless network nodes can communicate with the use of AP.
Ad-hoc networks- This type of network has no infrastructure and it does not have any Ap. Here any wireless nodes from two different wireless networks cannot communicate.

24. What is roaming?

If a user walks around with a wireless station, the station has to move from one access point to another to provide uninterrupted service. Moving between access points is called roaming.

25.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.

26.What are the functions of Session Initiation Protocol (SIP)?

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.

27. Differentiate an ad hoc network and a cellular network .

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 voice traffic)	Shared radio channel (more suitable 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.

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

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

29. 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.

Reactive protocols: This protocol invoke a route determination procedure only on demand.

30. Explain agent advertisement?

Foreign and the home agents advertise their presence through periodic agent advertisement   messages. An agent advertisement message, lists one or more care of address and a flag indicating whether it is a home agent or a foreign agent.

PART B

1. **Explain and compare the working mechanism of both Destination sequence distance vector (DSDV) and Dynamic source routing protocol when applied on a mobile adhoc network scenario. (April 2017)**
   Refer P.No. 328, "Mobile Communications", by Jochen Schiller, Pearson Education2012 .
2. **State the entities and terminologies used in Mobile IP along with tunneling and also explain the three types of encapsulation mechanisms used in mobile IP. (April 2017)**
   Refer P.No.315, "Mobile Communications", by Jochen Schiller, Pearson Education 2012.
3. **Discuss in brief about the IP packet delivery.**
   Refer P.No. 309, "Mobile Communications", by Jochen Schiller, Pearson Education 2012.
4. **Describe in detail the registration procedure.**
   Refer P.No. 312, "Mobile Communications", by Jochen Schiller, Pearson Education 2012.
5. **Briefly discuss about agent discovery in mobile-IP.**
   Refer P.No. 310, "Mobile Communications", by Jochen Schiller, Pearson Education 2012.

6. **Explain in detail the Dynamic host configuration protocol.**
   Refer P.No. 328, "Mobile Communications", by Jochen Schiller, Pearson Education 2012.
7. **Discuss the routing protocols in MANET.**
   Refer P.No.332, "Mobile Communications", by Jochen Schiller, Pearson Education 2012.
8. **Describe IPV6 in detail with its extension headers.**
   Refer P.No.323, "Mobile Communications", by Jochen Schiller, Pearson Education 2012.
9. **Explain Mobile IP-SIP in detail.**
   Refer P.No.324, "Mobile Communications", by Jochen Schiller, Pearson Education 2012.
10. **Discuss in detail how packets are routed in MANET using Dynamic source routing algorithm.**
   Refer P.No.336, "Mobile Communications", by Jochen Schiller, Pearson Education 2012.

UNIT-III MOBILE TRANSPORT LAYER
PART A

1. What is M-TCP? Give the advantages of M-TCP. (April 2017)

M-TCP (mobile TCP) M-TCP splits the TCP connection into two parts as I-TCP does. An unmodified TCP is used on the standard host-supervisory host (SH) connection, while an optimized TCP is used on the SH-MH connection. The supervisory host is responsible for exchanging data between both parts similar to the proxy in ITCP .The advantages of M-TCP are the following: It maintains the TCP end-to-end semantics. If the MH is disconnected, it avoids useless retransmissions, slow starts or breaking connections by simply shrinking the sender's window to 0. Since it does not buffer data in the SH as I-TCP does, it is not necessary to forward buffers to a new SH.

2. **List the disadvantages of I-TCP. (April 2017)** It does not maintain the semantics of TCP as the FH gets the acknowledgement before the packet is delivered at MH.I TCP does not maintain the end –end semantic of TCP and assumes that application layer would ensure reliability

3. What is I-TCP?

I-TCP segments a TCP connection into a fixed part and a wireless part. The example is mobile host connected via a wireless link and an access point to the 'wired' internet where the correspondent host resides. The correspondent node could also use wireless access.

Standard TCP is used between the fixed computer and the access point. No computer in the internet recognizes any changes to TCP. Instead of the mobile host, the access point now terminates the standard TCP connection, acting as a proxy.

4. What are all the various flavours of TCP available?
- Indirect TCP- I-TCP segments a TCP connection into a fixed part and a wireless part.
- Snooping TCP- Here the foreign agent buffers all packets with destination mobile host and additionally snoops the packet flow in both directions to recognize acknowledgements.
- Mobile TCP- M-TCP wants to improve overall throughput, to lower the delay, to maintain end to end semantics of TCP, and to provide a more efficient handover.
- Fast Transmit/Fast Recovery
- Transmission/Time-out freezing
- Selective retransmission
- Transaction-oriented TCP.

5. What led to the development of Indirect TCP?
- TCP performs poorly together with wireless links
- TCP within the fixed network cannot be changed.

This led to the development of I-TCP which segments a TCP connection into a fixed part and a wireless part.

6. What is BOOTP?

BOOTP protocol is used for Booting (starting) a diskless computer over a network. Since a diskless computer does not store the operating system program in its permanent memory, BOOTP protocol helps to download and boot over a network using the operating system files stored on a server located in the network.

7. What is Snooping TCP?

In this approach, the foreign agent buffers all packets with destination mobile host and additionally 'snoops' the packet flow in both directions to recognize acknowledgements. The reason for buffering packets toward the mobile node is to enable the foreign agent to perform a local retransmission in case of packet loss on the wireless link.

8. Define Routers.

Router is responsible for routing the packets that is receives to their destinations based on their IP addresses, possibly via other routers

9. What is the goal of M-TCP?

The goal of M-TCP is to prevent the sender window from shrinking if bit errors or disconnection but not congestion cause current problems.
- To provide overall throughput
- To lower the delay
- To maintain end-to-end semantics of TCP
- To provide a more efficient handover.

10. What are the different layers of TCP/IP?

Application layer, Transport layer, Internet layer, Network access layer.

11. Differentiate types of Care of address.

The COA could be located at the FA, i.e., the COA is an IP address of the FA. The FA is the tunnel end-point and forwards packets to the MN. Many MN using the FA can share this COA as common COA. The COA is co-located if the MN temporarily acquired an additional IP address which acts as COA. This address is now topologically correct, and the tunnel endpoint is at the MN. Co-located addresses can be acquired using services such as DHCP. One problem associated with this approach is the need for additional addresses if MNs request a COA.

12. Define Agent solicitation

Mobile node does not receive any COA, then the MN should send an agent solicitation message. But it is important to monitor that these agent solicitation message do not flood the network.

13. What is selective re-transmission?

A very useful extension of TCP is the use of selective retransmission. If a single packet is lost, the sender can now determine precisely which packet is needed and can retransmit it. Using selective retransmission is also beneficial in all other networks.

14. What is meant by a binding cache?

One way to optimize the route is to inform the CN of the current location by caching it in a binding cache which is a part of the local routing table for the CN.

15. What is the basic purpose of DHCP?

Dynamic Host configuration Protocol is set of rules used by communication devices, to request and obtain an IP address from a server which has a list of address available for assignment.

16. How does I-TCP isolate problems on the wireless link?
- I-TCP does not need any changes in the TCP protocol.
- Transmission errors on the wireless link cannot propagate into the fixed network.
- Mechanisms are needed to improve TCP performance as in the case of I-TCP only the mobile host and foreign agents need changes. Hence we can test new schemes without destabilizing the system.
- As there is strict partition, two different protocols can be used between the FA/MH and other end.

17. What is time out freezing?

It is used in situations where the mobile node (MN) faces long durations of disconnection. During the timeout period the MN may get some data sequences. After timeout, the TCP transmission freezes.

18. What are the possible locations for care of address?

The care-of address is a slightly tricky concept. There are two different types, which correspond to two distinctly different methods of forwarding datagrams from the home agent router. Foreign agent COA: The COA could be located at the FA, i.e., the COA is an IP address of the FA. The FA is the tunnel end-point and forwards packets to the MN. Co-located COA: The COA is co-located if the MN temporarily acquired an additional IP address which acts as COA. This address is now topologically correct, and the tunnel endpoint is at the MN. Co-located addresses can be acquired using services such as DHCP.

19. What is triangular routing?

The inefficient behavior of a non-optimized mobile IP is called triangular routing. The triangle is made up of three segments, CN to HA, HA to COA\MN, and MN back to CN.

20. 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.

21.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.

22. 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.

23.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 spit connection protocols, attempts to separate loss recovery over the wireless link from the wired link.

24. 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.

25.what are the advantages and disadvantages of Mobile TCP?

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.

26.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.

27.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.

28.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.

29.What is Selective Retransmission?

TCP acknowledgements are collective. They acknowledge in-order receipt of packets upto certain packets. Even if a single packet is lost, the sender has to retransmit everything starting from the lost packet. To overcome this problem, TCP can indirectly request a selective retransmission of packets. The receiver may acknowledge single packets and also trains of in-sequence packets.

30.What are the applications of TCP?

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

PART B

1. **Explain the traditional TCP .What are the improvements that are made into the classical TCP?**
   Refer P.No. 352, "Mobile Communications", by Jochen Schiller, Pearson Education 2012
2. **(a)Discuss how Snooping TCP acts as a Transparent TCP and explain the role of foreign agent in it in detail.**
   (b)What happens in the case of I-TCP if the mobile is disconnected? Discuss
   Refer P.No. 358, "Mobile Communications", by Jochen Schiller, Pearson Education 2012.
3. **Write notes on Mobile TCP and transaction oriented TCP in detail.**
   Refer P.No. 364, "Mobile Communications", by Jochen Schiller, Pearson Education 2012.
4. **Explain in detail the advantages and dis-advantages of I-TCP.**
   Refer P.No. 355, "Mobile Communications", by Jochen Schiller, Pearson Education 2012.
5. **Discuss in brief the pros and cons of Snooping TCP.**
   Refer P.No. 358, "Mobile Communications", by Jochen Schiller, Pearson Education 2012.
6. **Elaborate on classical enhancements to TCP for mobility.**
   Refer P.No. 355, "Mobile Communications", by Jochen Schiller, Pearson Education 2012.
7. **Describe the benefits and shortcomings of Mobile TCP**.
   Refer P.No. 368, "Mobile Communications", by Jochen Schiller, Pearson Education 2012.
8. **Explain in detail how TCP is optimized for 3G wireless networks?**
   Refer P.No. 366, "Mobile Communications", by Jochen Schiller, Pearson   Education 2012.
9. **Write short notes on time-out freezing and selective re-transmission**.
   Refer P.No. 363, "Mobile Communications", by Jochen Schiller, Pearson Education 2012.

10. **Write your understanding on indirect TCP, Snooping TCP, Mobile TCP and transaction oriented TCP. (April 2017)**
Refer P.No. 355, "Mobile Communications", by Jochen Schiller, Pearson Education 2012.
11. **Describe the working mechanism of Traditional TCP. (April 2017)**
Refer P.No. 352, "Mobile Communications", by Jochen Schiller, Pearson Education 2012.

UNIT IV WIRELESS WIDE AREA NETWORK
PART A

1. What is the role of firewall used in UMTS network? (April 2017)
All traffic coming in and going out of the private network is handled by the firewall. The firewall ensures that only authenticated traffic is allowed to pass through it.

2. Name the 3G radio access schemes identified to support different spectrum scenario.   (April 2017)
1. Enhanced data rates for GSM evolution (EDGE) with high-level modulation in a 200 kHz TDMA channel is based on plug-in transceiver equipment, thereby allowing the migration of existing bands in small spectrum segments.
2. 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.

3. List the sub-systems of UMTS Terrestrial Radio Access Network (UTRAN).
The UTRAN consists of a set of radio network subsystems (RNSs). The RNS has two main logical elements: Node B and an RNC.

4. **State the responsibilities of an RNC.**
An RNC is responsible for the use and allocation of all the radio resources of the RNS to which it belongs. The RNC also handles the user voice and packet data traffic, performing the actions on the user data streams that are necessary to access the radio bearers.

5. **State the responsibilities of Node B.**
A Node B is responsible for radio transmission and reception in one or more cells to/from the user equipment (UE).

6. **What is the need for I_u interface?**
The UMTS I_u interface is the open logical interface that interconnects one UTRAN to the UMTS core network (UCN). On the UTRAN side the I_u interface is terminated at the RNC, and at the UCN side it is terminated at U-MSC.

7. **Draw the UTRAN logical architecture.**

RNC: Radio Network Controller
RNS: Radio Network Subsystem
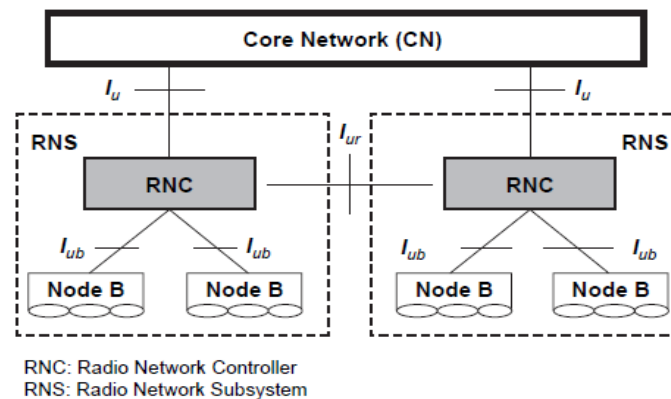
8. **State the three different protocol planes of I_u interface.**
The I_u interface consists of three different protocol planes — the radio network control plane (RNCP), the transport network control plane (TNCP), and the user plane (UP).

9. **List the functions of RNCP.**
It carries information for the general control of UTRAN radio network operations. It carries information for control of UTRAN in the context of each specific call. It carries user call control (CC) and mobility management (MM) signaling messages.

10. **What is the need for I_{ur} interface?**
The connection between two RNCs (serving RNC (SRNC) and drift RNC (DRNC)) is the I_{ur} interface. It is used in soft handoff scenarios when different macro diversity streams of one communication are supported by Node Bs that belong to different RNCs. Communication between one RNC and one Node B of two different RNCs are realized through the I_{ur} interface.

11. **What are the functions carried out by I_{ur} interface?**
Basic inter-RNC mobility support, dedicated channel traffic support, Common channel traffic support and Global resource management support.

12. **What is the need for I_{ub} interface?**
The connection between the RNC and Node B is the I_{ub} interface. There is one I_{ub} interface for each Node B. The I_{ub} interface is used for all of the communications between Node B and the RNC of the same RNS.

13. **State the functionality of U_u interface.**
The UMTS U_u interface is the radio interface between a Node B and one of its UE. The U_u is the interface through which UE accesses the fixed part of the system.

14. State the functions of 3G-MSC.

The 3G-MSC is the main CN element to provide CS services. The 3G-MSC also provides the necessary control and corresponding signaling interfaces including SS7, MAP, ISUP (ISDN user part), etc. The 3G MSC provides the interconnection to external networks like PSTN and ISDN.

15. Write about 3G-SGSN.

The 3G-SGSN is the main CN element for PS services. The 3G-SGSN provides the necessary control functionality both toward the UE and the 3G-GGSN. It also provides the appropriate signaling and data interfaces including connection to an IP-based network toward the 3G-GGSN, SS7 toward the HLR/EIR/AUC and TCP/IP or SS7 toward the UTRAN.

16. Draw UMTS core network architecture.
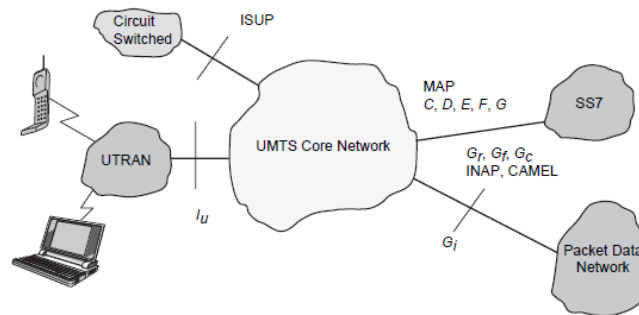
17. List the functions of 3G-GGSN

The GGSN provides interworking with the external PS network. It is connected with SGSN via an IP-based network. The GGSN may optionally support an SS7 interface with the HLR to handle mobile terminated packet sessions.

18. What are the tasks carried out by SMS-GMSC?

Reception of short message packet data unit (PDU), Interrogation of HLR for routing information and Forwarding of the short message PDU to the MSC or SGSN using the routing information.

19. Why do we need Firewall in a network?

This entity is used to protect the service providers' backbone data networks from attack from external packet data networks. The security of the backbone data network can be ensured by applying packet filtering mechanisms based on access control lists or any other methods deemed suitable.

20. Write about DNS.

The DNS server is used, as in any IP network, to translate host names into IP addresses, i.e., logical names are handled instead of raw IP addresses. Also, the DNS server is used to translate the access point name (APN) into the GGSN IP address. It may optionally be used to allow the UE to use logical names instead of physical IP addresses.

21. List out the need for DHCP.

A dynamic host configuration protocol server is used to manage the allocation of IP configuration information by automatically assigning IP addresses to systems configured to use DHCP.

22. State the salient features of HSDPA.

HSDPA is based on the same set of technologies as high data rate (HDR) to improve spectral efficiency for data services — such as shared downlink packet data channel and high peak data rates (8–10 Mbps) — using high-order modulation and adaptive modulation and coding, hybrid ARQ (HARQ) retransmission schemes, fast scheduling and shorter frame sizes. HSDPA also shortens the round-trip time between the network and terminals and reduces variance in downlink transmission delay.

21.What is Transport Network Control Plane (TNCP)?

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

22. 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.

22.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.

23.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.

24. What is SMS-GMSC?

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

25.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.

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

- 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

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

Control plane , User plane, Transport network control plane.

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

- Mobility management
- Call management
- Supplementary services
- Short message services (SMS)
- OAM (operation, administration, and maintenance) agent functionality.

PART B

1. **Explain in detail about UTRAN Logical Architecture with a neat sketch.**
   Refer P.No 508 Vijay Garg, "Wireless Communications and networking", Elsevier 2007
2. **Describe the distribution of UTRAN functions in RNC and Node B.**
   Refer P.No 516 Vijay Garg, "Wireless Communications and networking", Elsevier 2007.
3. **Elaborate on UMTS core network architecture with a neat sketch. (April 2017)**
   Refer P.No 518 Vijay Garg, "Wireless Communications and networking", Elsevier 2007
4. **Explain the UMTS network architecture with GSM,3G and also explain the reference architecture (April 2017)**
   Refer P.No 520 Vijay Garg, "Wireless Communications and networking", Elsevier 2007
5. **Discuss the salient features of HSDPA with respect to physical layer.**
   Refer P.No 530 Vijay Garg, "Wireless Communications and networking", Elsevier 2007
6. **Explain LTE network architecture and associated protocols in detail.**
   Refer P.No 536 Vijay Garg, "Wireless Communications and networking", Elsevier 2007
7. **Explain the functions performed by 3G-SGSN and 3G-GGSN.**
   Refer P.No 520 Vijay Garg, "Wireless Communications and networking", Elsevier 2007
8. **Explain the concepts of UMTS network Qos Service and its management.**
   Refer P.No 526 Vijay Garg, "Wireless Communications and networking", Elsevier 2007

UNIT V 4G NETWORKS
PART A

1. List the key features of 4G networks from the user point of view. (April 2017)
- High usability: anytime, anywhere, and with any technology
- Support for multimedia services at low transmission cost
- Personalization
- Integrated services

2. What is multi carrier modulation? Mention its advantages. (April 2017)

MCM is a baseband process that uses parallel equal bandwidth subchannels to transmit information and is normally implemented with fast Fourier transform (FFT) techniques. MCM's advantages are better performance in the inter-symbol-interference environment, and avoidance of single-frequency interferers.

3.Differentiate between 3G and 4G networks?

3G	4G
Bandwidth used is 5-20 MHz	Bandwidth used is more than 100MHz
Access technologies used are WCDMA and CDMA 2000	OFDM and MC-CDMA technologies are used

4.What is the data rate offered by 4G systems?

4G networks operate with higher data rates of 20-100 Mbps in mobile mode.

5.What are the applications of 4G technology?
- Virtual navigation
- Tele-medicine
- Tele-geo-processing applications

6 .Mention the challenges faced by 4G networks (April 2017)

Limitations in device size

Cost and power consumption,

Backward compatibilities to systems

7. **What are the types of multi carrier modulation?**

The types of multi carrier modulation are multicarrier code division multiple access (MC-CDMA) and orthogonal frequency division multiplexing (OFDM) using time division multiple access (TDMA).

8. Explain the concept of Multiple Input Multiple Output (MIMO)?

Smart antenna techniques, such as multiple-input multiple-output (MIMO) systems, can extend the capabilities of the 3G and 4G systems to provide customers with increased data throughput for mobile high-speed data applications. MIMO systems use multiple antennas at both the transmitter and receiver to increase the capacity of the wireless channel

9. Give the capacity equation for Single Input Single output (SISO) system.

The channel bandwidth is B, the transmitter power is P_t, the signal at the receiver has an average signal-to-noise ratio of SNR_0, then the Shannon limit on channel capacity C is

$$C = B \log_2(1+SNR_0)$$

10. Explain briefly the concept of MIMO-OFDM systems in detail.

OFDM and MIMO techniques can be combined to achieve high spectral efficiency and increased throughput. The OFDM-MIMO system transmits independent OFDM modulated data from multiple antennas simultaneously. At the receiver, after OFDM demodulation, MIMO decodes each sub channel to extract data from all transmit antennas on all the sub channels.

11. Explain briefly the concept of Bell Lab Layered Space Time (BLAST) architecture.

BLAST is a space division multiplexing (SDM)-based MIMO system. It provides the best trade-off between system performance (spectral efficiency and capacity) and system implementation complexity. The spectral efficiency of BLAST ranges from 20 to 40 bps/Hz. It uses a zero-forcing (ZF) nonlinear detection algorithm based on a spatial nulling process combined with symbol cancellation to improve system performance. The BLAST exploits multipath by using scattering characteristics of the propagation environment to enhance transmission accuracy.

12. How efficient packet data transmission can be achieved in 4G networks?

Efficient packet data transmission can be achieved by using a suitable automatic repeat request (ARQ) scheme combined with an adaptive modulation and coding system, and a time-slot scheduler that uses channel predictions.

13. What is Software Defined Radio (SDR)?

A software-defined radio (SDR) system is a radio communication system which uses significant amounts of signal processing in a general purpose computer, or a reconfigurable piece of digital electronics.

14. List out the features of 4G networks?
- Fully converged services
- Software independency
- Diverse user devices
- Autonomous networks
  - **Mention the hardware components of Software Defined Radio?**

The hardware of a software-defined radio typically consists of a super heterodyne RF front end which converts RF signals from and to analog RF signals, and analog to digital converters and digital to analog converters which are used to convert digitized intermediate frequency (IF) signals from and to analog form respectively.

15. Sketch the block diagram of MIMO system.
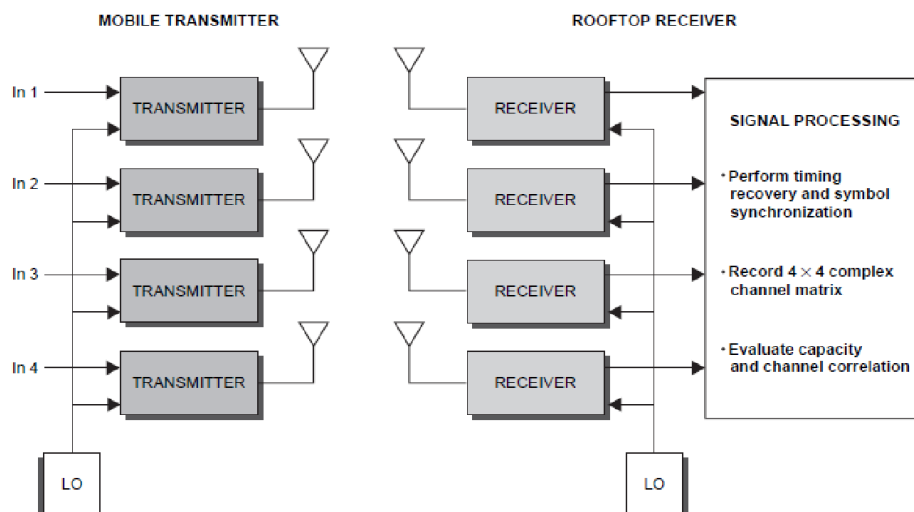
16. Sketch the architecture of BLAST system.
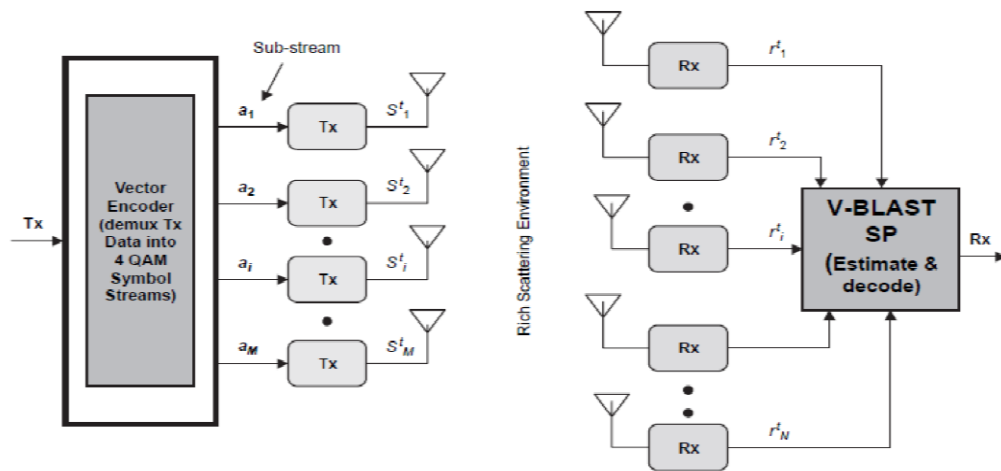
17. List out the various advantages of SDR technology.
- Software-defined radios can be quickly and easily upgraded with enhanced features. In fact, the upgrade could be delivered over-the-air.
- Software-defined radios can talk and listen to multiple channels at the same time.

18. What is Cognitive Radio? Mention any one application.
The CR can be viewed as an enabling technology that will benefit several types of users by introducing new communications and networking models for the whole wireless world, creating better business opportunities for the incumbent operators and new technical dimensions for smaller operators, and helping shape an overall more efficient approach regarding spectrum requirements and usage in the next generation wireless networks.
Application: Spectrum Sensing

19. Explain services provided by 4G?
4G systems will provide not only telecommunications services, but also data and multimedia services. To support multimedia services, high-data-rate services with system reliability will be provided. Personalized service will be provided by 4G networks. It is expected that when 4G services are launched, users in widely different locations, occupations, and economic classes will use the services.

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

22.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.

23.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.

24.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.

25.What are the benefits of Smart Antenna Technology?
a. Reduction in Co – Channel Interference
b. Range Improvement
c. Increase in Capacity
d. Reduction in Transmitted Power
e. Reduction in Handoff

PART B

1. **Explain motivation behind the evolution of 4G technology in detail.**
   Refer P.No A-23.3 Vijay Garg, "Wireless Communications and networking", Elsevier 2007
2. **Explain the key challenges faced by 4G networks and also propose solutions of how to mitigate those challenges.**
   Refer P.No A-23.5 Vijay Garg, "Wireless Communications and networking", Elsevier 2007
3. **Explain the concept of Multi carrier modulation (MCM) in detail.**
   Refer P.No A-23.7 Vijay Garg, "Wireless Communications and networking", Elsevier 2007
4. **Write your understanding on behaviour of smart antenna techniques (April 2017)**
   Refer P.No A-23.10 Vijay Garg, "Wireless Communications and networking", Elsevier 2007
5. **Explain in detail about Adaptive modulation and Coding with time slot scheduler in detail(April 2017)**

Refer P.No A-23.14 Vijay Garg, "Wireless Communications and networking", Elsevier 2007

6. **With a neat block diagram explain the concept of BLAST architecture in detail.**
   Refer P.No A-23.15 Vijay Garg, "Wireless Communications and networking", Elsevier 2007

7. **Explain in detail about Software Defined Radio (SDR).**
   Refer P.No A-23.18 Vijay Garg, "Wireless Communications and networking", Elsevier 2007

8. **Explain the concept of Cognitive Radio and enumerate in detail its role in field of spectrum sensing by highlighting its bottlenecks.**
   Refer P.No A-23.20 Vijay Garg, "Wireless Communications and networking", Elsevier 2007

B.E/B.TECH DEGREE EXAMINATION,APRIL/MAY 2017
Electronics and communication engineering
EC6802-WIRELESS NETWORKS
(Regulation-2013)
Answer All Questions
PART A

1. State significance of radio transmission over infra-red ?

	Radio transmission	**Infrared**
(i) Coverage range	Upto 50m for LOS	Upto 10m
(ii) Data rate	100kbps	500bps-1kbps
(iii) Power consumption	5-20 mW during ON state	20-150 mW during ON state

2.OFDM uses the set of orthogonal sub carriers for transmission of data OFDM used in wireless LAN consider OFDM system that uses 52 subcarriers out of which 48 are pilot sub carriers system bandwidth is 20mega hertz OFDM symbol duration including cycle to fixed is 4microsecs code rate is ¾ and 64 QAM is used find data rate ?

$$\text{Data rate} = \frac{\text{No of} \frac{bits}{symbol} \text{for the carrier}}{\text{OFDM symbol duration}};$$

For 64-QAM Bits Per symbol =6
with ¾ code rate, No of bits / subcarrier=6*3/4=4.5
Total No. of bits for 48 sub carriers = 4.5 * 48 = 216 bits/symbol;
Data rate = 216/4μs = 54Mbps.

3.What is the care of address in the mobile IP ?
   Encapsulation is the mechanism of taking a packet consisting of packet header and data 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 de-capsulation.

4.What is encapsulation in mobile IP ?
   Care-of address (COA): The COA 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 IP address of the MN. Packet delivery toward the MN is done using a tunnel. To be more precise, the COA marks the tunnel endpoint, i.e., the address where packets exit the tunnel.

5.List out th disadvantages of indirect TCP?
   It does not maintain the semantics of TCP as the FH gets the acknowledgement before the packet is delivered at MH.I TCP does not maintain the end –end semantic of TCP and assumes that application layer would ensure reliability

6.Mention the advantage of mobile TCP?
   M-TCP (mobile TCP) M-TCP splits the TCP connection into two parts as I-TCP does. An unmodified TCP is used on the standard host-supervisory host (SH) connection, while an optimized TCP is used on the SH-MH connection. The supervisory host is responsible for exchanging data between both parts similar to the proxy in ITCP .The advantages of M-TCP are the following: It maintains the TCP end-to-end semantics. If the MH is disconnected, it avoids useless retransmissions, slow starts or breaking connections by simply shrinking the sender's window to 0. Since it does not buffer data in the SH as I-TCP does, it is not necessary to forward buffers to a new SH

7.What is the purpose of firewall used in UMTS network ?
   All traffic coming in and going out of the private network is handled by the firewall. The firewall ensures that only authenticated traffic is allowed to pass through it.

8.Name the 3G ratio access schemes identify to support different scenario ?

1.Enhanced data rates for GSM evolution (EDGE) with high-level modulation in a 200 kHz TDMA channel is based on plug-in transceiver equipment, thereby allowing the migration of existing bands in small spectrum segments.

2. 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.

9.Mention the features challenges of 4G ?

- High usability: anytime, anywhere, and with any technology
- Support for multimedia services at low transmission cost
- Personalization
- Integrated services
- Limitations in device size
- Cost and power consumption,
- Backward compatibilities to systems

10.Define Multicarrier modulation ?

MCM is a baseband process that uses parallel equal bandwidth subchannels to transmit information and is normally implemented with fast Fourier transform (FFT) techniques. MCM's advantages are better performance in the inter-symbol-interference environment, and avoidance of single-frequency interferers.

PART –B

11 (a) **Explain and compare the medium access mechanism of DCF methods adopted in IEEE 802.11 WLAN ?**

Refer P.No.214, "Mobile Communications", by Jochen Schiller Second Edition, Pearson Education 2012

OR

(b) **Describe uses scenario architecture protocol stack of Bluetooth technology ?**

Refer P.No.269, "Mobile Communications", by Jochen Schiller Second Edition, Pearson Education 2012

12 (a) **State the entities and terminology used in mobile IP along with tunneling and also explain the encapsulation in mobile IP ?**

Refer P.No.328, "Mobile Communications", by Jochen Schiller Second Edition, Pearson Education 2012

OR

(b) **Explain and compare the working mechanism of both destination Sequence distance vector and dynamic source routing protocol Wen applied on mobile adhoc network scenario?**

Refer P.No.315, "Mobile Communications", by Jochen Schiller Second Edition, Pearson Education 2012

13 (a) **Describe the working mechanism of traditional TCP ?**

Refer P.No.322, "Mobile Communications", by Jochen Schiller Second Edition, Pearson Education 2012

OR

(b) **Write your understanding of indirect TCP ,snooping TCP ,MOBILE TCP and transaction oriented TCP?**

Refer P.No.355, "Mobile Communications", by Jochen Schiller Second Edition,Pearson Education 2012

14 (a) **Explain UMTS architecture with GSM ,3G,and also explain reference architecture?**

Refer P.No 520 Vijay Garg, "Wireless Communications and networking",

Elsevier 2007

<div align="center">OR</div>

(b)   Explain UMTS core network architecture ?
Refer P.No 518 Vijay Garg, "Wireless Communications and networking",
Elsevier 2007

15   (a)   write your understanding behavior of smart antenna technologies ?
Refer P.No A-23.10 Vijay Garg, "Wireless Communications and networking",
Elsevier 2007

<div align="center">OR</div>

(b)   Explain adaptive modulation and coding with timing slots scheduler with cognitive radio concept ?

Refer P.No A-23.14 Vijay Garg, "Wireless Communications and networking",
Elsevier 2007