15127/T1353 B.E.(INFORMATION TECHNOLOGY)(SEM VII) (CBSGS) WIRELESS TECHNOLOGY

QP CODE : 814500

3 Hours

[80 marks]

Note: 1. Question number 1 is compulsory.
2. Solve any three questions out of the remaining five questions
3. Assume suitable data if necessary
4. Figure indicate marks

Q1. A. A mobile communication system is allocated RF spectrum of 25 MHz and uses RF channel bandwidth of 25 KHz so that total number of 1000 voice channels can be supported in the system. [10]

a) If the service area is divided into 20 cells with a frequency reuse factor of 4, compute the system capacity.

b) The cell size is reduced to the extent that the service area is now covered with 100 cells. Compute the system while keeping the frequency reuse factor as 4.

c) Consider the cell size is further reduced to that the service area is now covered with 700 cells with the frequency reuse factor of 7. Compute the system capacity.

B. Explain in detail EDGE Network Architecture with neat diagram. [10]

Q2. A. Explain in detail GPRS Architecture with neat diagram. [10]

B. Explain in detail CDMA Architecture with neat diagram. [10]

Q3. A. Give in detail comparison between WiMax and LTE/3GPP. [10]

B. Explain in detail Bluetooth Protocol Stack with neat diagram. [10]

Q4. A. Neatly explain the WLL Architecture. Explain the two local loop techniques with diagram [10]

B. Explain in detail GSM Privacy and Authentication with neat diagram. [10]

Q5. A. Explain the main factors of change in economics of wireless technology. [10]

B. Explain the Wired Equivalent Privacy Protocol. Also explain WEP security based on the access control list with neat diagram. [10]

Q6. Write short notes: [20]

a. Compare CDMA 2000 & W-CDMA
b. Mobile IP.
c. IEEE 802.11 standards.
d. Wireless Sensor Network.

Scanned by CamScanner

Total Marks of Question no.		Examiner	Subject: WIRELESS TECHNOLOGY (B.E-IT Sem 7)
		Moderator	Solution of may 2017 (KT)
		ReAssessor	Prepared by :- Prof Indu Anoop

Space for Marks	Question No.	START WRITING HERE

Q1 A) A mobile communication system is allocated RF spectrum of 25MHz and uses RF channel bandwidth of 25 KHz so that total number of 1000 voice channels can be supported in the system

a) If the service area is divided into 20 cells with a frequency reuse factor of 4, compute the system capacity

b) The cell size is reduced to the extent that the service area is now covered with 100 cells. Compute the system while keeping the frequency reuse factor as 4.

c) Consider the cell size is further reduced to that the service area is now covered with 700 cells with the frequency reuse factor of 7. Compute the system capacity.

Solution :-

a) Total no. of clusters = 20/4 = 5 clusters

Each cluster is given 1000 voice channels

Total capacity of system = 1000 x 5 = 5000

b) Total cluster = 100/4 = 25

Each cluster is given 1000 voice channels

∴ Total system capacity = 1000 x 25

= 25,000.

c) Total no. of clusters = 700/7

= 100 clusters

Scanned by CamScanner

Marks of
stion no.

Moderator

ReAssessor

START WRITING HERE

e for rks | Question No.

Each cluster is given 1000 voice channels

∴ Total System Capacity = 100×1000
= 100000 channels

Q15) Explain in detail EDGE Network Architecture with neat diagram

EDGE stands for Enhanced Data Rates for GSM Evolution. It is another evolutionary step of the GSM technology. It can easily handle data subscribers three times more than that in GPRS. The implementation of EDGE is cost effective. It only requires the deployment of EDGE capable transceivers and software.

EDGE introduces an advanced coding scheme in which each time slot is able to transmit more data. An important feature of EDGE is that it requires no additional spectrum and improves the data bit rates of GSM/GPRS

The elements needed for the EDGE network architecture

i) GGSN (Gateway GPRS Support Node)
It acts as a gateway to the world outside the network. GGSN is the most important element of the EDGE network architecture.

Scanned by CamScanner

Examiner
Moderator
ReAssessor

START WRITING HERE

Question No.

It manages the working between EDGE network and external packet switched networks to which mobile devices are connected. A gateway, router and firewall combined together form a GGSN as it hides the internal network from the outside world. When data for a specific user is received by the GGSN. It first verifies whether the user is active or not and only then it forwards the data.

In reverse direction, packet data received from the mobile device is routed to a valid destination network by the GGSN.

ii) SGSN: (Serving GPRS Support Node)

It acts as a gateway to the services that are found within the network. SGSN focusses on IP elements of the system. It offers different services such as packet routing and transmission, authentication, logical link management, mobility management and data charging, to mobiles. SGSN has a location register, which maintains location information such as current cell and VLR. It also contains information related to user profiles such as packet addresses used. Such information is maintained for all the GPRS users who are registered with a specific SGSN

iii) PCU (Packet Control Unit)

It determines whether the data has to be routed to the circuit switched networks or packet switched

Scanned by CamScanner

Total Marks of Question no.		Examiner	
		Moderator	
		ReAssessor	

START WRITING HERE

Space for Marks	Question No.

networks. PCU refers to a hardware router added with a BSC. It decides and differentiates the data to be sent to the GSM network (circuit switched data) and data to be sent to the EDGE network (packet switched data). PCU can be a separate physical element, or it can be included with a BSC to save additional costs.

To Public Networks . . .

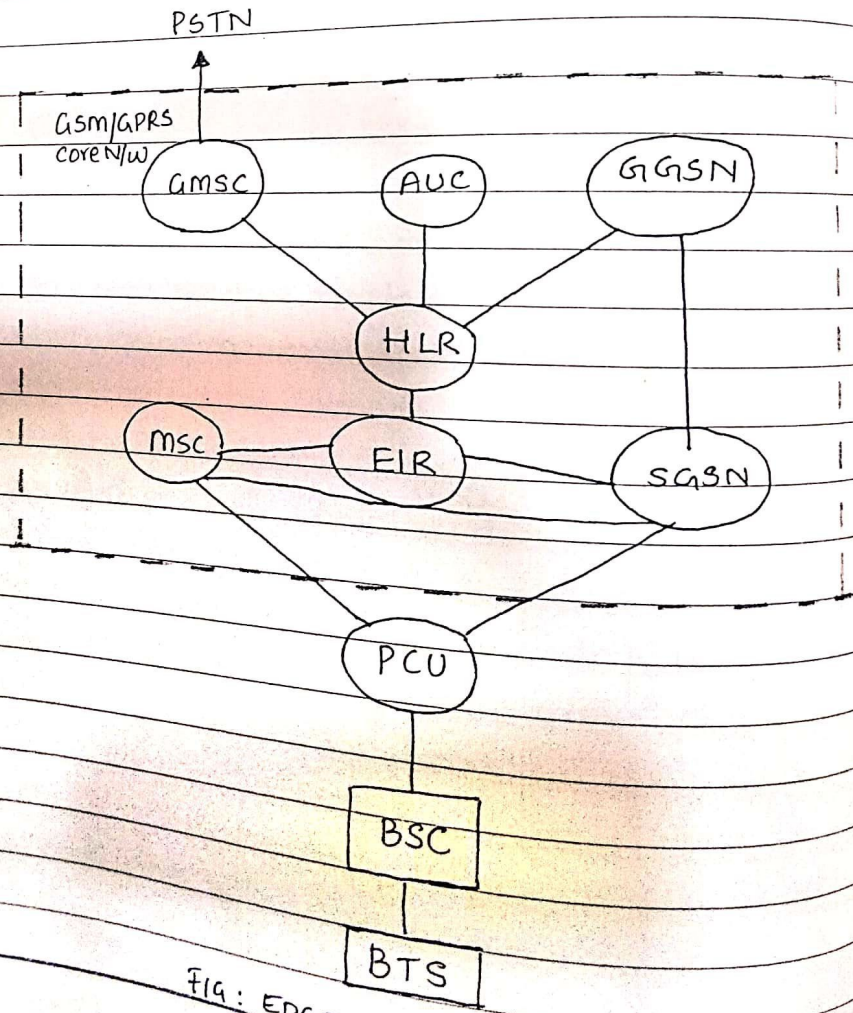


Fig: EDGE Network Architecture

Scanned by CamScanner

Examiner
Moderator
ReAssessor

Question No.

START WRITING HERE

HLR :- Home Location Register - database that contains subscriber information

GMSC :- Gateway Mobile Switching Centre

BSC :- Base Station Controller

SGSN : Serving GPRS Support Node

GGSN : Gateway GPRS Support Node

Q2 (A) Explain in detail GPRS Architecture with neat diagram.

GPRS stands for General Packet Radio Service. It is a fully packet-oriented, flexible and powerful data transmission technique. This technique is used to provide packet mode data transfer for applications in which some specific traffic patterns such as frequent transmission of small volumes of data or infrequent transmission of small and medium volumes of data are exhibited as per the specified requirements.

GPRS Support Nodes

Following two new components are added :

a) Gateway GPRS Support Node (GGSN)
It acts as an interface and a router to external networks. It contains routing information for GPRS mobiles which is used to tunnel packets through the IP based internal backbone to the correct serving GPRS Support Node

Scanned by CamScanner

Total Marks of Question no.		Examiner	
		Moderator	
		ReAssessor	

START WRITING HERE

Space for Marks	Question No.

b) Serving GPRS Support Node (SGSN)

It is responsible for authentication of GPRS mobiles, registration of mobiles in networks, mobility management and collecting information on charging for use of the air interface.

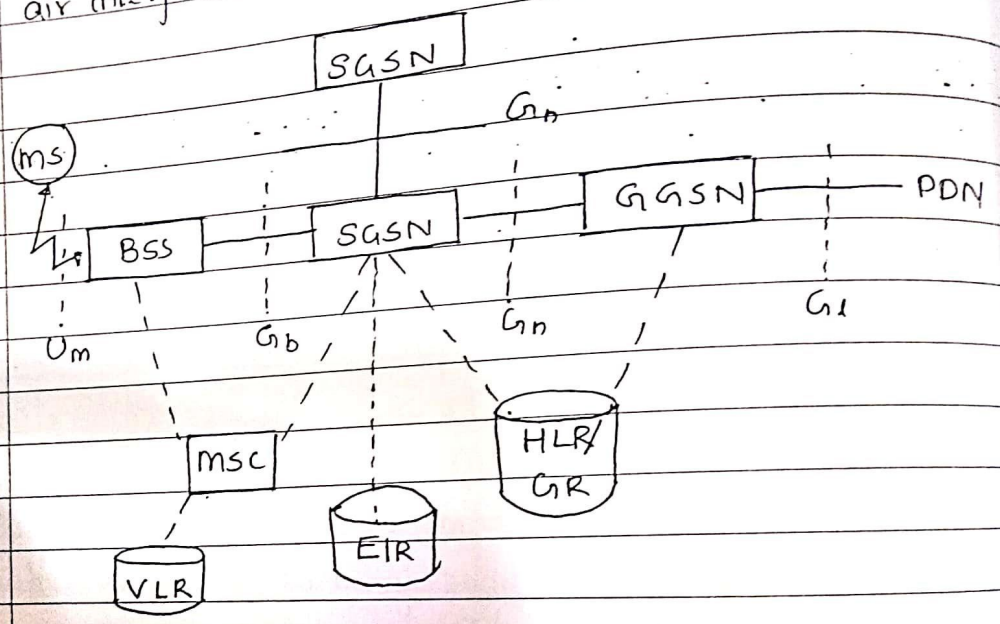


Figure :- GPRS Architecture.

* SGSN uses the Gb interface to provide support to the mobile station.
* GGSN and SGSN in GPRS Networks is similar to the role played by home agents and foreign agents respectively
* All data relevant to GPRS is stored in the GR; a part HLR
* Every mobile station has a GPRS context which is setup and stored in the corresponding SGSNs.

Scanned by CamScanner

The context Includes

- → Status of mobile station (ready, idle, standby)
- → A CKSN (Ciphering Key Sequence Number)
- → A flag to determine whether compression is used

The transmission Plane Protocol Architecture is shown as :-

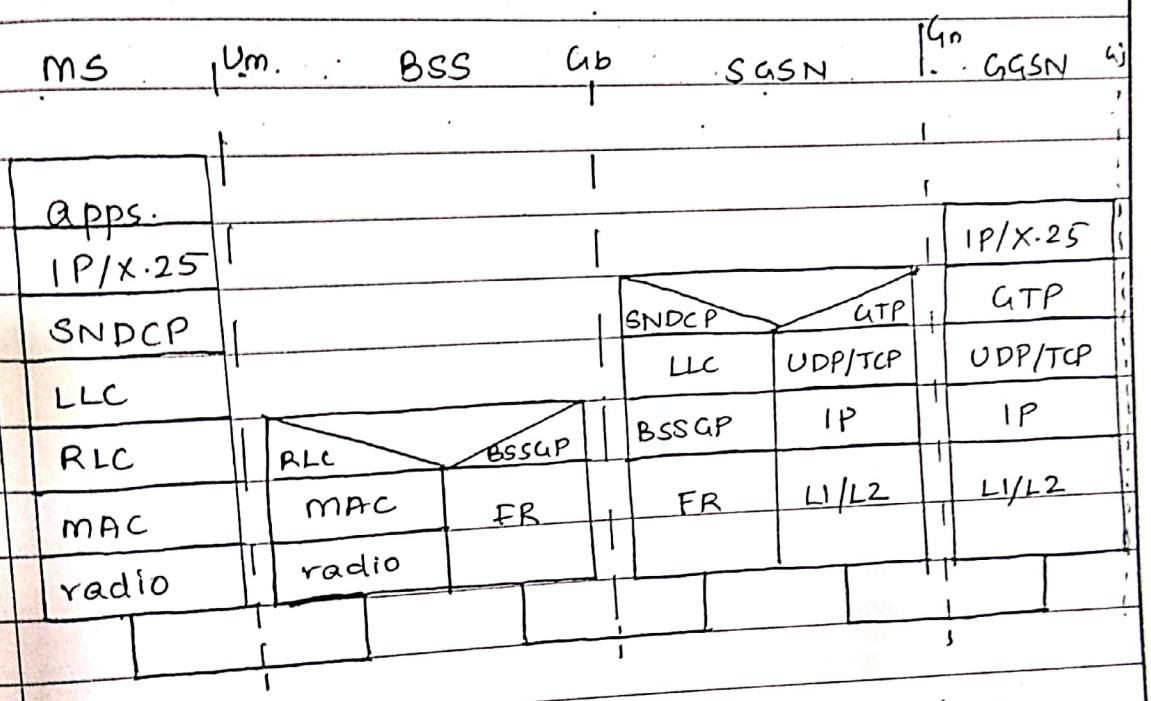


Fig :- Transmission Plane Protocol Architecture.

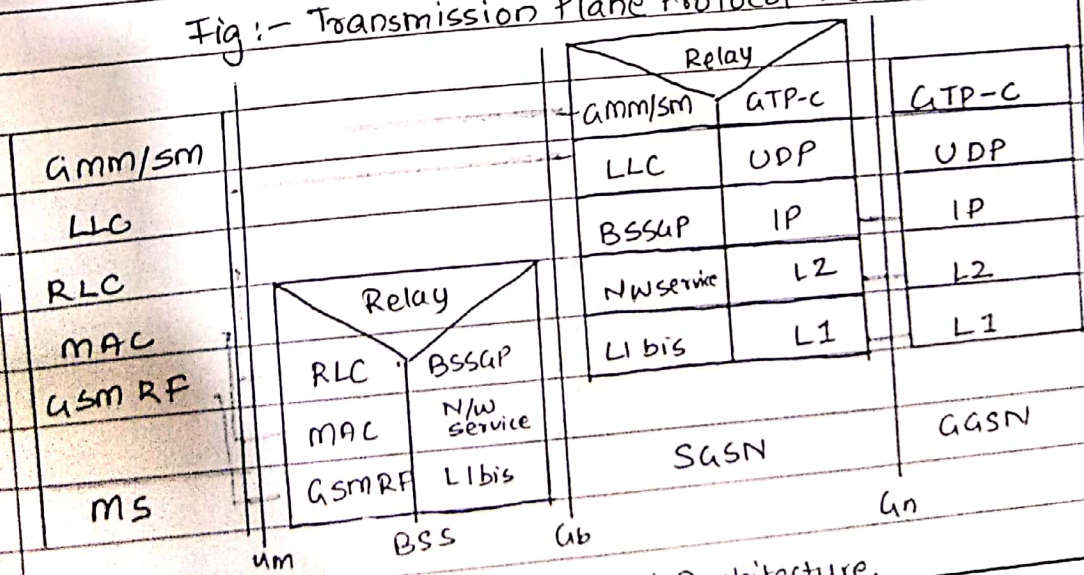


Fig :- Signaling Plane Protocol Architecture.

Scanned by CamScanner

Total Marks of Question no.		Examiner	
		Moderator	
		ReAssessor	

START WRITING HERE

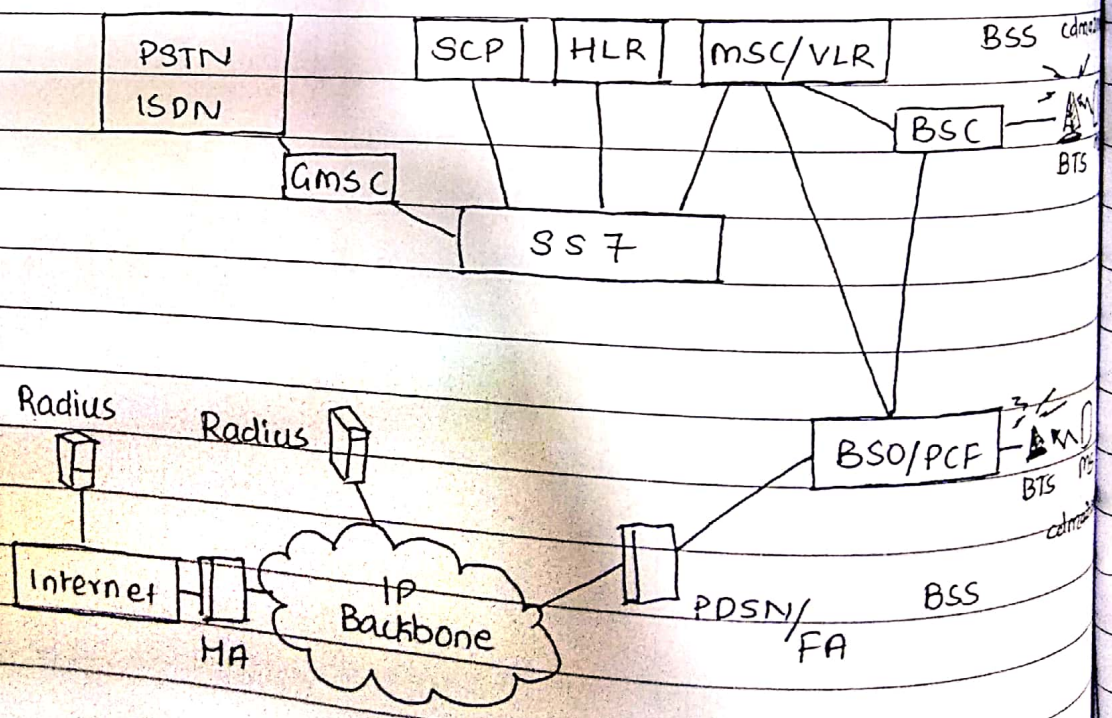
Space for Marks	Question No.	
	Q2 (B)	Explain in detail CDMA Architecture with neat Diagram.

CDMA stands for Collission Detection Multipe Access. It refers to a method of accessing a channel and is used by different radio communication technologies.

In CDMA, multiple transmitters are able to transmit information at the same time using a single communication channel. This enables mobile users to share the same band of frequencies. It uses spread spectrum technology.

It is used as a channel access method in mobile standards such as cdma One, CDMA 2000 and W-CDMA

ARCHITECTURE OF CDMA



Scanned by CamScanner

Moderator
Reassessor

START WRITING HERE

Components

a) MS :- Refers to the mobile subscriber equipment that can initiate and receive calls, and it can also interact with the BTS

b) BTS :- Transfers and receives radio signals and enables communication between the radio system and MS

c) BSC :- Implements the following functions
- Controlling and managing BTS
- Connecting and disconnecting calls
- Managing mobility
- Providing reliable radio link facility for the upper layer services by soft/hard handoff
- Controlling power
- Managing Radio Resource.

d) PCF (Packet Control Function): Implements the R-P connection management. As there is a shortage of radio resources, few radio channels should be released if subscribers do not send or receive data. The PCF can use handoff to guard radio mobility for the upper layer services.

e) Packet Data Service Node (PDSN): Implements the switching of packet data services for mobile users. A single PDSN is connected to multiple PCFs. It offers an interface between radio network and packet data network

f) Home Agent (HA): Identifies the location where the Mobile Node (MN) opens it's account and obtains the registration information thus obtained

Scanned by CamScanner

Total Marks of Question no.		Examiner	
		Moderator	
		ReAssessor	

START WRITING HERE

Space for Marks	Question No.	

from the MN, configures the tunnel between FA and HA and then transmits the data to the MN through the tunnel

g) MSC : Implements the functionality of service switching between the calling and called subscribers. A single MSC is connected with multiple BSCs. It can also be connected to the PSTN, ISDN or other MSCs. It offers the interface between radio N/w and PSTN

h) VLR :- Refers to a dynamic database that maintains the short-term information of the roaming subscribers in the local MSC area. It is used to maintain the information related to the subscribers in the local MSC area. It is used to maintain the information related to the subscribers of all the MSs in it's local area. This information can help in establishing incoming and outg.

Type of channels

IS-95 is used for operations related to reverse links within the frequency band of 824-849 MHz and forward link having frequency band of 869-894 MHz. To separate the forward and reverse channel pair, a frequency of 45 MHz is used.

FORWARD CDMA Channel

The forward CDMA channel contains the following channels. (Cell to mobile direction - downlink path)

Scanned by CamScanner

Examiner
Moderator
ReAssessor

START WRITING HERE

* Pilot Channel : Allows an MS to obtain timing needed for forward CDMA channel. It facilitates each mobile to make comparisons between signal strengths arising from the BSs to ascertain when to handoff

* Synchronization Channel : Helps in broadcasting messages to MSs relating synchronization and works at 1200bps

* 7 Paging channels :- Help in transmitting paging messages from BSs to mobiles and work at 9600, 4800 and 2400bps

* 63 Forward Traffic Channels :- Support variable user data rates at 14400, 7200, 3600 or 1800bps.

Reverse CDMA Channel.

* BS receives signal using different propagation path. User data stream is encoder using a rate that is equal to 1/3 code. Once interleaving is performed every single block containing six encoded symbols is mapped to one of the 64 orthogonal walsh functions

* User data is sent at data rate of 13,200, 9600, 4800, 2400 or 1200 bps on reverse channel.

* It is mobile-to cell communication or uplink path.

Scanned by CamScanner

Total Marks of Question no.		Examiner	
		Moderator	
		ReAssessor	

START WRITING HERE

Space for Marks	Question No.	
	Q3(A)	Give a detailed comparison between WiMax and LTE/3GPP.

WiMax : It is a technology defined by IEEE which offers a set of standards for metropolitan area data access called Wireless MAN standards.

LTE : It is a telecommunication technology defined by 3GPP. LTE-Advanced refers to an advanced version of LTE which is based on 3GPP UMTS Release 10.

Characteristic	3GPP/LTE	WiMax (IEEE802.16)
a) All IP vs Circuit Switched	Started Circuit switched, moved to half IP (2.5/3G) and finally all IP (LTE)	All IP from Beginning
b) Architecture	Centric Architecture gradually moving to flat Architecture	Flat architecture from beginning
c) Mobility	High Mobility from beginning	Started as fixed Wireless, moved quickly to mobile Wimax.
d) Voice versus Data	Started voice centric gradually moved to datacentric	Started as datacentric gradually to serving voice

Scanned by CamScanner

Examiner
Moderator
ReAssessor

START WRITING HERE

Characteristic	3GPP/LTE	Wimax (IEEE 802.16)
e) Mode of operation	FDD is the main mode with increased interest in TDD recently	TDD mode mainly
f) Access Technology	Different access technologies like TDM/FDM and spread spectrum before heading to OFDMA in LTE	OFDMA was considered at early stages by IEEE 802.16 standards
g) Spectrum	Lower licensed bands	Higher licensed and unlicensed bands
h) Target	Targeted wide coverage and ubiquitous service	Targetted spotty dedicated coverage. Failed to provide ubiquitous coverage later on

Further Differences between Wimax and LTE are as follows

i) Wimax utilizes channel bandwidth up to 40MHz, whereas LTE-A utilizes channels bandwidth from 1.4MHz to 100MHz

ii) Wimax utilizes the same modulation technology for both uplink and downlink that is SOFDMA while LTE

Scanned by CamScanner

Total Marks of Question no.		Examiner	
		Moderator	
		ReAssessor	

START WRITING HERE

Space for Marks	Question No.	

utilizes different modulation techniques for uplink and downlink ie, SC-FDMA for uplink and OFDMA for downlink

iii) Wimax Frame duration is 5ms, LTE is 10ms

iv) Wimax can manage speed of 120 km/h or 75mph & LTE-A can manage speed of upto 450km/hr or 280

v) Wimax N/w fails to support legacy systems such as 2G and 3G technologies, whereas LTE is compliant with these technologies and provides co-existence and roaming between LTE and 3G

vi) The cost involved to build Wimax N/w is much lower than cost to build LTE N/w

Benefits of LTE over Wimax :

i) LTE is compliant with different technologies such as GSM, UMTS, CDMA-one, CDMA-2000, GPRS, EDGE, WCDMA, EV-DO, HSPA, EV-DV and SC-CDMA

ii) LTE provides high speed such as 450km/hr or 250mph for mobile users

iii) LTE-A is the only real 4G technology

iv) LTE uses SC-FDMA as modulation technology for uplink. This technology saves battery life of mobile terminals

Benefits of Wimax over LTE :

i) The cost involved in deploying Wimax network

Scanned by CamScanner

Examiner
Moderator
ReAssessor

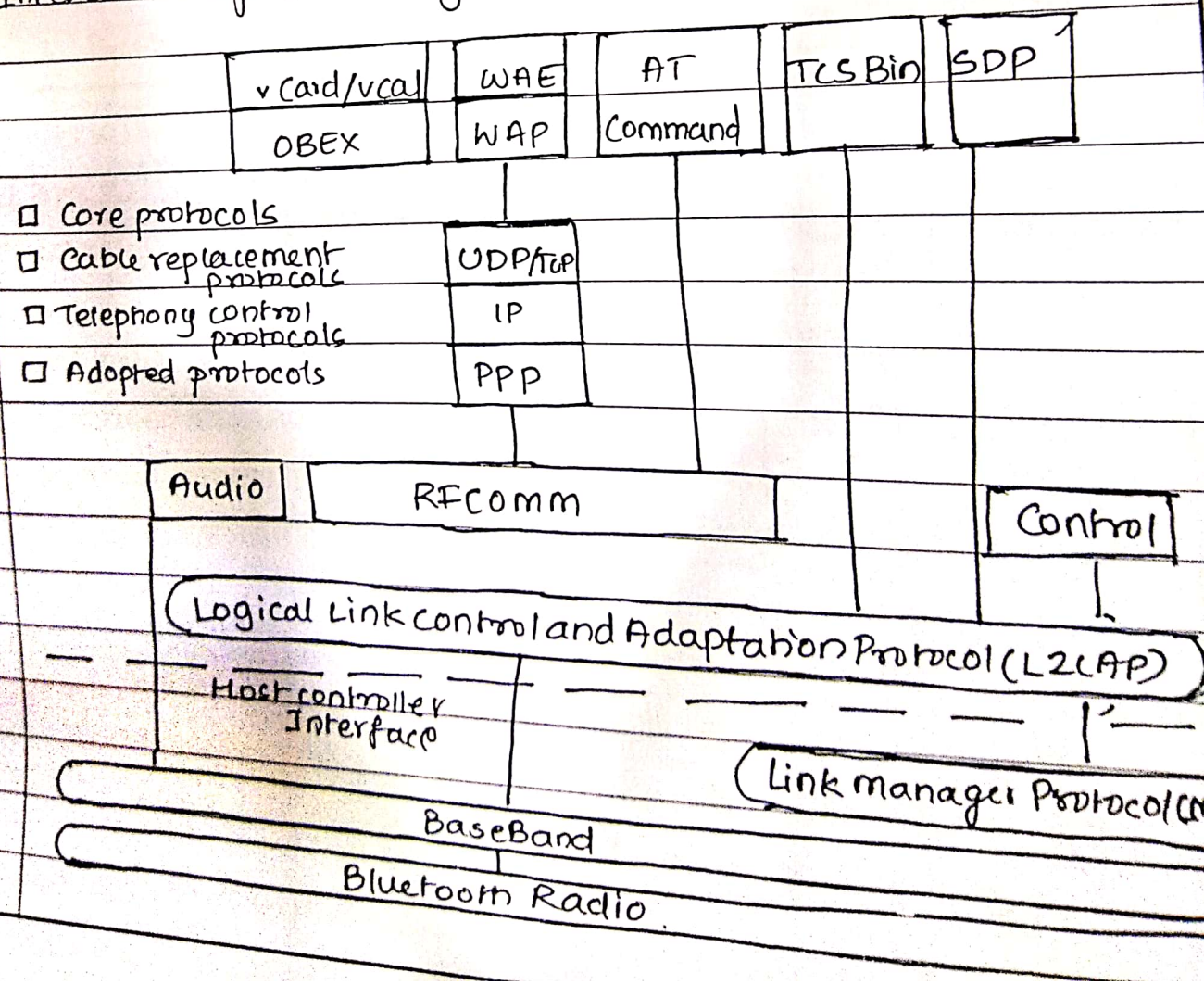
START WRITING HERE

is considered to be much cheaper than the deployment of LTE Network.

ii) WiMax is best for private mobile broadband wireless networks

(b) Explain in detail Bluetooth Protocol Stack with neat diagram.

With the help of Bluetooth protocol stack, devices are able to locate, connect and exchange data with each other and are easily able to use interoperable applications. The Bluetooth Protocol stack was developed by Bluetooth Special Interest Group (SIG) organization.



Scanned by CamScanner

Total Marks of Question no.		Examiner	
		Moderator	
		ReAssessor	

START WRITING HERE

Space for Marks	Question No.

The protocol and layers used in Bluetooth protocol stack

Sr No	Bluetooth	Member Protocol
1	Bluetooth Core Protocols	i) BaseBand (BB) ii) Link manager Protocol (LMP) iii) Logical Link control & Adaptation Layer (L2CAP) iv) Service Discovery Protocol (SDP)
2.	Cable Replacement Protocol	i) Radio Frequency Communication (RFCOMM)
3.	Telephony control Protocols	i) Telephony Control Specification Binary (TCS BIN) ii) Attention Sequence (AT)
4.	Adopted Protocols	i) Point to Point Protocol (PPP) ii) User Datagram Protocol (UDP) iii) Transmit control Protocol (TCP) iv) Internet Protocol (IP) v) Object Exchange Protocol (OBEX) vi) Wireless Application Protocol (WAP) vii) vCard viii) vCalendar ix) Wireless Application Environment (WAE)

Scanned by CamScanner

START WRITING HERE

1) Bluetooth core :- All Bluetooth devices must have this layer. It consists of following Protocols

I BASEBAND (BB)

* BB and LLC creates a physical radio frequency link between Bluetooth devices thereby creating a piconet.
* Layer handles power level operations.
* Facilities two physical links - Synchronous Connection Oriented and Asynchronous connectionless.
* Operations - CRC Encryption, ARQ etc.

II LOGICAL LINK CONTROL & ADAPTATION LAYER (L2CAP)

* Segmentation and Reassembly - SAR of Large Data Packets
* Provides services like protocol multiplexing connection oriented and connectionless data services etc to upper layers
* Service Discovery Protocol (SDP)
  - Information regarding devices are queried
  - helps in connection between multiple bluetooth devices.

2) Cable Replacement Protocols - Call control in bluetooth devices

I * Radio Frequency communication (RFcomm) - It is an emulation protocol which is based on ETSI 07.10 specification. It emulates RS-232 control and provides transport capabilities to upper level services.

Scanned by CamScanner

Total Marks of Question no.		Examiner	
		Moderator	
		ReAssessor	

START WRITING HERE

Space for Marks	Question No.

3) Telephony control protocols.

I Telephony Control Specification Binary (TCS BIN)
- configuration of speech and data calls
- manages mobility to handle TCS devices and AT commands

II Attention Sequence (AT) - TCS BIN defines AT commands to control mobile phone or modem

4) ADOPTED PROTOCOLS LAYER : This layer is reused for different purposes and contains following protocols

I Point to Point Protocol (PPP)
* IP packets are sent or received

II Internet Protocol (IP)
* Distinct IP address is given to each device

III Object Exchange Protocol (OBEX) :- It is a session protocol developed by IrDA to exchange objects. A client-server model is used by OBEX and helps in reliable data transfer. OBEX offers a model to represent objects & operations.

IV Wireless Application Protocol (WAP) :- It is used in Bluetooth to create application gateways. These gateways act as intermediary between WAP servers and other PC applications. WAP helps in facilitating remote control

Scanned by CamScanner

Moderator
ReAssessor

START WRITING HERE

and data retrieval functions from PC to handset. WAP is used to reuse the upper layer software application

V vcard and vcalendar :- They are specifications created by versit consortium and managed by Internet mail consortium. These assist in defining formats for electronic Business card and calendar which helps in exchange of personal information

VI Wireless Application Environment (WAE) :- It follows the web content delivery model. All WAP applications reside within WAE

Q4(A) Neatly explain the WLL Architecture. Explain the two local loop techniques with diagram.

WLL System Architecture.

WLL (Wireless Local Loop) is a new communication access method that uses radio waves for transmission of information between customers and service provider sites, rather than traditional fixed methods such as copper or fiber optic.

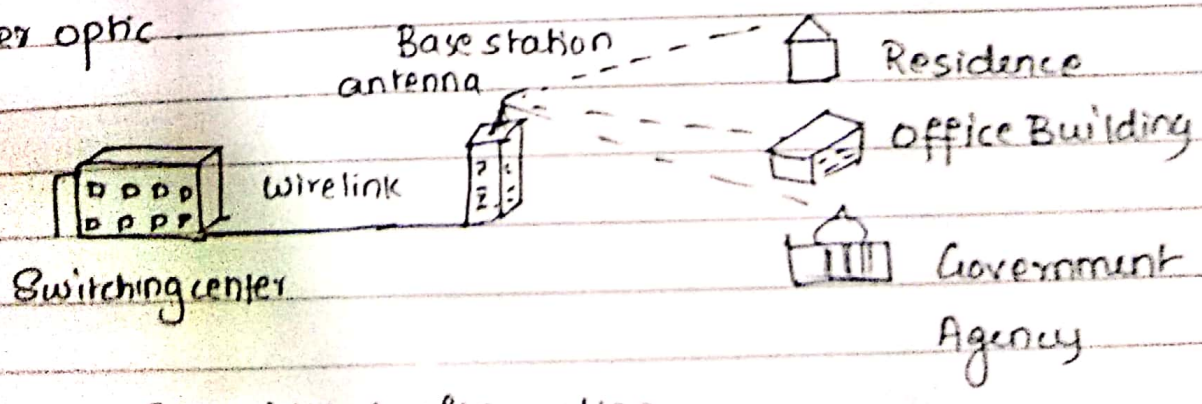


Fig:- WLL configuration

Scanned by CamScanner

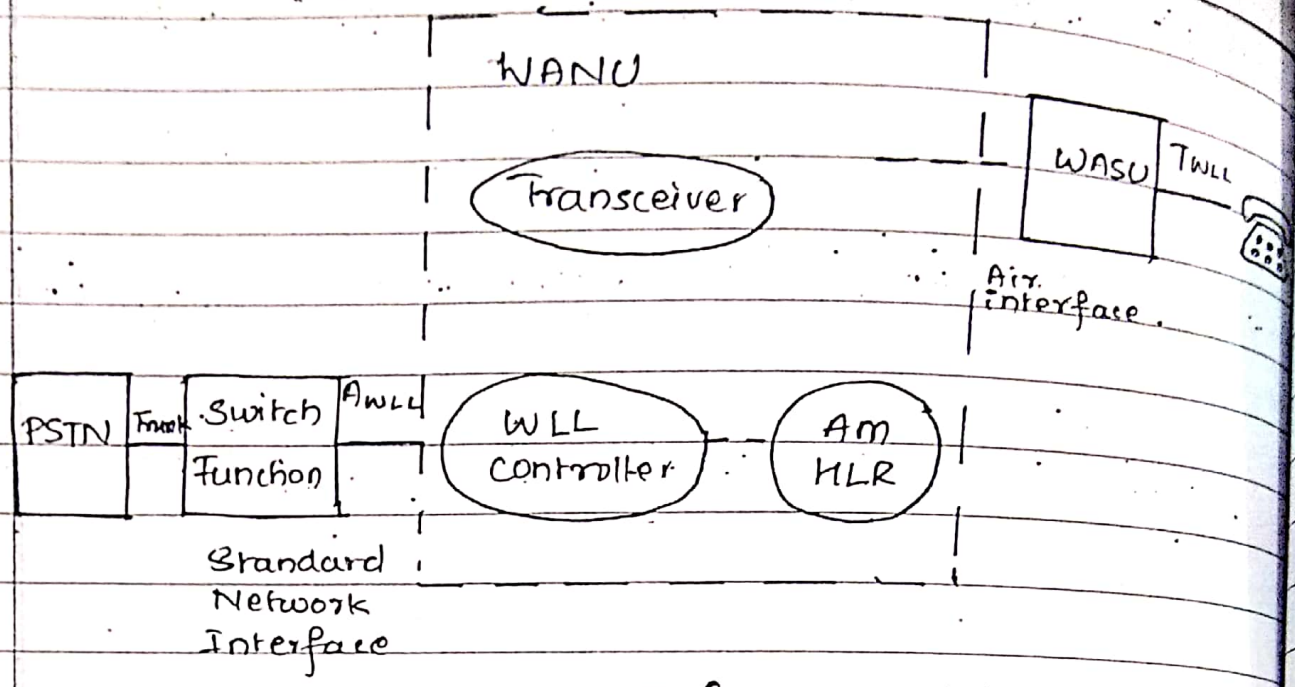


Fig:- WLL Reference Model.

WLL refers to a system that is used to link subscribers to the PSTN with help of radio signals. WLL architechture contains the following major components

I Wireless Access Network Unit (WANU): Contains BS transceivers or Radio Ports (RPs) an Access Manager (AM), a Radio Port Controller Unit (RPCU) and a Home Location Register (HLR). It's main responsibility is to provide authentication, privacy of air interface, and management of radio resources. It also provides Operations, Administration and maintenance (OAM), billing, routing and switching functions. It also provides facility of converting protocols and encrypting voice and data.

II Wireless Access Subscriber Unit (WASU).
Offeres two air interfaces — U_{WLL} and T_{WLL}. U_{WLL} is an air interface toward the network and T_{WLL} is traditional air interface toward the subscriber.

Scanned by CamScanner

START WRITING HERE

WASU facilitates services such as.

* Protocol conversion, signalling functions
* Transponding, OAM.
* Authentication and providing power supply locally.

WLL can be AMPS, GSM, DECT or PACS for radio communication link.

TWLL can be RJ-11; RJ-45 and so forth.

III Switch Function :- Refers to a switch which can be a digital switch that may or may not have Advanced Intelligent Network (AIN) capability, an ISDN switch or mobile switching centre.

WIRELESS LOCAL LOOP TECHNIQUES.

MMDS (Multichamel multipoint Distribution Service)

LMDS (Local multipoint Distribution Service)

MMDS

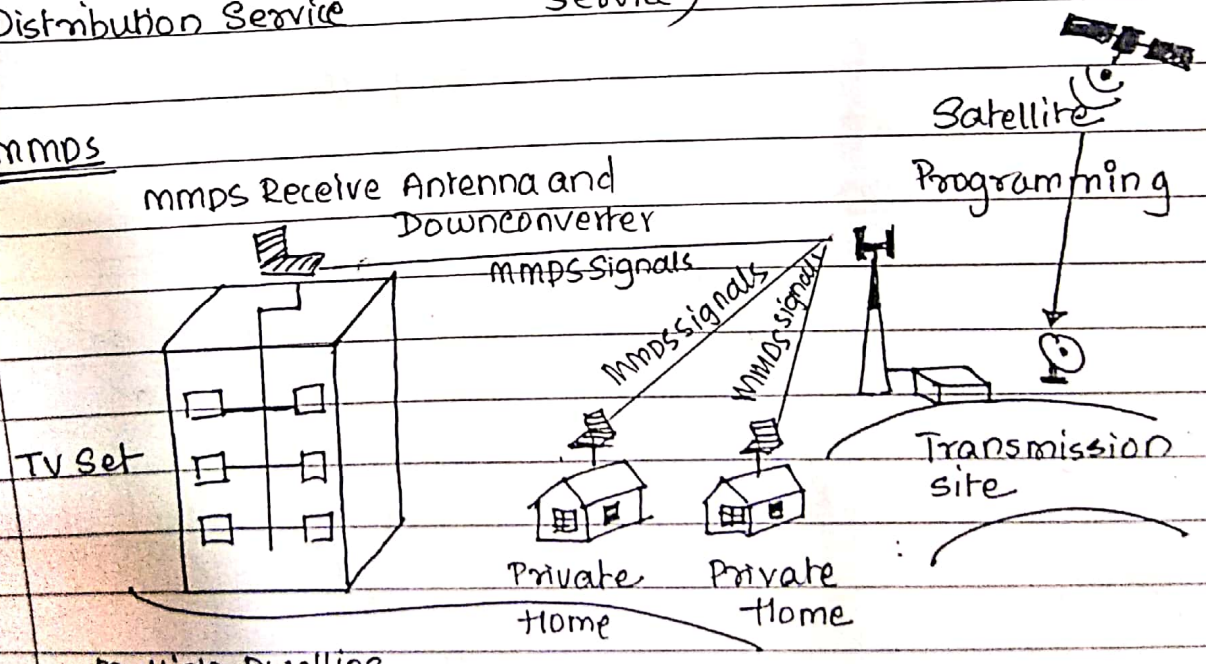


Fig:- Working of an MMDS system.

Scanned by CamScanner

Total Marks of Question no.		Examiner	
		Moderator	
		ReAssessor	

START WRITING HERE

Space for Marks	Question No.	

a) MMDS ~~has~~ is a WLL-based telecommunication technology that operates in the frequency range of 2.15 GHz to 2.68 GHz

b) mainly used for wireless broadcast of TV signals.

c) MMDS uses point-to-multipoint transmission because a single transmitting station serves several subscribers

* Antennas are installed for both signal broadcast at head end and signal reception at each subscriber location
* At head end an upconverter converts signal to higher frequency. [Set-top box is downconverter] is required

Advantages

→ Work on lower frequencies and less cost

→ Signals travel longer distances ∴ less no. of transmission base station is required

→ MMDS signal suffer less signal absorption or reflection

→ Faster & cheaper deployment

LMDS

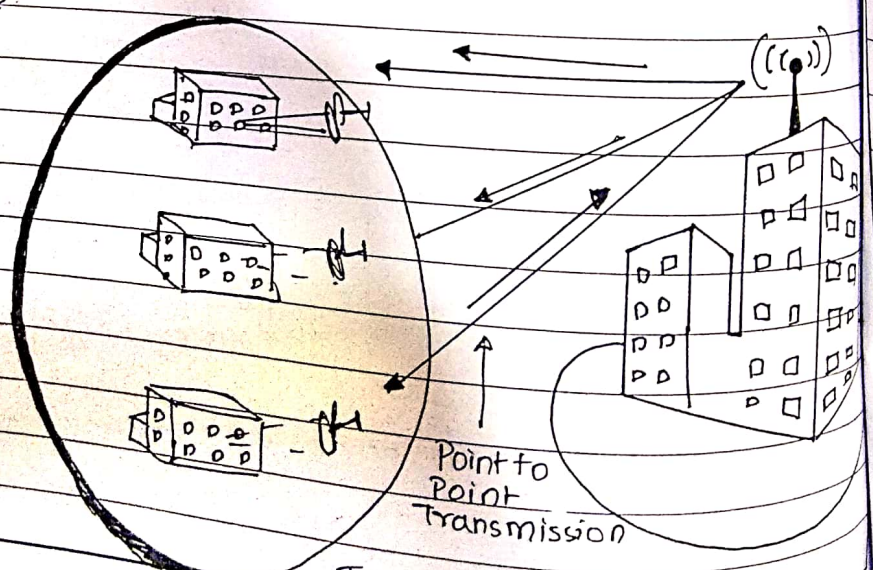


Fig:- Working of LMDS.

Scanned by CamScanner

Moderator
ReAssessor

START WRITING HERE

Working of LMDS

a) LMDS is a fixed wireless access technology that operates on high frequencies that is 26GHz to 43GHz

b) It can operate in deplex mode.

c) Can serve subscribers within range of 3 to 5 miles

Advantages.

→ Fast and easy deployment compared to cabled s/ms

→ Faster revenue generation

→ Less costly compared to wired broadcast systems

→ These systems offer higher bandwidth and speed of data transmission

→ Can accomodate new subscribers (flexible)

B) Explain in detail GSM Privacy and Authentication with neat diagram.

The GSM system provides various security mechanisms to ensure privacy and authentication of users.

I Registered Subscriber's Authentication :- This provides protection of network against unauthorised use. It also provides protection of GSM PLMN subscribers as it allows you to stop intruders to copy authorised users.

This is based on a secret KI which is shared between the HLR of subscriber's home network and subscriber's SIM. This secret KI is generated and written to the SIM card at a secret place when a SIM card is personalized. At the same time, a copy KI

Scanned by CamScanner

Total Marks of Question no.		Examiner	
		Moderator	
		ReAssessor	

START WRITING HERE

Space for Marks	Question No.

is also registered in the HLR. When a new GSM subscriber turns on the phone for the first time, it is the IMSI which is transmitted to the AU on the network.

The MS sends IMSI to the network.

The N/w receives IMSI and found corresponding KI of IMSI

The network generated 128 bit random no. and send to MS over air

The MS calculates a SRES with A3 algorithm using given challenge (RAND) an the KI residing in the SIM.

Fig:- Procedure of Registered Subscriber Authentication

II. Subscriber Identity Protection :- This is provided by IMSI which is stored in the SIM card. The IMSI ensures that a valid subscriber is using the Temporary Mobile Subscriber Identity (TMSI)

III Encryption of Data :- This is done using a ciphering key.

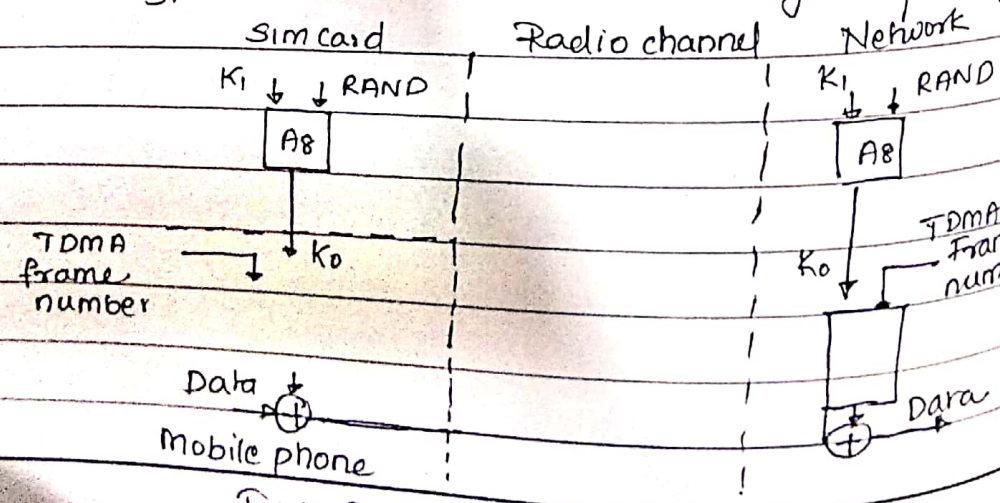


Fig:- Data Encryption Process.

Scanned by CamScanner

Moderator

ReAssessor

START WRITING HERE

Ciphering key provides protection of user data and signals on the open air interface. Once the user is authenticated GSM ciphering key; the RAND is delivered from the N/W. This RAND is delivered along with the KI from the SIM by using the A8 Ciphering key (KC). Using this KC with the A5 ciphering algorithm helps in the encryption or decryption of the data.

- The following algorithms are used in user authentication

a) A3 :- Specifies the MS authentication algorithm that is used in the GSM security model. The A3 algorithm gets the RAND from the MSC and the secret key KI from the SIM as input to generate the 32-bit output which is the SRES response. Both the secret keys RAND and KI are of 128 bits long.

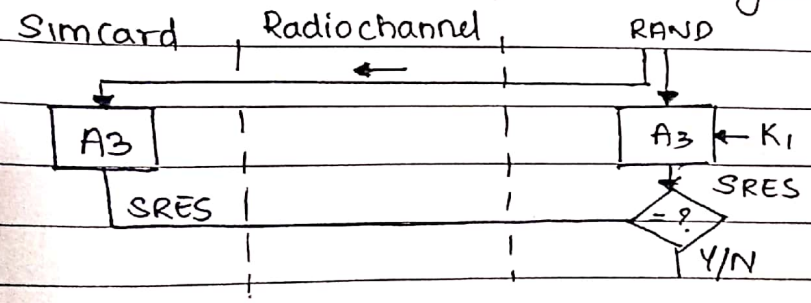


Fig:- Verification of User Authenticity.

b) A8 : Specifies the ciphering key generation algorithm which is also called the session key generation algorithm in the GSM security model. The A8 algorithm takes the input of two 128 bit for generating the output of 64 bit.

Scanned by CamScanner

Space for Marks	Question No.	START WRITING HERE

c) A5 : Specifies the stream-ciphering algorithm. The A5 algorithm is used to encrypt over-the air transmissions in any of these three ways: A5/0 algorithm (unencrypted one), A5/1 algorithm or A5/2 algorithm to secure the data.

Security using SIM

i) SIM stands for Subscriber Identity module and is the most recognized terms in field of mobile and wireless communication. It is used as a technique to identify the device with which it is used

ii) It has a smart card that contains the identity of mobile device with which SIM is used. A mobile device is identified by it's IMSI (International mobile Subscriber Identity). It stores info about subscriptions such as calls, messages, Internet access and other services.

iii) SIM contains identification details about networks in an encoded form. All details are protected by a Person Identification Number (PIN) which is issued only to the authorized person on whose name the SIM is subscribed.

iv) Can use SIM with any phone provided it must be verified that the person is authorized to use.

Scanned by CamScanner

Moderator

ReAssessor

START WRITING HERE

Q5(B) Explain the main factors of change in economics of wireless technology.

The wireless industry has totally adopted the data oriented approach. The following are the main factors that contribute to such a change.

I mobile Terminal manufacturers.

They are companies that make mobile products. They contribute to changing economies of the wireless industry in following ways :-

* Movement towards Internet Devices : Earlier wireless terminals have been currently substituted by Internet Enabled ones, such as Internet etabled mobile phones and digital assisstants. There is requirement to provide support for high speed data services. Also, different types of mobile terminals are characterized on basis of different device costs and capabilities. IoT has emerged with need for human-to computer interaction

* Maximized Sales Figures :- Users changes phones every few years. Eg :- upgrade of GPRS phone from a GSM phone so that users can enjoy higher data rates. The no. of s/w used in GPRS phone is 10 x No. of s/w used in GSM

II Role Played by Government Agencies in Wireless Industry

Some regulatory bodies that play a role in economies of the wireless industry are :-

Scanned by CamScanner

Space for Marks	Question No.	START WRITING HERE

* Industry Canada (ICRST) : It increases global trade of Canada
* Canadian Radio-TV and Telecommunications Comission (CRTC) It regulates telecommunication carriers
* Telecom Regulatory Authority of India (TRAI) :- Regulates services and tariffs decided by central Government
* FCC (Federal communications Commission) :- Refers to regulatory agency of US to regulate communication b/w states
* Cellular Telephone Industries Association (CTIA) :- Has sectors ie, cellular, personal communication services and specialized mobile radio.

TRAI has following roles and activities
* Protecting Customer Interest
* Monitoring Quality of Service (QoS)
* Regulating Retail and Wholesale Tariffs
* Ensuring Transparency in Service Provision
* Combating Spam
* Offering Number Portability

The factors that are affected by various government agencies is as follows

a) Revenue due to 3G Spectrum Licensing :- Government's auctions of 3G spectrum is a big source of income. In Great Britain auction earned 40 billion dollars

b) License Use :- Spectrum licence refers to approval given by a government agency to a service operator to use a particular frequency band for a specific geographical region.

Scanned by CamScanner

c) Role of Government in market: Government can affect the rate of growth of market by maximizing or minimizing no. of carriers.

III Infrastructure manufacturers.

The following factors are affected by infrastructure manufacturers

a) Increased market opportunities: Market will grow to 200 billion dollars.

b) Increased Entry Barriers: - manufacturers of equipment for data N/ws are also likely to enter this market. Increased complexity of infrastructure equipment for Next-Gen Wireless N/ws

IV Mobile Carriers.

The factors affected by mobile carriers are :-

a) Market challenges :- Falling growth rates, decreasing prices, shift to wireless internet, cost for 3G licences. Mobile carriers have to play different roles

* ISP Role :- wireless Internet prices to be reduced.
* Portal Role :- Advantage of having own portals
* Application Service Provider Role :- location Based services
* Content Provider Role : New content to be created.

b) Self enforcing Agreement by Carrier Companies :- Companies come to a mutual agreement relating to prices.

c) Bundled Products :- Carriers with telecom operators are related to data services

d) Changing Traffic Patterns :- Increase in intra-country mobility and roaming

e) Different Situation in each country :- Factors of US & European union are different

Scanned by CamScanner

Space for Marks | Question No. | START WRITING HERE

WIRELESS DATA FORECAST

Mobile data traffic is expected to grow by 61% annually in 2019

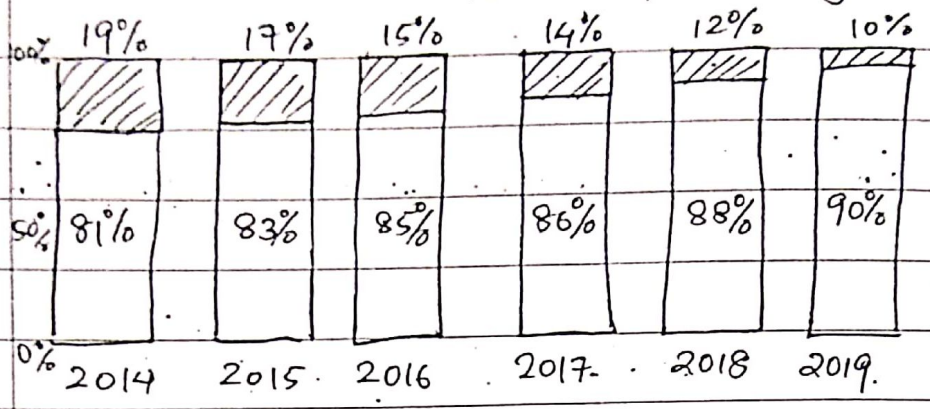


Fig :- Growth in mobile Data Traffic due to mobile Video Applications

I Data Demanding Applications

* Video Telephony and Videoconferencing :- TV-quality video feed
* Internet Browsing :- WAP
* mobile commerce :- Online mobile purchases
* multimedia messaging :- voice mails + notifications
* Geolocation :- GPS system
* Big Data Analytics Based Applications :- Hadoop applicatio

II Technological Alternatives and Their Economics

* CDMA2000 :- CDMA 2000 3x enhances datarate of 2mbit/s
* HighDataRate (HDR) :- provides higher speeds than 1X.
* wideband CDMA (W-CDMA) - Supports FDD & TDD. (2mbps)
* GPRS :- Data rates - 14.4 to 115.2kbps
* LTE :- 4G wireless technology
* UWB (Ultra Wideband) Technology :- large data over widespread with low power

Scanned by CamScanner

CHARGING ISSUES

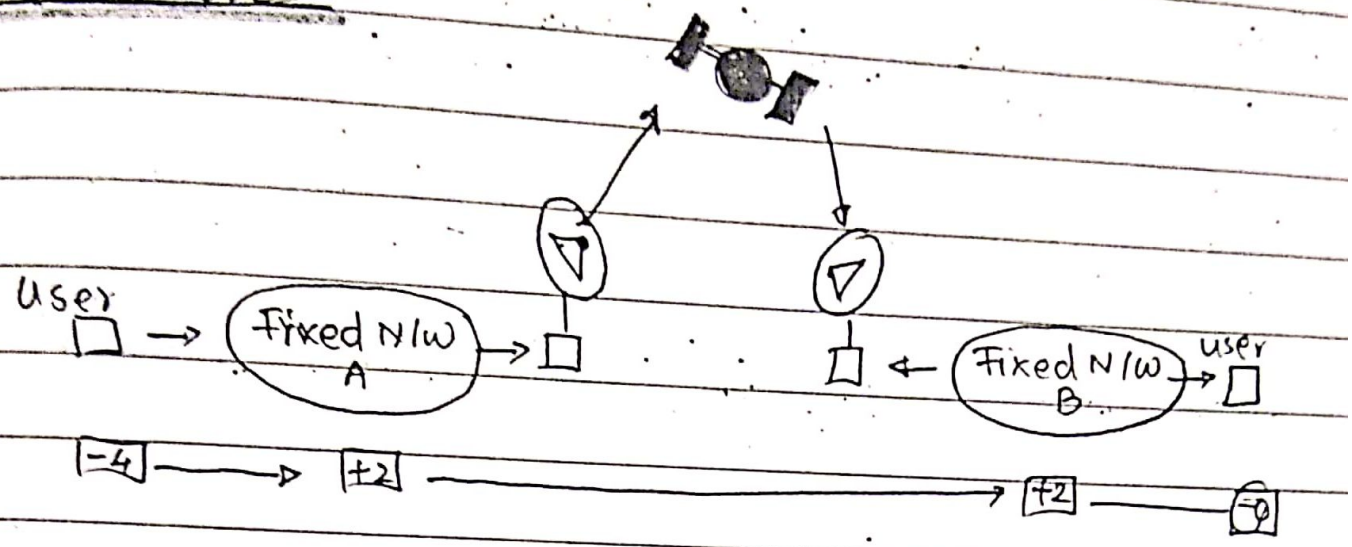


Fig :- Charging on International call.

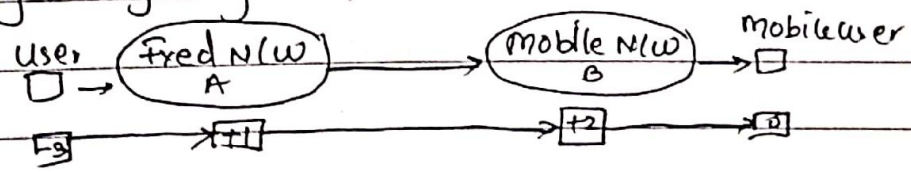
User has to pay for both carriers A and B. when fixed telephone carriers entered into market of same country, prices for international calls reduced due to that.

mobility charges -

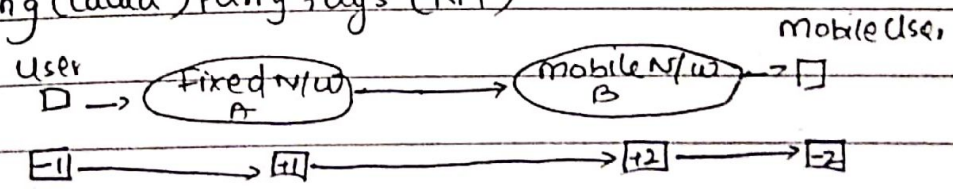
* mobile carriers paid a lot of money to get spectrum licences
* Pay money to install new infrastructure.

Other Approaches are :-

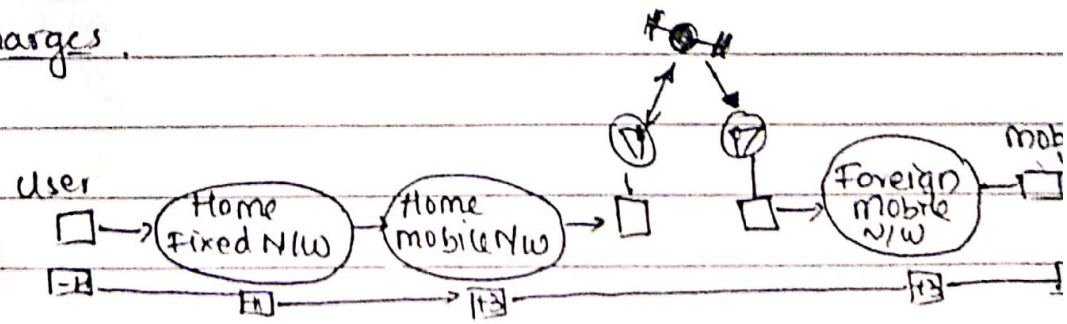
→ Calling Party Pay (CCP)



→ Receiving (Called) Party Pays (RPP)



Roaming charges.



Scanned by CamScanner

Total Marks of Question no. | ReAssessor

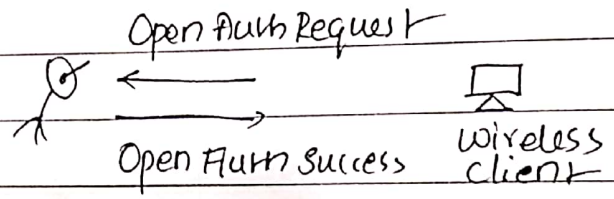
START WRITING HERE

Space for Marks | Question No.

Q5(B) Explain the wired Equivalent Privacy Protocol. Also explain WEP security based on the access control list with neat diagram.

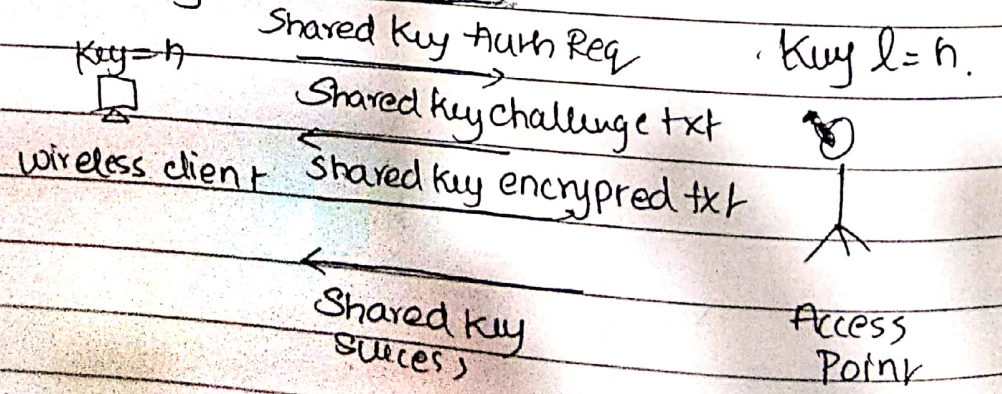
Authentication is the process in which a station verifies and provides authentication to communicate with another station within a coverage Area. (For infrastructure mode, APs are also authenticated

Open Authentication.



1) Client is allowed to send authentication request to AP as long as any MAC address filter policies are met
2) AP sends back open Authentication Success response to client
3) Packet transmission w/o encryption

Shared Key Authentication



1) It enables WEP (Wired Equivalent Privacy) which provides WEP keys to client & AP

Scanned by CamScanner

ReAssessor

START WRITING HERE

2) Shared Key: challenge txt ie, randomly generated text of 128 byte long

3) client encrypts challenge txt using WEP Key

4) AP decrypts this txt by it's WEP Key. If text is similar to shared key challenge text, then it sends shared key success message.

WEP Encryption

It is based on RC4 symmetric stream cipher. Keys can be 40 or 104 bits in length.

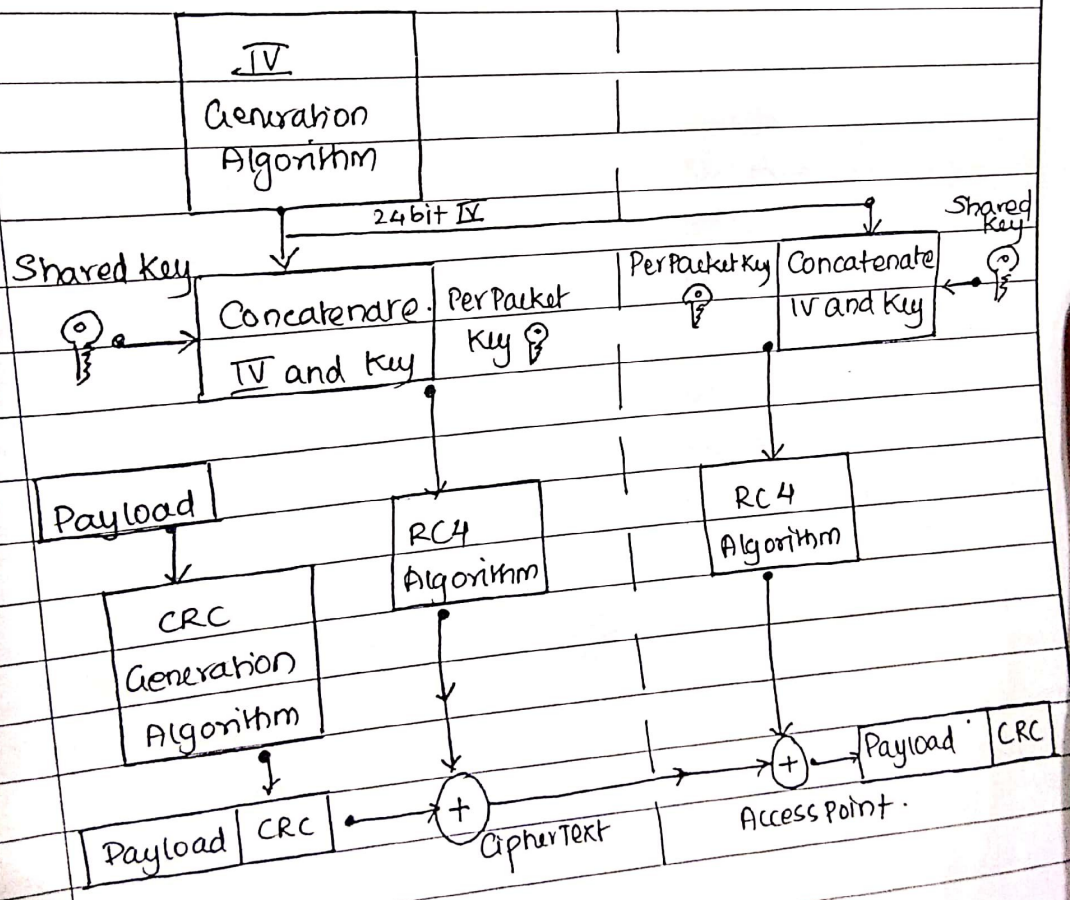


Figure: Displaying WEP Security Based on Access Control List

Scanned by CamScanner

Total Marks of Question no.		Examiner Moderator ReAssessor	

START WRITING HERE

Space for Marks	Question No.

The access control list contains mac addresses of all the clients who are authorized to access the network. Any users who are not specified in this list are restricted from accessing the network.

In case of shared key authentication,

* BS sends a request management frame for authentication
* Responder sends challenge text. (PRNG - Pseudo Random Number Generation) along with shared secret and random Initialization Vector (IV)
* Once BS receives challenge management frame, data of the challenge text is copied to a new management frame which is encrypted with help of shared secret and new Initialization Vector (IV). This is sent to responder
* Once received, responder decrypts it and verifies the CRC (Cyclic Redundancy Check) and ICV (Integrity Check Value) is valid. Also verifies if challenge text matches challenge text sent in first message.
* If Both match, authentication is successful.

(Size in octets)

2	2	6	6	6	2	0-23124	4
Frame Control	Duration	Dest Addr	Source Addr	BSSID	Seq #	Frame Body	FCS

	Algorithm Number	Seq Num	Status Code	Element ID	Length	Challenge Text
Size in octets	2	2	2	1	1	128

Fig:- Authentication management frame

Scanned by CamScanner

ReAssessor

START WRITING HERE

Question No. 6(a) Write short Notes on

(a) Compare CDMA2000 and WCDMA. [5 marks]

Parameters	cdma2000	WCDMA
i) Core Network	ANSI -41 MAP	GSM MAP
ii) Channel Bandwidth	1.25 MHz (1x), 3.75 MHz (3x)	5.0 MHz
iii) Channelization codes	4-128 (1x), 4-256 (3x)	4-256
iv) ChipRate	1.2288 mcps (1x), 3.6864 mcps	4.096 mcps (DoCoMo) 3.84 mcps (UMTS)
v) Synchronized Base station	Yes	No; but synchronized BS is optional
vi) Multi-carrier spreading option	Yes, but in cdma 2000 1x (direct spread)	No (direct spread)
v) Frame Length	5ms (signalling), 20, 40, 80ms. physical layer frams)	10ms for physical layer, 10, 20, 40 & 80ms for transport layer
vi) Modulation	QPSK (forward link) BPSK (reverse link)	QPSK (both links)

Scanned by CamScanner

Total Marks of Question no.		Examiner	
		Moderator	
		ReAssessor	

START WRITING HERE

Space for Marks	Question No.	Parameters	CDMA2000	WCDMA
	vii)	Modes of operation	FDD	FDD & TDD
	viii)	Channel coding	convolutional & turbo code	Convolutional & turbo code
	(x) ~~viii~~)	multimedia Services	Yes	Yes
	x)	Peak data Rate	614kbps	2mbps
	xi)	Power control	Both links (800Hz)	Both Links (1500Hz)
	(xii)	OverHead	Low (Because of Shared pilot code channel)	High (Because of non-shared pilot code channel)

Scanned by CamScanner

Moderator

ReAssessor

START WRITING HERE

Short Note on Mobile IP (5 marks)

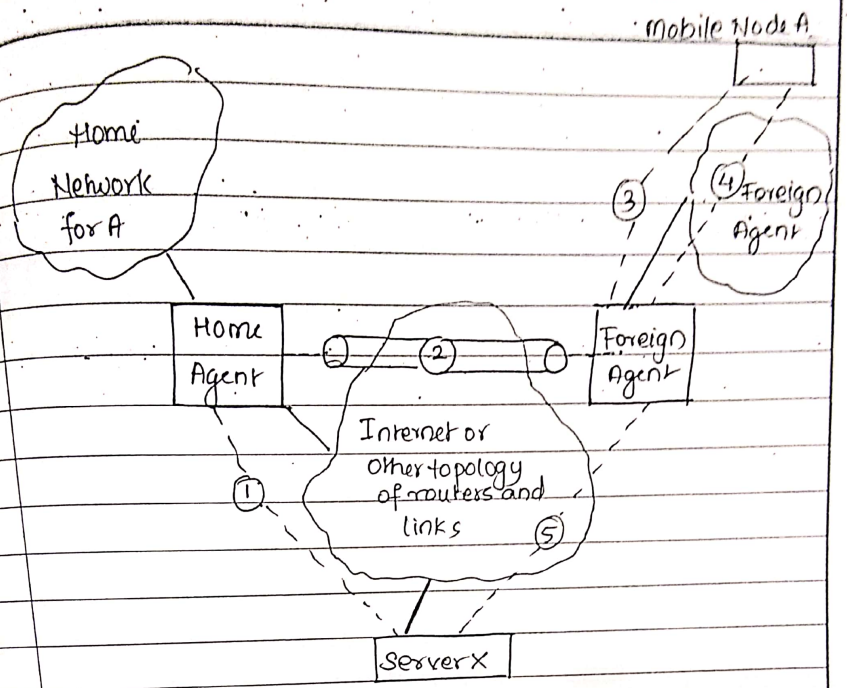


Figure:- mobile IP senario.

Mobile IP implies that a user is connected to one or more applications across the Internet, that the user's point of attachment changes dynamically, and that all connections are automatically maintained despite the change. The mobile Node needs to maintain same IPaddress

The MIP scenario.

Step① :- Server X transmits an IP datagram destined for mobile node A, with A's home address in the IP header. The IP datagram is routed to A's home Network

Scanned by CamScanner

Total Marks of Question no.		Moderator	
		ReAssessor	

Space for Marks	Question No.	START WRITING HERE

Step 2 :- At the home Network, the incoming IP datagram is intercepted by the home agent. The home agent encapsulates the entire datagram inside a new IP datagram which has the A's care-of address in the header, and re-transmits the datagram. The use of an outer IP datagram with a different destination IP address is known as "tunneling". This IP datagram is routed to the foreign agent

Step 3 :- The foreign agent strips off the router IP header, encapsulates the original IP datagram in a network level packet data unit (PDU) and delivers the original datagram to A across the foreign Network.

Step 4 :- When A sends the IP datagram to X, it uses X's IP address. This is a fixed address, ie X is not a mobile Node. Each IP datagram is sent by A to a router on the foreign Network to X. Typically this router is also the foreign Agent.

Step 5 :- The IP datagram from A to X travels directly across the Internet to X, using X's IP address.

Scanned by CamScanner

START WRITING HERE

Short Note on IEEE 802.11 standards [5 marks]

IEEE 802.11 and 802.11x are the specifications for WLAN technology developed by IEEE. The IEEE 802.11 a, b, g etc specifications are amendments to IEEE 802.11 standard.

The latest developments are :-

IEEE 802.11ad : Known as WiGig. Fast Session Transfer
* Enables transmission in 2.4GHz, 5 & 60GHz
* improves capacity
* modified for personal BSS, directional antennas & beam forming

) IEEE 802.11ae * Prioritization mechanism for frames
* Has management frame prioritization policy

) IEEE 802.11ac :- * Build on basis of 802.11n std
* 5-GHz frequency range.
* Uses Beam-forming capabilities.
* 433 Mbps per spatial stream

) IEEE 802.11af : * Functions in TV white spaces (TVWS)
* Built on geolocation database

) IEEE 802.11ah * Amendment of the IEEE 802.11-2007 standard.
* Enable subscriber to have the right to use subcarrier frequencies below

Scanned by CamScanner

Space for Marks	Question No.	START WRITING HERE

1GHz in ISM band.

vi) IEEE 802.11ai :- * Offers Fast Initial Link setup (FILS)
* Protected connection in less than 100ms.

viii) IEEE 802.11mc :- It is an enhanced version of IEEE 802.11n. This specification is directed towards assigning an operating group with the task of managing the standard around 2015

ix) IEEE 802.11aj :- * IEEE 802.11aj specification is an amendment to IEEE 802.11ad standard
* It aims at modifying the physical layer and MAC Layer of IEEE 802.11ad standard to function in chinese milli-meter wave (cmmw) frequency bands, such as the 59-64 GHz frequency band. This specification will be finalized by 2015.

	IEEE 802.11a	IEEE 802.11b	IEEE 802.11g	IEEE 802.11n
Operating Frequency	5GHz UNII/ ISM bands	2.4GHz ISM band	2.4GHz ISM band	2.4-5GHz.
Modulation Technique	BPSK, QPSK, 16-, 64-QAM, OFDM	QPSK, DBPSK DSSS	BPSK, QPSK 16-, 64-QAM OFDM	64-QAM, DSSS

Scanned by CamScanner

START WRITING HERE

multiple Access	CSMA/CA	CSMA/CA	CSMA/CA	CSMA/CA
channel Bandwidth	20MHz	20-25 MHz	20MHz	20 or 40MHz
Half/Full Duplex	Half	Half	Half	Full duplex
Outdoor Range	120 Mtrs	140 Mtrs	140 mtrs	250 mtrs
Throughput	23 mbits	4.3 mbits	19 mbits	74 mbits

Q6 d. Write Short Note on "Wireless Sensor Network" (5 marks)

A WSN is made up of several sensor nodes scattered in an area that can be left unattended. It consists of four components

* Sensing unit
* Processing Unit
* Power Unit
* Transceiver

Scanned by CamScanner

Total Marks of Question no.		Examiner	
		Moderator	
		ReAssessor	

Space for Marks	Question No.	START WRITING HERE

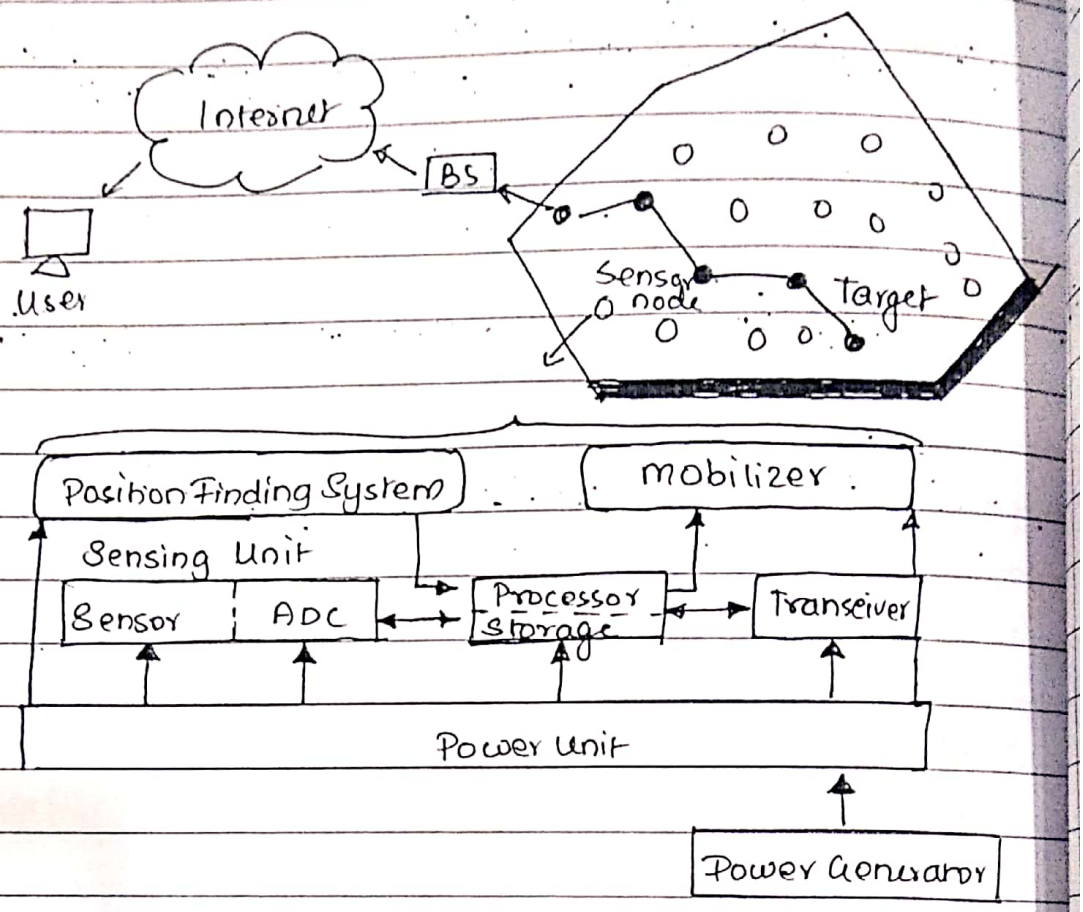


Fig:- WSN Network model

* Sensing unit :- Has ADC used for converting analog signals generated by sensors to digital form. These digital signals are to the processing unit. Processing unit has small memory storage that stores procedures for processing and communicating with other sensors.

* Transceiver Unit :- Used for sending and receiving signals from one sensor node to another and also for transmitting sensed data [illegible]

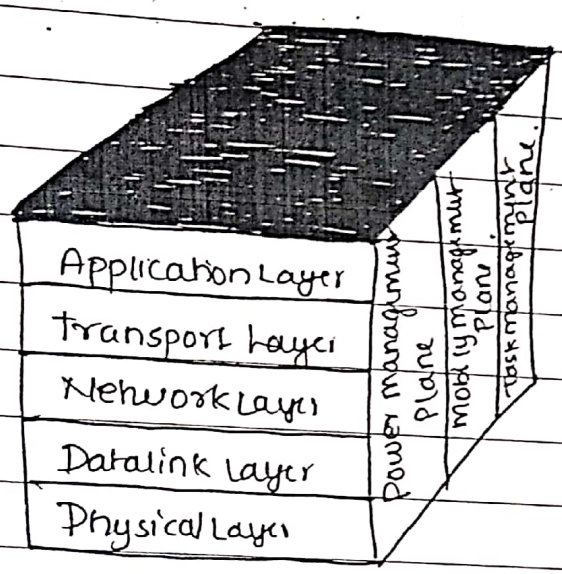
Scanned by CamScanner

Question No.

START WRITING HERE

* Processing unit
  - → managing data collected by sensor
  - → Power management
  - → managing N/w operations according to wireless N/w protocols.

Protocol Stack



Protocol Stack of WSN

Layers	Functions
Transport	: Data Flow.
Network	: Routing
Power mangt Plane	: Sensing, Processing, Radio transmission
mobility Plane	:- Senses movement of nodes
Task mngt plane	:- Schedule events..

Routing Algorithm

* Proactive Algorithm :- OSPF, OLSR, TBRPF work through continuous transmission of routing information from one sensor node to every other node that is par of N/w. High overhead but smaller delay
* Re-active Algorithm :- Demand routing protocols - start route detection only at request of sensor node. Reduces overhead, Delay increases. ABR, DSR, AODV etc
* Hybrid Algorithm :- Combination of re-active & proactive. Proactive (locally), Reactive (inter locally). Considers nodes which are not widely separated

Scanned by CamScanner