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WINTER – 19 EXAMINATION

Subject Name: Mobile And Wireless Communication   **Model Answer**   Subject Code: **22533**

Important Instructions to examiners:

Q. N o.	Sub Q. N.	Answer	Marking Scheme
Q .1		**Attempt any FIVE of the following:**	**10-Total Marks**
	a)	**State two features of CDMA 2000.**	**2M**
	Ans :	1. It has very high packet data rates. 2. It has high radio channel bandwidth of 1.25 MHz 3. It has global seamless connectivity. 4. Very good performance 5. Support for advanced mobile services 6. Efficient use of spectrum 7. selection of device 8. Evolution path 9. Flexible 10. CDMA2000 uses Frequency Division Duplexing-Multicarrier (FDD-MC) mode. Here, multicarrier implies N × 1.25 MHz channels overlaid on N existing IS-95 carriers or deployed on unoccupied spectrum. CDMA2000 includes − 11. 1x — uses a spreading rate of 1.2288 Mcps. 12. 3x — uses a spreading rate of 3 × 1.2288 Mcps or 3.6864 Mcps. 13. 1xEV-DO (1x Evolution – Data Optimized) — uses a spreading rate of 1.2288 Mcps, optimized for the data..	**Any two 1M each**

b)	**Define forward control channel and reverse control channel.**		**2M**
Ans:	**Forward control channel:-** Radio channel used for transmission of data from base station to mobile stations. **Reverse control channel:-** Radio channel used for transmission of data from Mobile station to base stations.		
c)	**Explain the term cell splitting.**		**2M**
Ans:	**Cell splitting:-** • Cell splitting is the process of subdividing a congested cell into smaller cells, each with its own base station and corresponding reduction in antenna height and transmitter power. • Cell splitting increases the capacity of a system since it increases number of times that channels are reused.		
d)	**List two features of 4G LTE.**		**2M**
Ans:	1. Peak data rates: downlink – 1Gbps; uplink -300Mbps 2. Spectrum efficiency: 3 times greater than LTE. 3. 10 times faster than the 3G network. 4. Peak spectrum efficiency:downlink -30bps / Hz; uplink – 15bps / Hz 5. 4G LTE is flexible and reliable. 6. Easy to standardize and it offers affordability		**Any 2 features- 1M each**
e)	**State the spectrum requirement of IMT 2000.**		**2M**
Ans:	Common spectrum for IMT 2000 world-wide is from 1.8 GHz-2.2 GHz band or For Uplink: 1885-2025 MHz (Mobile satellite services) Downlink: 2110-2200 MHz (Mobile satellite services)		**2M**
f)	**State any two features of bluetooth technology.**		**2M**
Ans:	**Features of bluetooth technology:- (Any two)** 1. It is implemented using IEEE 802.15 standard. 2. Used ISM band at 2.4 GHz 3. Uses FHSS technique 4. Data transfer rate is 1 Mbps. 5. Maximum range is 10 meters. 6. It is wireless PAN standard which uses radio link instead of wires. 7. Uses TDMA (TDD-TDMA) 8. Type of modulation used GFSK 9. It does not have a very good quality. 10. It uses 1600 hops / second.		**Any 2 features - 1M each**
g)	**Give the applications of WLAN technology.**		**2M**
Ans	**Applications of WLAN technology:-** 1. For accessing internet, checking emails, receive and send instant message when user is		**Any two**

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	:	moving.	**1M each**
		2. WLAN can set up networks in the location affected by earthquakes and other disasters where no suitable infrastructure is availabe.	

Q.2		**Attempt any THREE of the following:**	**12-Total Marks**
	a)	**State the advantages of CDMA 2000 over 3G-GSM standards.**	**4M**
	Ans :	**Advantages of CDMA 2000 over GSM:-** 1. Increased voice capacity 2. Higher data throughput 3. Multicast services 4. Frequency band flexibility 5. Incresed battery life 6. Synchronization 7. Power control and supplemental channels 8. Flexible channel structure in support of multiple services with various QoS and variable transmission rates.	**Any 4 advantages 1M each**
	b)	**State the types of interference in cellular system. Explain any one type in Detail.**	**4M**
	Ans :	**Types of Interference in cellular system:-** The common types of interference in cellular networks are: 1. Self-interference 2. Multiple access interference 3. Co-channel interference (CCI) 4. Adjacent channel interference (ACI). 5. Near-End-Far-End Interference **Explanation:-** **Self-interference** Self-interference is due to interference induced among signals that are transmitted from a shared transmitter. The amount of interference induced depends on the modulation type. Interference between the uplink and downlink transmissions in a FD duplex system may be classified as self-interference, as it occurs among signals send on the same two-way connection. or **Multiple access interference** Multiple access interference refers to the interference induced among the transmission from multiple radios using the same frequency resource to a single receiver. or **Adjacent-Channel Interference**: It occurs in a radio **channel** when unwanted energy from **channels adjacent** to it falls into its desired bandwidth. or **Next-Channel Interference:** • Next-channel interference will arrive at the mobile unit from other cell sites if the system is not	**Four Types 2M, ½ M each** **Any 1explanation-2M**

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designed properly.

• Mobile unit initiating a call on a control channel in a cell may cause interference with the next control channel at another cell site.

• The filter with a sharp falloff slope can help to reduce all the adjacent-channel interference, including the next-channel interference.

or

Co-channel interference (CCI) –When interference occurs in the cells having same channel set is called co-channel interference ,to reduce it the co-channels have to be separated by sufficient amount of distance.

or

Neighboring-channel Interference:

• The channels which are several channels away from the next channel will cause interference with the desired signal.

• A fixed set of serving channels is assigned to each cell site.

• If all the channels are simultaneously transmitted at one cell site antenna, a sufficient amount of band isolation between channels is required for a multi-channel combiner to reduce inter-modulation products

or

Near-End-Far-End Interference:

➢ **In One Cell :**

• The close-in mobile unit has a strong signal which causes adjacent-channel interference

• In this situation, near-end-far-end interference can occur only at the reception point in the cell site as shown in fig (a)

➢ **In Cells of Two Systems:**

• The frequency channels of both cells of the two systems must be coordinated in the neighborhood of the two- system frequency bands. The situation can be seen in fig: (b)

•
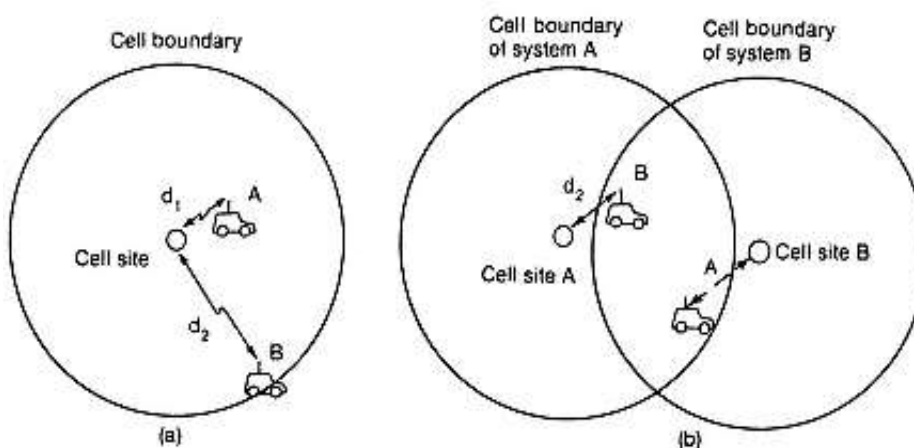
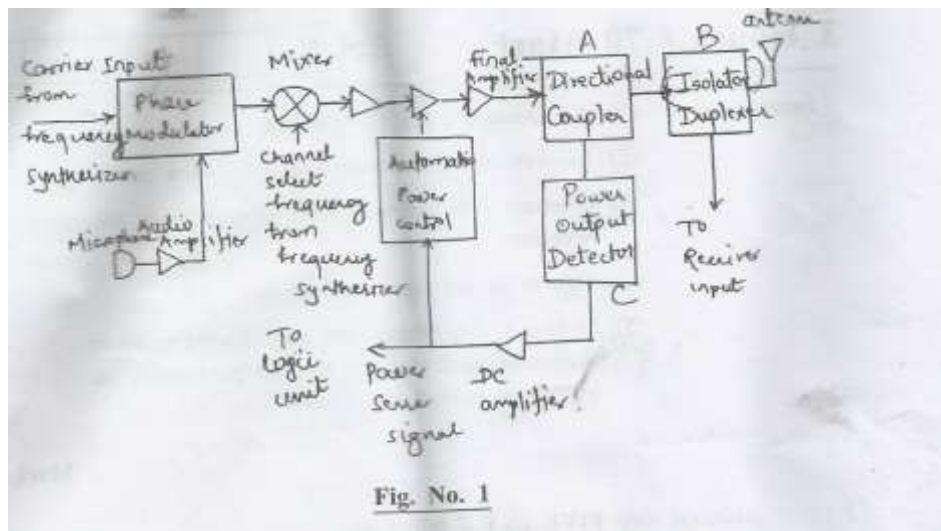| | | c) | **Compare IS95 with GSM. (any four points)** | | | **4M** |

Ans :	**Sr .No.**	**Parameters**	**IS-95**	**GSM**	**Any 4 points; 1M each**
	1	**Number of full duplex channel**	20	125	

2	Bandwidth of each channel	1.25MHz	200KHz
3	Muliple Access method	CDMA	TDMA
4	Number of users per channel	64	8
5	Type of Modulation	BPSK / QPSK	GMSK
6	Data rate	9.6 / 14.4 Kbps	27.833Kbps
7	Frame duration	20ms	4.615ms
8	Hand off	Soft	Hard
9	Frequency spectrum	800 or 1900 MHz	890-915 MHz 935-960MHz

| d)	Identify the block diagram and state the functions of blocks A, B and C in Figure No.1	4M
	Fig. No. 1	Identificati on 1M Function of A,B,C- 1M each
Ans :	It is the block diagram of **Mobile phone transmitter.** **Function of block A(directional coupler):-** It is used to tap the received power and convert it into a proportional D.C signal. This D.C signal controls the APC(Automatic power control) circuit **Function of block B (Isolator/ duplexer):-** The transmitter output is fed to a duplexer. It allows transmitter and receiver to share same antenna for transmission and reception. **Function of block C (Power output detector):-** The power detector estimate the signal power,, if the signal is found offset of estimate value it is given to automatic power control unit to match the estimation.	

Q.3		Attempt any THREE of the following:	12-Total Marks
	a)	**Explain Microcell zone concept.**	4M
	Ans :	- The problem associated with the sectoring is the number of handoffs. This puts additional load on the switching and control link elements of the mobile system. A solution to this problem is based on microcell concept for seven cellreuse. - In this scheme, all the three or more zone sites represented as Tx/Rx are connected to the same base station and share the same radio equipment. The transmission media used for connecting the zones to the base station are coaxial cable, fiber optics cable or a microwavelink. - So each cell consists of a base station and multiple zones. A mobile travelling within a cell, is served by the zone that has the strongest signal ofall. - As shown in figure, the antennas in zones are placed at the outer edge of the cell and any base station channel can be assigned to any zone by the base station. As a mobile travels from one zone to the other within a cell, it uses the samechannel. - This will avoid handoff. The base station will just switch the channel to the appropriate zone site. Thus a given channel is being used only in a particular zone in which the mobile istravelling. So the base station radiation is localised.this will reduce interference. The channels are distributed in space and time by all zones and are reused in the co channel cells. The microcell zone concept is very useful along highways or in the busy areas.	
	b)	**CDMA 2000 is more advantages over 3G GSM standards. Justify.**	4M
	Ans :	Advantages of CDMA 2000 1 .Increased voice capacity. 2. Higher data throughput. 3. Multicastervices.	**Any 4 advantages with explaination**

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		4. Frequency band flexibility.	
		5. Migration paths.	
		6. Serves multiple markets.	
		7. Supports multiple service performances.	
		8. Full backward compatibility.	
		9. Increased battery life.	
		10. Power control.	
		It provides high data rate internet access capabilities in gradual manner within the existing systems.	
	c)	**Describe MANET and write applications of MANET.**	**4M**
	Ans :	- Mobile ad hoc networks (MANETs) are envisioned to become key components in the 4G architecture, and ad hoc networking capabilities are expected to become an important part of overall next-generation wireless network functionalities. - Mobile ad hoc networks are formed dynamically by an autonomous system of mobile nodes that are connected via wireless links without using an existing network infrastructure or centralized administration. - The nodes are free to move randomly and organize themselves arbitrarily; thus, the network's wireless topology may change rapidly and unpredictably. - Such a network may operate in a standalone fashion, or may be connected to the larger Internet. - Mobile ad hoc networks are infrastructure less networks since they do not require any fixed infrastructure such as a base station for their operation. - Routes between nodes in an ad hoc network may include multiple hops and, hence, it is appropriate to call such networks "**multihop wireless ad hoc networks.**"	**Description -2M,any 2 appl-2M**

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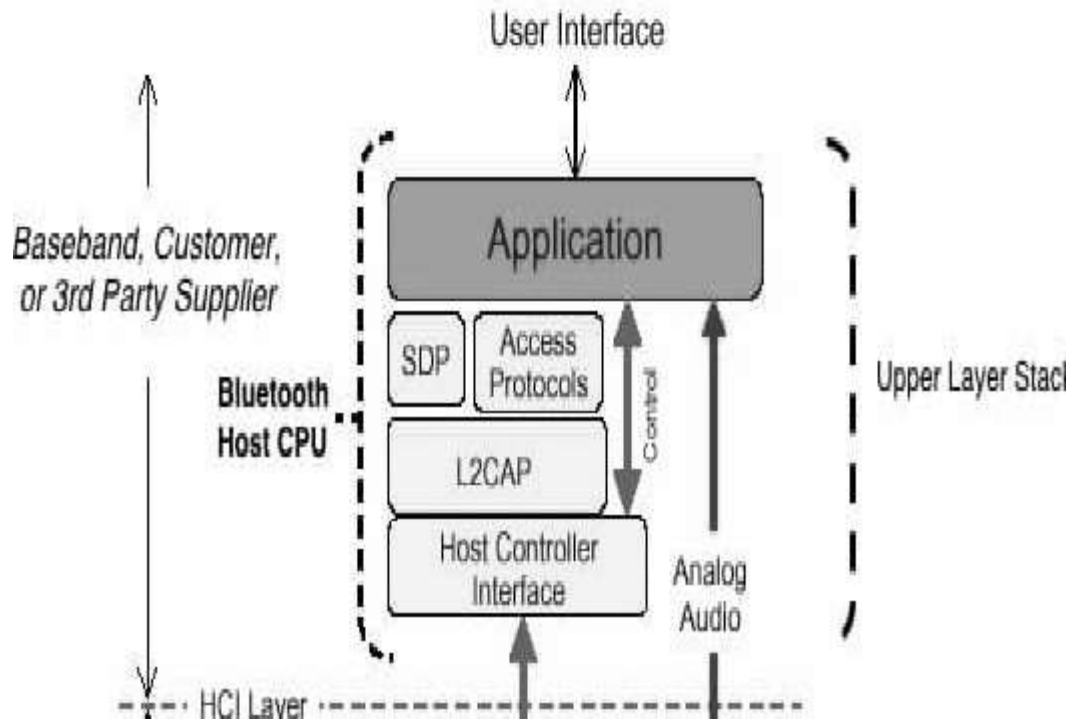(ISO/IEC - 2700   ·tified)
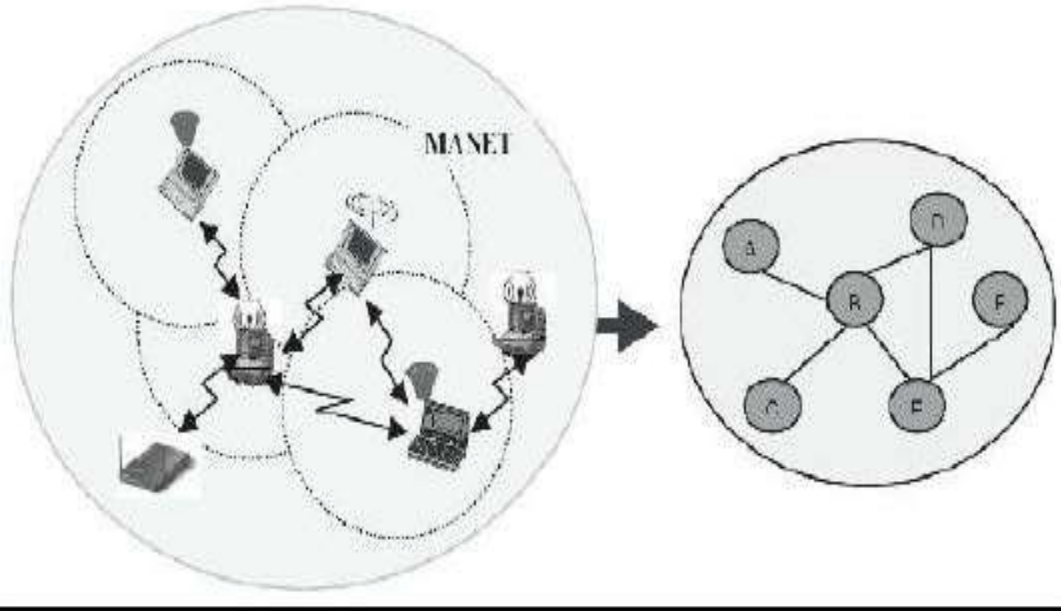
Note: Any other Relevant applications can be considered. Any
2 Applications.

- Personal area networking, cell phone, laptop, ear phone, wristwatch
- Military environments, soldiers, tanks, planes
- Civilian environment Carnet work meeting rooms

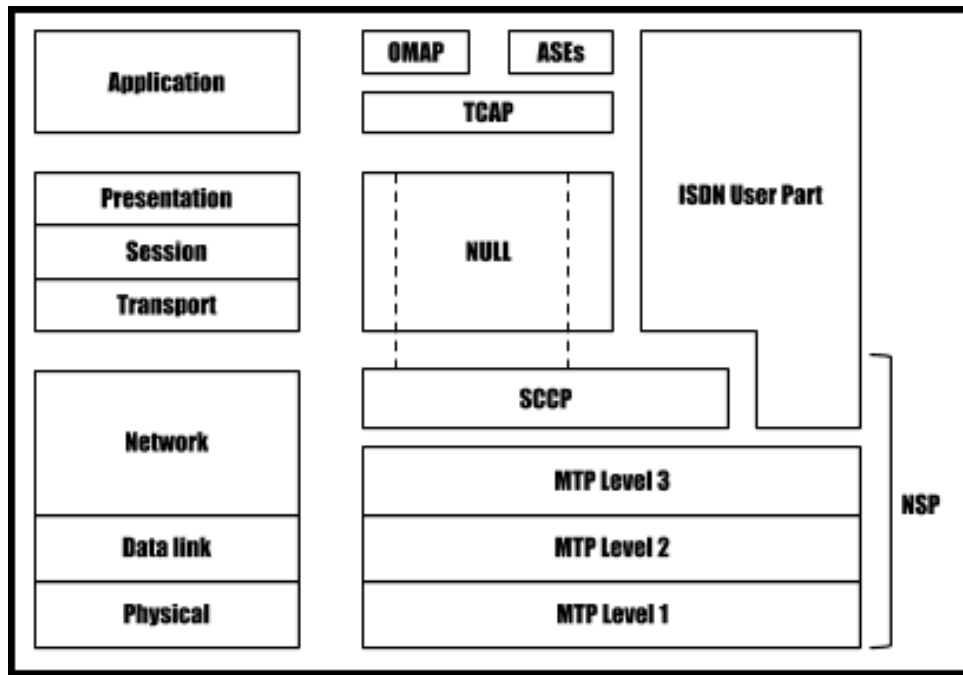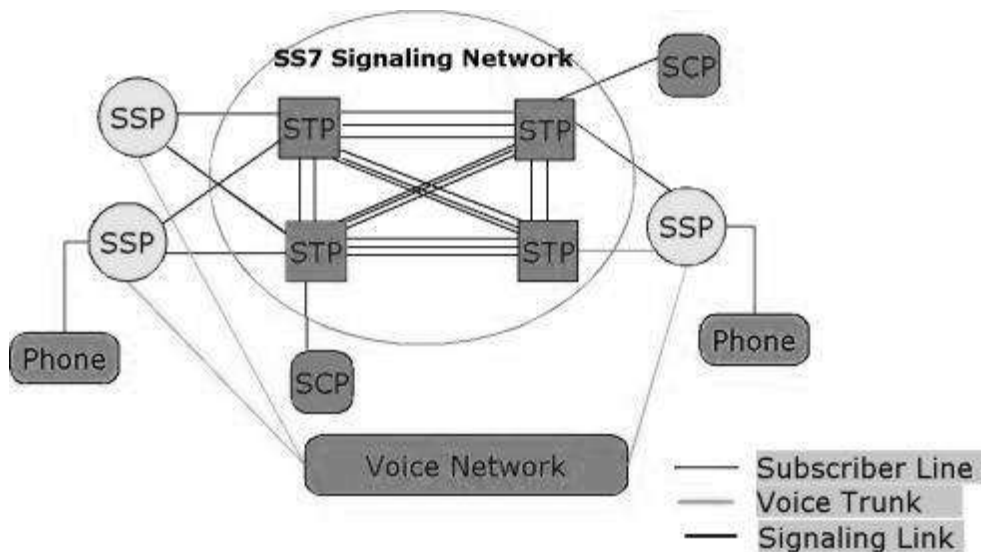|		
d)	**Explain the architecture of Bluetooth technology.**	**4M**
Ans:	 Bluetooth is both a hardware-based radio system and a software stack that specifies the linkages between the architecture layers of the two.	**Dig-2M,** **Explanation -2M**

The heart of this specification is the protocol stack, which is used to define how Bluetooth works. The Bluetooth protocol stack is a set of layered programs.

Each layer in a protocol stack talks to the layer above it and to the layer below it.

Think of Bluetooth as having two well-defined layers of functionality in the stack. These layers range from the lower level hardware-based radio system, to an upper level software stack that specifies the linkages between the layers .

Lower Stack Layers

The lower layers are the *basic core specifications* that describe how Bluetooth works. The base of the Bluetooth protocol stack is the **radio layer**, or module. The radio layer describes the physical characteristics of the transceiver. It is responsible for modulation/demodulation of data for transmitting **or** receiving over radio frequencies in the 2.4 GHz band. This is the physical wireless connection. It splits the transmission band into 79 channels and performs fast frequency hopping (1600 hops/sec) for security.

Upper Stack Layers

The upper stack layers consist of *profile specifications* that focus on how to build devices that will communicate with each other, using the core technology.

The **host controller interface** (**HCI**) serves as the interface between the software part of the system and the hardware (i.e., the device driver).

The **L2CAP** (logical link control and adaptation protocol) layer is above the HCI in the upper stack. Among other functions, it plays a central role in communication between the upper and lower layers of the Bluetooth stack. It keeps track of where data packets come from and where they should go. It is a required part of every Bluetooth system.

Above the L2CAP layer, the protocol stack is not as linearly ordered. Still, the **service discovery protocol** (**SDP**) is important to mention because it exists independently of other higher-level protocol layers. It provides the interface to the link controller and allows for interoperability between Bluetooth devices.

Q.4		**Attempt any THREE of the following :**	**12-M**
	a)	**Draw signalling system SS7 and explain services and performance.**	**4M**
	Ans:		**Dig-2M,**
		Signalling system SS7 and explain services and performance.	**any 1 service-1M**
			Performance-1M

FIGURE: SS7 PROTOCOL ARCHITECTURE

Or

SS7 Services:

- **Touch star:**

This kind of service is also known as CLASS and is a group of switch- controlled services that provide its users with certain call management capabilities.

Services such as call return, call forwarding, repeat dialing, call block, call tracing and caller ID are provided

or

- **800Services:**

These services were introduced by Bell Systems to provide toll-free access to the calling party and to the services and database which is offered by the private parties.
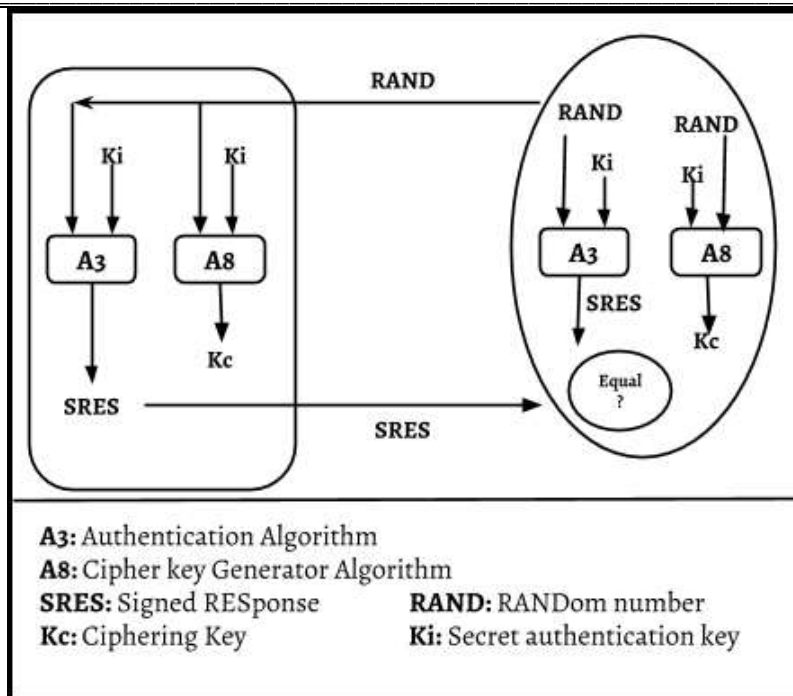
The costs associated with the processing of the calls are paid by the service subscriber.

The service is offered in two plans known as the 800-NXX plan and the 800 database plan.

In the 800-NXX plan the first six digits of an 800 call are used to select the interexchange

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carrier(IXC).

In the 800 database plan, the call is looked up in a database to determine the appropriate carrier and routing information.

- **Alternate Billing Service and Line Information Database(ADB/LIDB):**

These services use the common channel signaling (CCS) network to enable the calling party to bill a call to a personal number (third party number, calling card or collect, etc.) from any number.

Performance of SS7

1) Performance of signaling network is studied by connection set-up time (response time) or the end-to-end Signaling information transfer time. The delays in the signaling point (SP) and the STP depend on the specific hardware configuration & switching software
2) **Congestion control In SS7networks:**
   o With the increase in subscribers it is important to avoid congestion in the signaling network under heavy traffic conditions.SS7 networking protocols provide several congestion control schemes, allowing traffic to avoid failed links & nodes.

b)	**State the features of 4.5G and 5.6.**	**4M**
Ans :	**Features** 1) Network based on the user experience. 2) Enhanced system performance. 3) Business models, managements and operations. 4) Beam division multiple access (BMDA) technology. 5) Filter band multicarrier (FBMC) multiple access. 6) For computing and achieving low latency, high mobility, high scalability and real time executing. 7) Ultra Wide band (UBC) networks. **8)** World combination service mode (WSGM)	**Any 4 feature- 1M each**
c)	**Explain authentication process by using Cipher key generation in GSM.**	**4M**

|		
Ans :	A3: Authentication Algorithm A8: Cipher key Generator Algorithm SRES: Signed RESponse RAND: RANDom number Kc: Ciphering Key Ki: Secret authentication key	**Dig-2M,expla-2M**

Explanation
- Authentication refers to process by which station confirms the identity of mobile station. It protects GSM network against unauthorized access.

- The Authentication Centre is responsible for all security aspects.
- The AUC generates the Ki"s associates them with IMSI and provides for each IMSI a set of triplets consisting of RAND(Random Number), SERS (signed Response), Kc (Cipher key)
- Authentication center first authenticate the subscriber mobile station and only then MSC provides service.
- At MS- SIM contains the entire authentication data along with A3 and A8 algorithm and signed response is generated using this.
- At network side signed response is generated using same algorithm and random number and if both the signed response matches then mobile phone authenticated.

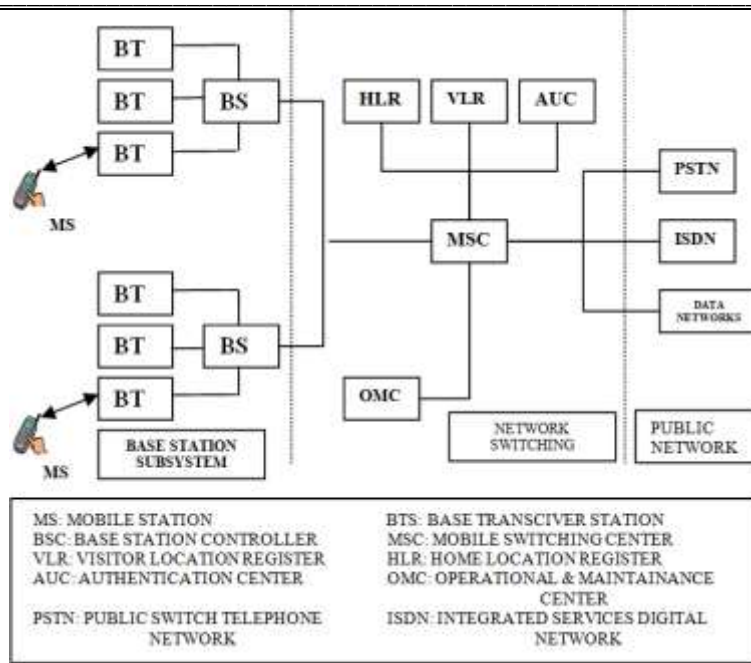| **d)**	**Draw the architecture of UMTS the function of different blocks in UMTS.**	**4M**
Ans :	**Draw the architecture of UMTS the function of different blocks in UMTS.**	**Dig-2M,expla-2M**
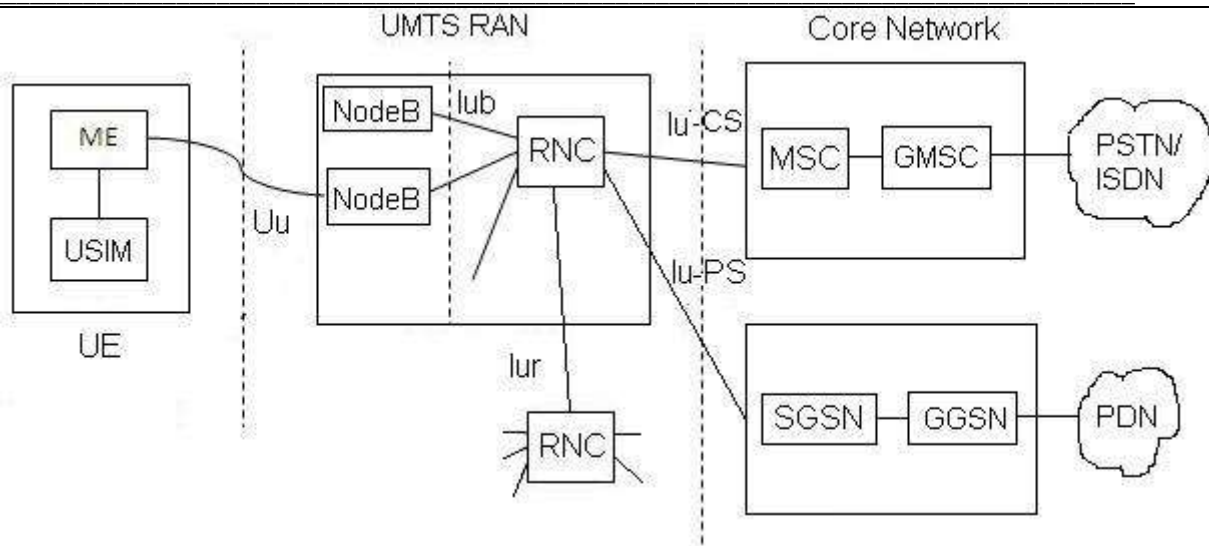
- **User Equipment (UE):**
  The User Equipment or UE is the name given to what was previous termed the mobile, or cellphone. The new name was chosen because the considerably greater functionality that the UE could have. It could also be anything between a mobile phone used for talking to a data terminal attached to a computer with no voice capability.
- **Radio Network Subsystem (RNS):**
  The RNS also known as the UMTS Radio Access Network, UTRAN, is the equivalent of the previous Base Station Subsystem or BSS in GSM. It provides and manages the air interface for the overall network.
- **Core Network:** The core network provides all the central processing and management for the system. It is the equivalent of the GSM Network Switching Subsystem or NSS.
The core network is then the overall entity that interfaces to external networks including the public phone network and other cellular telecommunications networks.

	e)	**Draw GSM architecture and explain GSM control channels.**	**4M**

MS: MOBILE STATION
BSC: BASE STATION CONTROLLER
VLR: VISITOR LOCATION REGISTER
AUC: AUTHENTICATION CENTER

BTS: BASE TRANSCIVER STATION
MSC: MOBILE SWITCHING CENTER
HLR: HOME LOCATION REGISTER
OMC: OPERATIONAL & MAINTAINANCE
CENTER

PSTN: PUBLIC SWITCH TELEPHONE
NETWORK

ISDN: INTEGRATED SERVICES DIGITAL
NETWORK

Ans :

GSM control channel (CCH):
1) Broadcast channel (BCH):
Broadcast control channel (BCCH):
The BCCH is a forward control channel that is used to broadcast information such as cell and network identity, operating characteristics of the cell (current control channel structure, channel availability and congestion).
The BCCH also broadcast a list of channels that are currently in use within the cell.
(a) Frequency correction channel(FCCH):
The FCCH allows each subscriber unit to synchronize its internal frequency standard (local oscillator) to the exact frequency of the base station.
(b) **Synchronization channel (SCH):** SCH is used to identify the serving BS while allowing each mobile to frame synchronizes with the BS. The frame number (FN) is sent with the base station identity code (BSIC) during the SCH burst.

2) Common control channel (CCCH):
(a) **Paging channel (PCH):** The PCH provides paging signals from the BS to all mobiles in the cell, and notifies a specific mobile of an incoming call which originates from PSTN.PCH may be used to provide cell broadcast ASCII text messages to all subscribers.
(b) **Random Access Channel (RACH):** The RACH is a reverse link channel used by a subscriber unit to acknowledge a page from the PCH and is also used by mobiles to originate a call.
(c) **Access grant channel (AGCH):** The AGCH is used by the BS to provide forward link communication to the mobile, and carries data which instructs the mobile to operate in a particular physical channel.

3) Dedicated control channel (DCCH):
(a) **Stand-alone Dedicated control channel (SDCCH):** The SDCCH carries signaling data following the connection if the mobile with the BS, and just before TCH assignment issued by the BS. The SDCCH ensures that the mobile station and base station remain connected while the BS and MSC verifies subscriber unit.
(b) **Slow Associated Control Channel (SACCH):** On the forward link the SACCH is used

GSM architectur e :2M

Explanatio n of any two control channel :2M

Q.5		Attempt any **TWO** of the following :	**12-Total Marks**
	(a)	**Draw LMDS and explain it in detail.**	**6M**
	Ans	LMDS is one of the new proposed services and applications. It is in the early stages of commercialization.	**3M Explan**

to send slow but regularly changing control information to the mobile such a transmit power level instruction. On the reverse link the SACCH carries information about the received signal strength.

Fast Associated Control Channel (FACCH): FACCH carries urgent messages and contains essentially the same type of information as SDCCH.

LMDS is one of the new proposed services and applications. It is in the early stages of commercialization.

In 1998, 1200MHz of the unused spectrum in the 27-31GHz band was auctioned by the US government to support LMDS.

Similar auctioned were held worldwide. Various spectrums were allotted for the LMDS.

Most of these allocations share the frequencies with the teledesic band approved by the ITU for broadband satellite systems.

The teledesic band was originally established for the Motorola iridium system.

LMDS is a fixed wireless system. The table given shows the total spectrum bandwidth of various wireless systems in the US. It shows that the BW of 1300MHz has been allotted for LMDS.

The 1300MHz bandwidth of LMDS is sufficient to provide more than 200TV channels or 65000 full duplex voice channels.

The US LMDS band is 27.5 - 28.35 GHz, 29.1 – 29.25 GHz and 31.075 – 31.225 GHz.

However LMDS has its own drawbacks. LMDS is a brand new, and an unproven system. The equipment required for LMDS are millimeter wave equipment which are costly.

The most important application of LMDS is the Local Exchange Carrier (LEC) network. It is shown in the figure.

In this network the LEC uses a very wide bandwidth ATM (asynchronous transfer mode) or SONET (synchronous optical network) backbone switch.

Such a switch can connect hundreds of megabits per second traffic to the internet, PSTN, or to its own private network.

The LMDS thus provides wireless broadband connectivity to the customers without using the cables.

Difficulties:

The most important problem for LMDS of WLL is that of line of sight (LOS). If the antennas can be seen, then only the transmission is successful.

The other problem is that rain, snow and hail can create large changes in the channel gain between the transmitter and receiver.

Diagram:

3M Diagram

3M Explanation
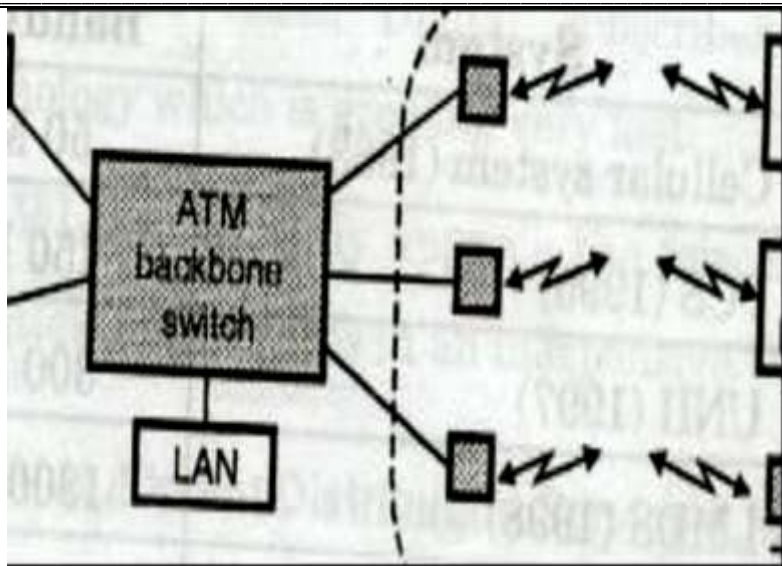
OR

LMDS: Local multi-point distribution system.

It is a broadband wireless point to multipoint communication system that provides reliable digital two-way voice, data and Internet services. The term "Local" indicates that the signals range limit. "Multipoint" indicates a broadcast signal from the subscribers, the term "distribution" defines the wide range of data that can be transmitted, data ranging anywhere from voice, or video to Internet and video traffic.

It provides high capacity point to multipoint data access that is less investment intensive.

Advantages:
- Lower entry and deployment cost.
- Ease and speed of deployment.
- Fast realization of revenue.
- Uses low powered high frequency (25-31 GHz) signals over a short distance.

3M Diagram

Four parts in LMDS are:
1. NOC (network operation center).
2. Fiber based infrastructure.
3. Base station.
4. Customer premise equipment.

Diagram:

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LMDS System Architecture

or

|	(b)	**Explain frequency reuse concept. Draw the frequency reuse pattern for cluster size 7.**	**6M**
	Ans :	i. The design process of selecting and allocating channel groups for all cellular base stations within a system is called as frequency reuse or frequency planning. **ii.** Cellular radio systems rely on an intelligent allocation and reuse of channels throughout a coverage region. Each cellular base station is allocated a group of radio channels to be used with small geographic area called a cell. Base stations in adjacent cells are assigned channel group which contains completely different channels than neighbouring cells. **iii**. By limiting the coverage area to boundaries of a cell, same group of channels may be used to cover different cells that are separated from each other by distances large enough to keep interference levels within tolerance limits.	**4M for explanation of frequency reuse concept**
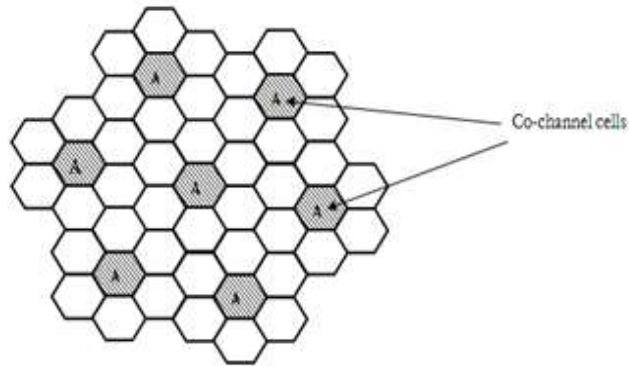
Fig: Frequency reuse

iv. If each cell is allotted K sets of channels and if S channels are divided among N cells in unique and disjoint groups which have same number of channels, then total number of available channels can be S=KN.
If cluster is replicated M times then capacity C=MKN=MS.
v. Frequency reuse factor =1/Cluster size (N)

vi. The cells which have been allotted same group of channels are called co-channels.
The co-channel reuse factor Q is defined as Q=D/R
Where, D=Minimum safe distance after which group of frequencies can be repeated
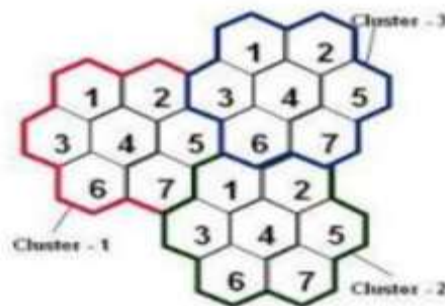R=Cell radius
Thus a small value of Q means larger capacity as cluster size N is small whereas large value of Q improves transmission quality. To improve capacity N is usually 4, 7 or 12.
vii. To improve capacity and efficiency of frequency reuse plan, cell sectoring is employed with Omnidirectional antenna.
Diagram:

frequency reuse pattern with cluster size 7

		2 M for Diagram of frequency reuse pattern for cluster size 7

(c)	**Explain step by step procedure of landline originated call with neat timing diagram.**	**6M**
Ans:	When a cellular phone is turned ON, but not yet engaged in a call, it first scans the group of forward control channels to determine the one with the strongest signal, and then monitors that control channel until the signal level drops below a usable level. **Call initiation by a landline (PSTN) subscriber to mobile user:** The mobile switching centre (MSC) dispatches the request to all base station in a cellular system. The Mobile Identification Number (MIN) which is subscriber telephone number is then broadcast as a paging message over all of the forward control channels throughout the cellular system. The mobile receives the paging message sent by BS which s monitors, and responds by identifying itself over the RCC. The BS relays the acknowledgement sent by the mobile and informs the MSC of handshake.	3M for

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The MSC instructs the BS to move the call to an unused voice channel pair within the cell.

The BS signals the mobile to change frequencies to an unused forward and reverse voice channel pair.

Another data message is transmitted on forward channel to instruct the mobile telephone to ring and mobile user to answer the phone.

Figure below shows sequence of events involved in call connection.

Diagram:

explanation

3M for timing diagram

OR

Call Procedure initiated by landline user/Call initiated by Landline Telephone

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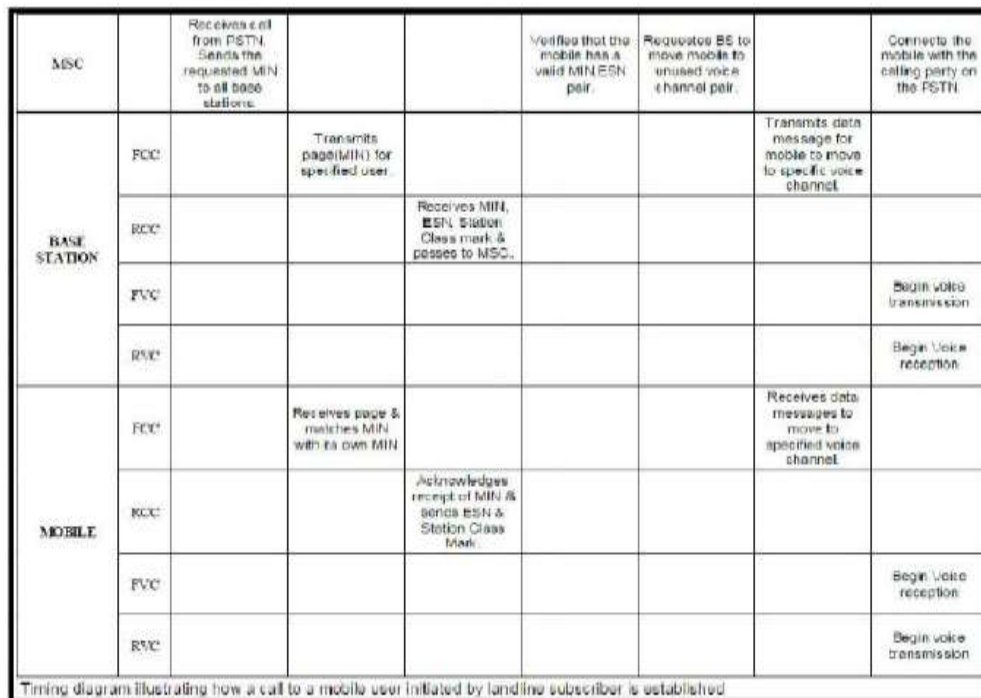
Figure: Call procedure initiated by Landline user

Q.6		**Attempt any <u>TWO</u> of the following:**	**12 Total Marks**
	(a)	**Identify the block diagram and explain the blocks A and B in Figure No. 2.** Fig. No. 2	**6M**
	Ans :	Block Diagram is of Mobile Unit. **Block A is Frequency Synthesizer** **Frequency Synthesizer of mobile unit:-** A frequency synthesizer is an electronic system for generating any of a range of frequencies from a single fixed time base or oscillator used for transmitter and receiver. • It uses PLL and mixer. • Crystal oscillator provides reference for the PLLs.	**2M for Identificati on of block diagram** **1M each**
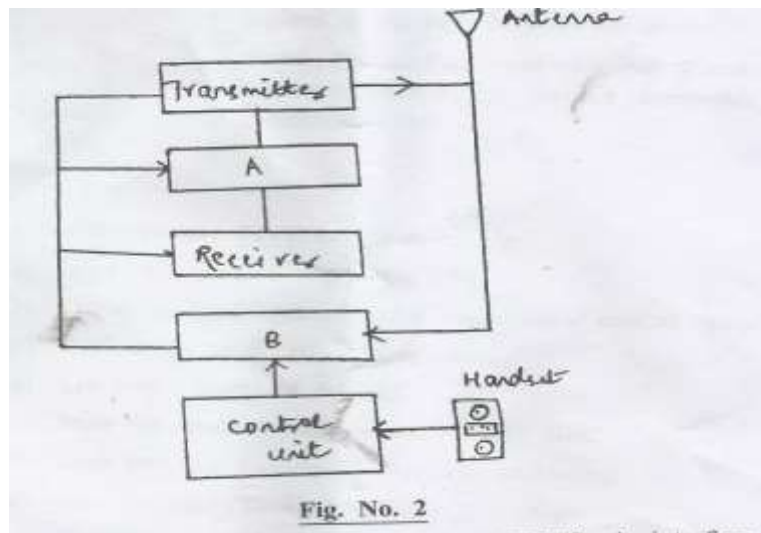
		Block B is Logic Unit	**for identification of block A & B**
		This unit contains master control circuit for a cellular radio. It is made up of microprocessor with RAM and ROM and additional circuit used for interpreting signals from MSC and BS and generates control signal for the transmitter and receiver. MTSO send serial data stream at 10Kbps the cell site to radio to control the transmit and receive frequency and transmitter power. MTSO monitors the received cell signal strength at the cellular radio by RSSI signal, and it monitors transmitter power level. These are transmitted back to cell site and MTSO. Audio tones are used for signaling purpose.	**1 M for explanation of frequency synthesizer** **1 M for explan of logic unit**
	(b)	**State the features of UMTS and give UMTS air interface specification.**	**6M**
	Ans :	**Features of UMTS:** UMTS (Universal Mobile Telecommunications Service) is a third generation (3G) broadband, packet-based transmission of text, digitized voice, video, and multimedia at data rates up to 2 megabits per second (Mbps). 1. Universal Mobile Telecommunications System (UMTS) is a air interface standard UMTS as a competitive open air-interface standard for 3G wireless telecommunications. 2. UMTS offers a consistent set of services to mobile computer and phone users, which is not depend on the location. UMTS is based on the Global System for Mobile (GSM) communication standard. Once UMTS is available, computer and phone users can be continuously connected to the Internet wherever they travel will have the same set of capabilities. Users will get access to internet via combination of terrestrial wireless and satellite transmissions. 3. A packet-switched connection that uses the Internet Protocol (IP) that provides a virtual connection is always available. 4. UMTS also makes it possible to provide new services like alternative billing methods or calling plans. For instance, users can choose to pay-per-bit, pay-per-session, flat rate, or asymmetric bandwidth options. 5. The higher bandwidth of UMTS also enables other new services like video conferencing. 6. UMTS may allow the Virtual Home Environment (VHE) to fully develop, where a roaming user can have the same services to either at home, in the office or in the field through a combination of transparent terrestrial and satellite connections. **UMTS air interface specification:**	**2 M for features of UMTS** **4M for UMTS air interface specifications**

SR.No	Parameters	Specifications
1	Frequency spectrum	Uplink,1920MHz-1980MHz,
2	Channel bandwidth	5MHz
3	Chip rate	3.84 Mcps

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4	Duplexing technique	FDD and TDD modes
5	Modulation scheme	Direct sequence CDMA and QPSK
6	Frame length	10 ms frame with 15 time slots
7	Coding technique	Orthogonal Variable Spreading
8	Service type	Multi-rate and multi-service

(c)	**Give the classification of RFID tags and give the application of RFID.**	**6M**
Ans :	**Classification of RFID Tags:** **Applications of RFID:** **i**. Automotive: • Auto makers have added security and convenience to automobiles by using RFID technology for anti-theft immobilizers and passive entry systems. • Some auto manufacturers use RFID systems to move cars through an assembly line. At each successive stage of production, the RFID tag tells the computers what the next step of the automated assembly is. **ii.** Animal tracking: • Ranchers and livestock producers use RFID technology to meet export regulations and optimize livestock value. • Wild animals are tracked in ecological studies, and many pets who are tagged are returned to their owners. • Thus a tag can carry information as simple as a pet owner's name and address. **iii**. Assets tracking: • Hospitals and pharmacies meet tough product accountability legislation with RFID; libraries limit theft and keep books in circulation more efficiently. **iv**. Contactless commerce: • Blue-chip companies such as American Express, Exxon Mobile, and MasterCard use innovative form factors enabled by RFID technology to strengthen brand loyalty and	**2M for classification of RFID tags** **4M for Applications of RFID**

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		boost revenue per customer.
		v. Supply chain:
		    • Wal-Mart, Target, Best Buy, and other retailers have discovered that RFID technology can keep inventories at the optimal level, reduce out of stock losses, limit shoplifting, and speed customers through check-out lines.
		vi. Replacement for bar codes:
		    • RFID can serve a lot of advantages by replacing bar codes.
		    • One of the key differences between RFID and bar code technology is RFID eliminates the need of line-of-sight reading that bar coding depends on.
		    • Also, RFID scanning can be done at greater distances than bar code scanning. High frequency RFID systems (850–950 MHz, 2.4–2.5 GHz) offer transmission ranges more than 90 feet.
		    • Barcodes are fixed at the time of printing and can be rendered useless by defacement or smudging.
		    • Bar codes can be spoofed or easily defeated by any malicious individual having a laser printer at their disposal.
		Note: marks to be credited if classification is given on frequency bases.	