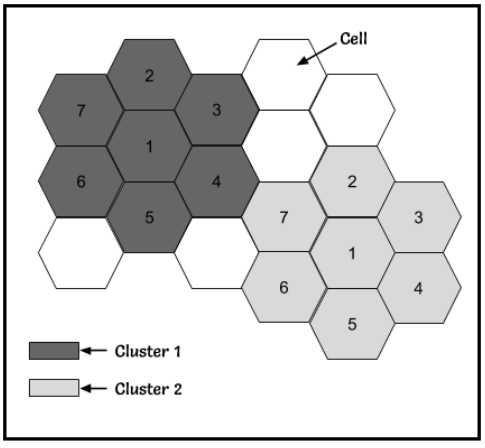
MODEL ANSWER
SUMMER– 18 EXAMINATION

Subject Title: MOBILE COMMUNICATION **Subject Code:-** 17657

Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills.
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q. No.	Sub Q.N.	Answer	Marking Scheme
Q.1	A)	**Attempt any THREE:**	12 Total Marks
	a)	**Define the following terms with the help of diagram :** **(i) Cell** **(ii) Cluster**	4 Marks
	Ans:	**Cell:** A cell is the geographical area covered by a cellular telephone transmitter. **Cluster:** The Number of cells which collectively use the complete set of available frequency is called CLUSTER.  Figure: Cluster Size & Frequency Reuse	1 M Each Definition 2 M Diagram

	b)	**List the specifications of IS-95B 2.5G.**	**4 Marks**
	Ans:	**Note: Any other relevant Specification can be considered.(any 4 correct Specification)** 1. Channel Bandwidth:1.25MHz 2. No. of voice channels: 64 user channels 3. Duplexing technique: FDD 4. Data Rate :115kbps 5. Throughput rate specification of 14.4 kbps 6. Allowing a dedicated user to command up to 8 different user Walsh codes simultaneously	**1M Each Specification.**
	c)	**Which system is best from GSM,IS—136 &IS-95? Justify your answer with any four points.**	**4 Marks**
	Ans:	Based on following parameters we can say IS-95 system is best 1. Multiple access technique CDMA, TDMA (Used in Both GSM & IS-136) 2. Modulation BPSK with quadrature spreading (π/4 DQPSK in IS-136) 3. Carrier separation 1025MHz (30KHz. In IS-136, & 45MHz in GSM) 4. Voice channels per carrier 64 (3 in IS-136 & 8 in GSM)	**1M for Mentioning System, 3M for justification**
	d)	**State the range of frequency access method and modulation type used in AMPS & GSM.**	**4 Marks**
	Ans:	**For GSM:** Frequency: Reverse Channel Frequency 890-915MHz, Forward Channel Frequency 935-960MHz Access method: TDMA Modulation: 0.3 GMSK **For AMPS:** Frequency: Reverse Channel Frequency 824-849 MHz, Forward Channel Frequency 869-894 MHz Access method: TDMA, FDMA Modulation: FM modulation	**2M GSM** **2M AMPS**
	B)	**Attempt any ONE:**	**06 Marks**
	a)	**Explain GSM radio subsystem and list any four GSM air interface specifications.**	**06 M**
	Ans:	Radio subsystem As the name implies, the radio subsystem (RSS) comprises all radio specific entities, i.e., the mobile stations (MS) and the base station subsystem (BSS). A GSM network is composed of several functional entities, whose functions and interfaces are specified.The GSM network can be divided into three broad parts. 1. The Mobile Station is carried by the subscriber. 2. The Base Station Subsystem controls the radio link with the Mobile Station. 3. The Network Subsystem. The Mobile Station and the Base Station Subsystem communicate across the **Um interface, also known as the air interface or radio link**. The Base Station Subsystem communicates with the Mobile services Switching Center across the **A interface.**	**4M Explanation** **1/2M each air interface specifications (any4)**

Mobile Station:

The mobile station (MS) consists of the mobile equipment (the terminal) and a smart card called the Subscriber Identity Module (SIM).

Base Station Subsystem:

The Base Station Subsystem is composed of two parts:

1. The Base Transceiver Station (BTS) and
2. The Base Station Controller (BSC).

- These communicate across the standardized Abis interface, allowing (as in the rest of the system) operation between components made by different suppliers.
- The Base Transceiver Station houses the radio transceivers that define a cell and handles the radio-link protocols with the Mobile Station. In a large urban area, there will potentially be a large number of BTSs deployed, thus the requirements for a BTS are ruggedness, reliability, portability, and minimum cost.
- The Base Station Controller manages the radio resources for one or more BTSs. It handles radio-channel setup, frequency hopping, and handovers, as described below. The BSC is the connection between the mobile station and the Mobile service Switching Center (MSC).

Sr. No.	Parameter	Specification
1.	Reverse Channel Frequency	890-915 MHz
2.	Forward Channel Frequency	935-960 MHz
3.	ARFCN Number	0 to 124 and 975 to 1023
4.	Tx/Rx Frequency Spacing	45 MHz
5.	Tx/Rx Time slot Spacing	3 Time slots
6.	Modulation Data rate	270.8333 kbps
7.	Frame Period	4.615ms
8.	User per Frame (Full rate)	8
9.	Time Slot Period	576.9s
10.	Bit Period	3.692 s
11.	Modulation	0.3 GMSK
12.	ARFCN Channel Spacing	200 kHz
13.	Interleaving (Max. Delay)	40 ms
14.	Voice Coder Bit Rate	13.4 kbps

b) Illustrate the process of call routing in mobile communication system. 6 Marks

	Ans:	**Note: Any other relevant Routing can be considered.**	**6 Marks Illustrate**

MSC		Receives call from PSTN. Sends the requested MIN to all base stations.			Verifies that the mobile has a valid MIN,ESN pair.	Requestes BS to move mobile to unused voice channel pair.		Connects the mobile with the calling party on the PSTN.
BASE STATION	FCC		Transmits page(MIN) for specified user.				Transmits data message for mobile to move to specific voice channel.	
	RCC			Receives MIN, ESN, Station Class mark & passes to MSC.				
	FVC							Begin voice transmission
	RVC							Begin Voice reception
MOBILE	FCC		Receives page & matches MIN with its own MIN				Receives data messages to move to specified voice channel.	
	RCC			Acknowledges receipt of MIN & sends ESN & Station Class Mark.				
	FVC							Begin Voice reception
	RVC							Begin voice transmission

Timing diagram illustrating how a call to a mobile user initiated by landline subscriber is established

OR

		MSC			Receives call initiation request from base station & verifies that the mobile has a valid MIN, ESN pair.	Instructs FCC of originating base station to move mobile to a pair of voice channels.		Connects the mobile with the called party on the PSTN.	
		BASE STATION	FCC				page for called mobile, instructing the mobile to move to voice channel.		
			RCC	Receives call initiation request and MIN,ESN,Station Class Mark.					
			FVC						Begin voice transmission
			RVC						Begin Voice reception
		MOBILE	FCC				Receives page & matches the MIN with its own MIN. Receives instruction to move to voice channel.		
			RCC	Sends a call initiation request along with subscribe MIN & number of called party					
			FVC						Begin Voice reception
			RVC						Begin voice transmission
		Timing diagram illustrating how a call initiated by mobile is established							

Q 2		**Attempt any FOUR:**	**16 Marks**
	a)	**Describe the effect of co-channel-interference in mobile communication. How it affect system capacity?**	**4 Marks**
	Ans:	• Frequency reuse implies that in a given coverage area there is several cells that use the same set of frequencies. These cells are called co-channel cells, and the interference between signals from these cells is called co-channel interference. • Unlike thermal noise which can be overcome by increasing the signal-to-noise ratio (SNR), co-channel interference cannot be eliminated by simply increasing the carrier power of a transmitter. This is because an increase in carrier transmit power increases the interference to neighboring co-channel cells. • To reduce co-channel interference, co-channel cells must be physically separated by a minimum distance to provide sufficient isolation due to propagation. When the size of each cell is approximately the same and the base stations transmit the same power, the co-channel interference ratio is independent of the transmitted power and becomes a function of the radius of the cell (R) and the distance between centers of the nearest co-channel cells (D).	**2M Effect, 2M System Capacity**

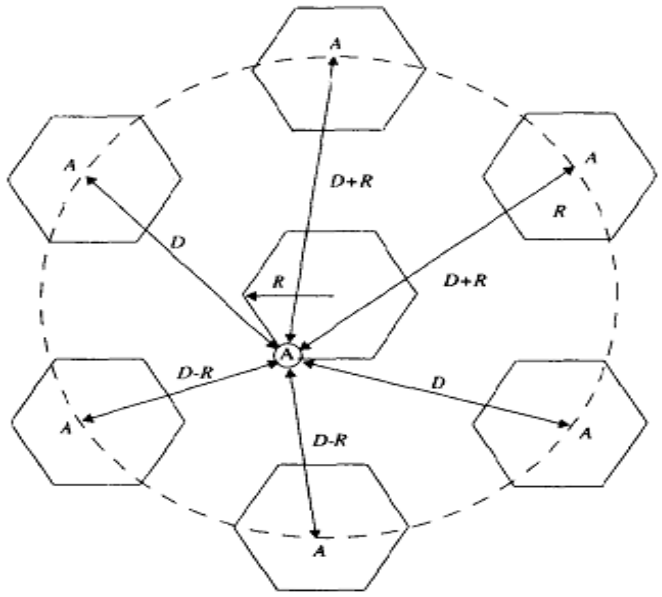


Figure: Co channel interference

- By increasing the ratio of D/R, the spatial separation between co-channel cells relative to the coverage distance of a cell is increased. Thus, interference is reduced from improved isolation of RF energy from the co-channel cell. The parameter Q, called the co-channel reuse ratio, is related to the cluster size. For a hexagonal geometry
- A small value of Q provides larger capacity since the cluster size N is small, whereas a large value of Q improves the transmission quality, due to a smaller level of co-channel interference. A trade-off must be made between these two objectives in actual cellular design.

b)	**State the advantages of 3G wireless network system. (any four)**	**4 Marks**
Ans:	**Note: Any other relevant Advantage can be considered.** • **Multi-megabit internet access.** • **Voice activated cells** • **Unparalleled network capacity** • **Ubiquitous "always on" access** • **Communications using Voice Over Internet Protocol**	**1M Each**
c)	**State the features of 3G-WCDMA.**	**4 Marks**
Ans:	**Note: Any other relevant Feature can be considered.**	**1M Each Feature**

Multiple access method	DS-CDMA
Duplexing method	Frequency division duplex/time division

		duplex	
		Base station synchronisation	Asynchronous operation
		Chip rate	3.84 Mcps
		Frame length	10 ms
		Service multiplexing	Multiple services with different quality of service requirements multiplexed on one connection
		Multi-rate concept	Variable spreading factor and multicode
		Detection	Coherent using pilot symbols or common pilot
		Multi-user detection, smart antennas	Supported by the standard, optional in the implementation

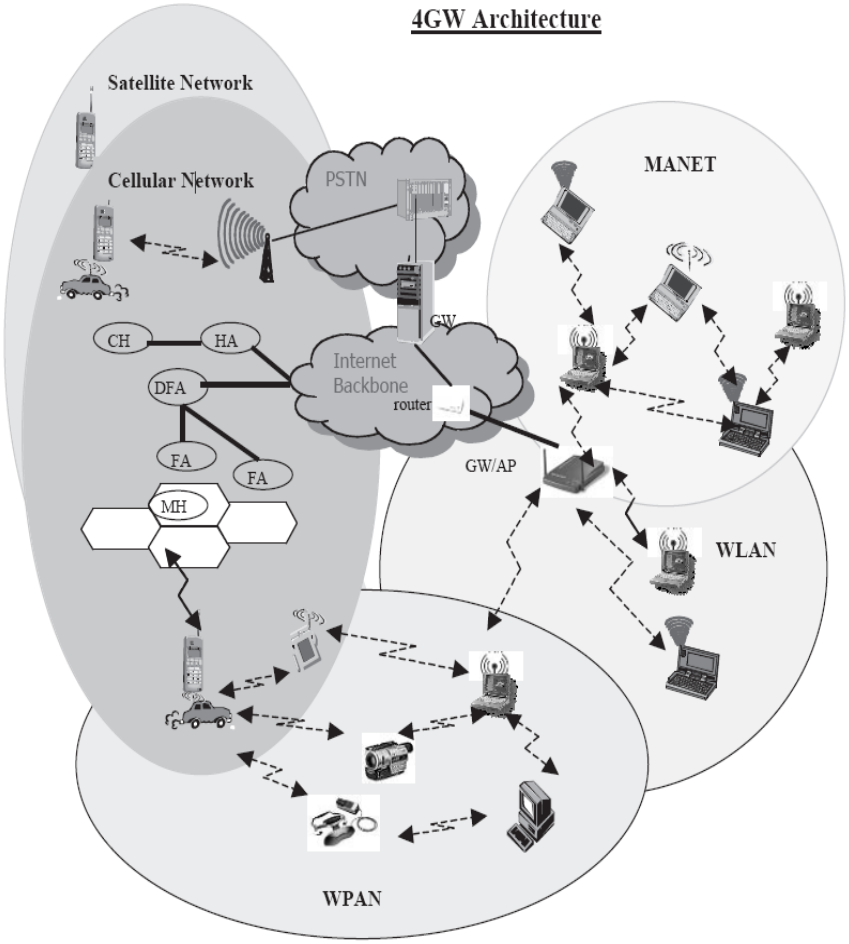
OR

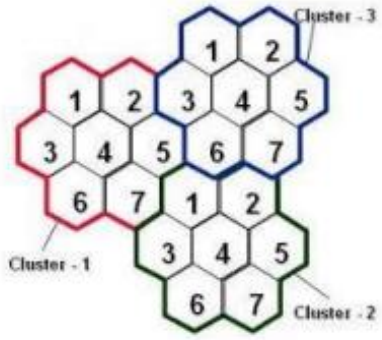
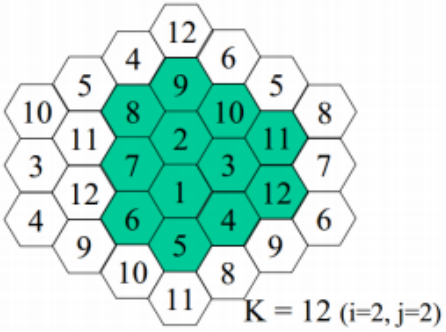
- It is more robust for multipath delays.
- It has very high packet data rates of 2.048 Mbps.
- It has very high channel bandwidth of 5 MHz
- It has backward compatibility with GSM systems.
- It has high frame structure of 16 slots per frame.
- It gives signals of higher voice and data quality and also small bit error rates.
- It has a common world-wide spectrum band.
- It has global seamless connectivity (roaming).

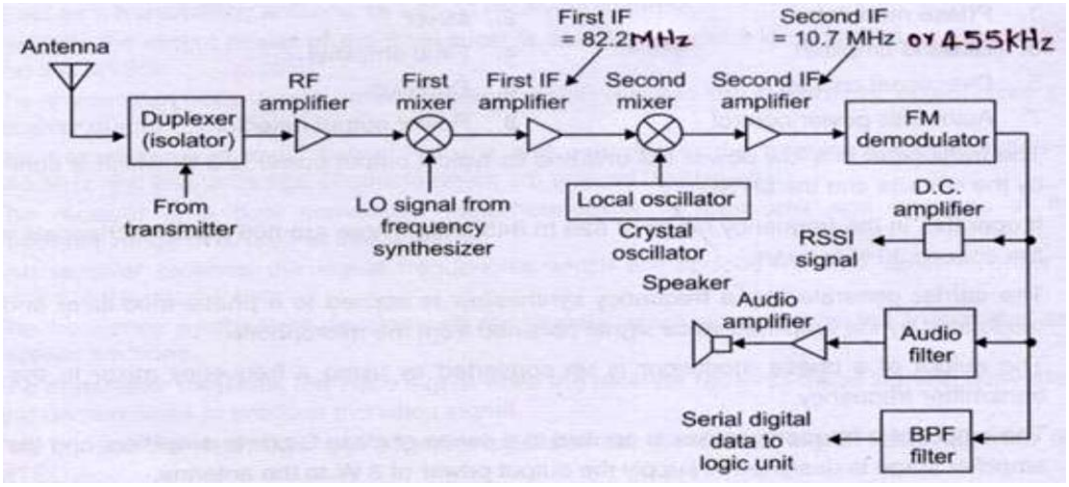
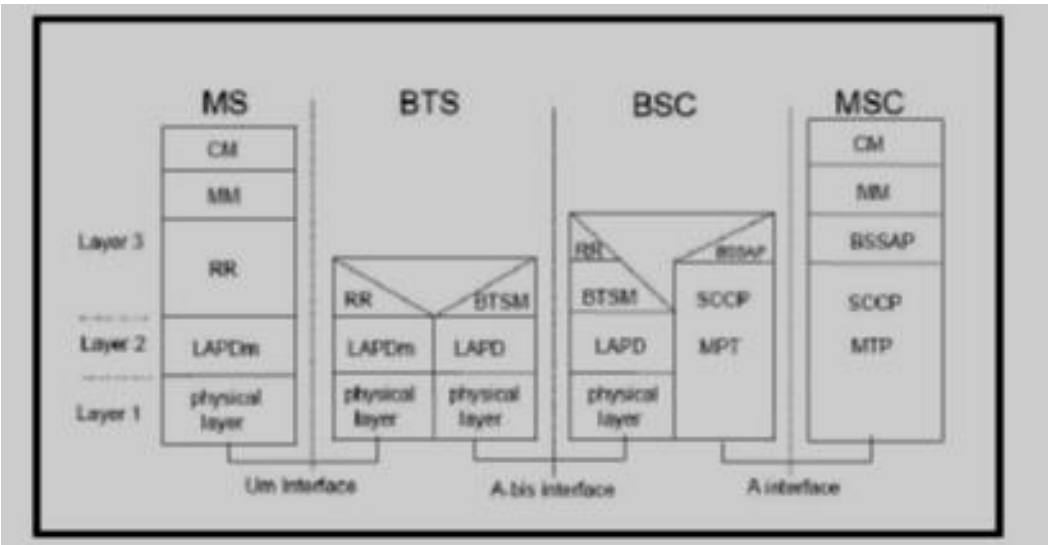
d)	**Compare GPRS standard with IS-95B standard with respect to** **(i) Backward compatibility** **(ii) Channel Bandwidth** **(iii) Data rate** **(iv) Number of voice channels**	**4 Marks**
Ans:		**1M Each**

	IS-95B	**GPRS**
Backward compatibility	**IS.95**	**GSM**
Channel bandwidth	**1.25 MHz**	**200 KHz**
No of voice channels	**64**	**8 per carrier**
Data rate	**64 kbps**	**171.2kbps**

e)	**Draw and explain architecture of 4G wireless system.**	**4 Marks**
Ans:	**Note: Any other relevant Diagram can be considered.**	**2M Diagram,**

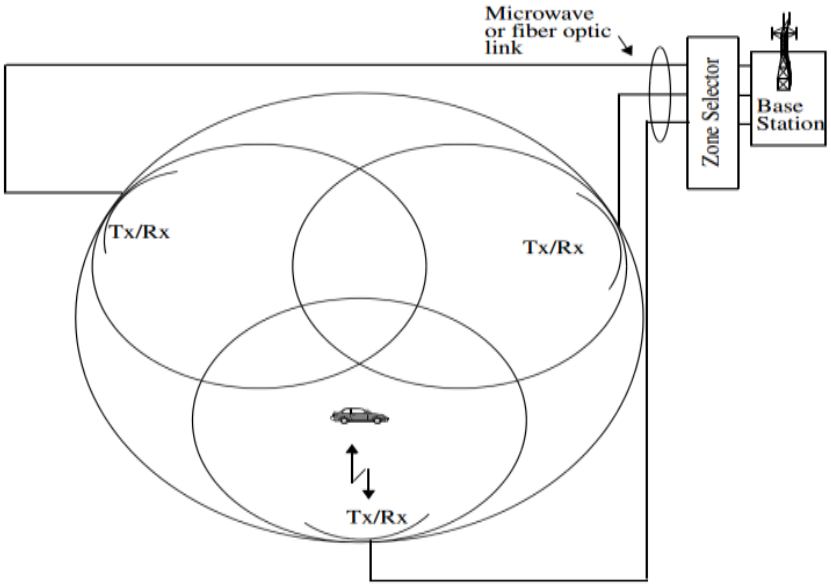
		 **All-IP Networks:** 4G starts with the assumption that future networks will be entirely packet-switched using protocols evolved from those in use in today's Internet. Lower Cost and Higher Efficiency: 4G IP-based systems are expected to be cheaper and more efficient. First, equipment costs are four to ten times lower than equivalent circuit-switched equipment for 2G and 3G wireless infrastructures. **Ultrahigh Speed and Multimedia Applications**: 4G systems aim to provide ultrahigh transmission speeds of up to 100 Mbps, 50 times faster than those in 3G networks. This leap in transmission speed will enable high-bandwidth wireless services, allowing users to watch TV, listen to music, browse the Internet, access business programs, perform real-time video streaming, and other multimedia-oriented applications, such as E-Commerce. **Ubiquitous Computing**: A major goal toward the 4G Wireless evolution is the provision of pervasive computing environments that can seamlessly and ubiquitously support users in accomplishing their tasks, in accessing information or communicating with other users at anytime, anywhere, and from any device. **Support of Ad Hoc Networking**: Non infrastructure-based mobile ad hoc networks (MANETs) are expected to become an important part of the 4G architecture. An ad hoc mobile network is a transient network formed dynamically by a collection of arbitrarily located wireless mobile nodes without the use of existing network infrastructure or centralized administration. Mobile ad hoc networks are gaining momentum because they	**2M Explanation**

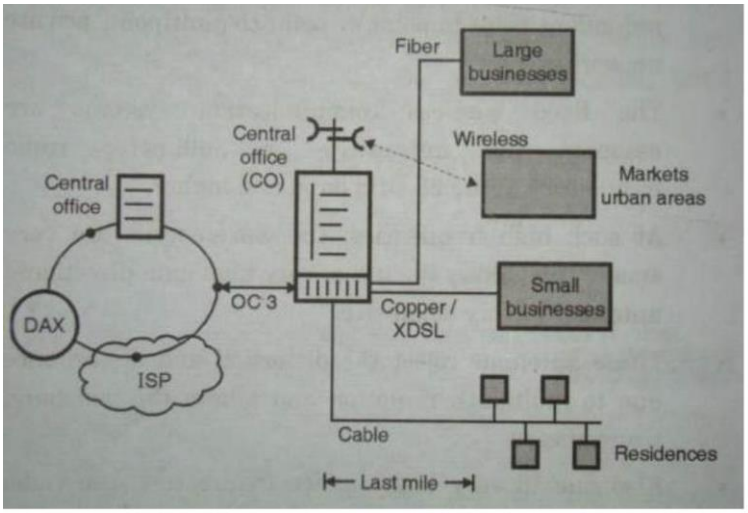
		help realize network services for mobile users in areas with no preexisting communications infrastructure. **Location Intelligence:** To support ubiquitous computing requirements, 4G terminals need to be more intelligent in terms of user's locations and service needs, including recognizing and being adaptive to user's changing geographical positions, as well as offering location-based services. Possible location-based services include finding nearest service providers, e.g., restaurants and cinemas; searching for special offers within an area; warning of traffic or weather situations; sending advertisements to a specific area; searching for other collocated users; active badge systems, and so on.	
	f)	**Draw the frequency reuse pattern with cluster size 7 & 12. State the advantages of frequency reuse.**	**4 Marks**
	Ans:	**frequency reuse pattern with cluster size 7**  **frequency reuse pattern with cluster size 12**  • **Increased capacity** • **Limited spectrum is required** • **Same spectrum may be allocated to other network** • **More Number of users can communicate simultaneously** • **Channel Efficiency is Increased** **Note: Any other Advantage can be considered.**	**1.5 M each Diagram, 1M Advantage**
Q. 3		**Attempt any FOUR:**	**16 Marks**

	a)	**Draw the block diagram of receiver unit of mobile handset and state its function.**	**4 Marks**
	Ans:	 The main function of receiver is to capture the signal of the desired frequency by filtering other adjacent frequency and demodulate signal and give to loudspeaker, apart from that mobile receiver also able to detect RSSI signal and other usable signals transmitted by BS and MSC □The receiver is a dual conversion super heterodyne radio receiver. □An RF amplifier boosts the level of received cell site signal. □The first mixer translates the incoming signal down to a first IF of 82.2MHz. □The signal passes through IF amplifier and filters to the second mixer. The second IF is usually either 10.7MHz or 455KHz □The signal is then demodulated, de-emphasized, filtered and amplified before being applied to the output speaker in the handset.	**Diagram - 2Mark , Function- 2 Mark**
	b)	**Draw GSM protocol model and describe any one layer.**	**4 Marks**
	Ans:	 **Figure: Protocol Model for GSM**	**Diagram - 2Mark , explaination-2 Mark**

- As shown in the figure, the signaling at the radio interface (Um) consist LAPDm at layer 2. LAPD is the modified version of LAPD (link access protocol f channel).
- Layer 3 is divided into 3 sublayers that deal with radio resource management (Mobility management (MM), and connection management (CM), respectively.
  - The radio resource management is concern with managing logical chan including the assignment of paging channels, signal quality measuren reporting, and handoff.
  - The Mobility management provides function necessary to sup user/terminal mobility, such as terminal registration, location upda authentication, and IMSI detach/attach.
  - The connection management is concern with call and connection con establishing & clearing calls/connections, management of supplemen services, and support of the SMS.
- the Abis interface between the BTS and the BSC, tends to be a proprietary inter in most GSM implementations.
  - The radio resource layer (RR') in the BTS is responsible for cha establishment and release, handoff, and paging.
  - The BTS management (BTSM) layer looks after the management c aspects of the radio channels, including radio link layer, control chan and transceiver management.
- The BSC-to -MSC interface (A interface) and the interface between an MSC VLR/HLR or another MSC deploy ITU-T signaling system 7 (SS7) using
  - MTP (message transfer part)
  - SCCP (signaling connection control part)
  - TCAP (transaction capability application part)
  - MAP (mobile application protocol).
- Connections between the MSC and other PSTN/ISDN exchanges utilize the Telephone user part (TUP) or the ISDN user part (ISUP) specific to the country or region.

	c)	**Describe microcell zone concept with suitable diagram.**	**4 Marks**

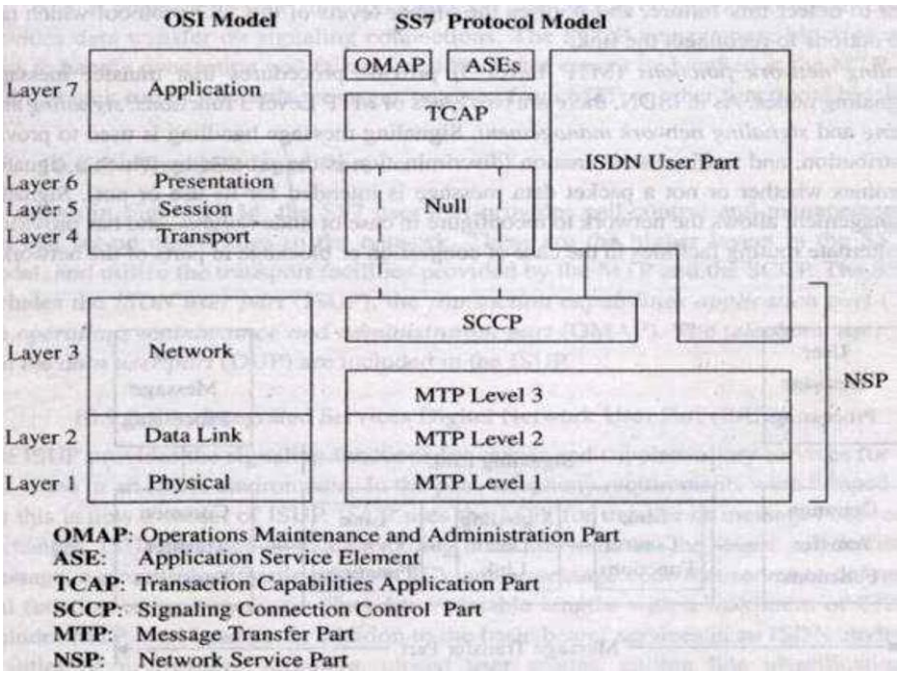
	Ans:	 **Description:** • The problem associated with the sectoring is the number of handoffs. This puts additional load on the switching and control link elements of the mobile system. A solution to this problem is based on microcell concept for seven cell reuse. • In this scheme, all the three or more 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 microwave link. • 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 of all. • 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 same channel. • 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 is travelling. • So the base station radiation is localized. 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.	**Diagram - 2Mark , Explaination-2 Mark**
	d)	**Draw the architecture of WLL. Write its applications.**	**4 Marks**
	Ans:	**WLL architecture**	**Diagram - 2Mark , Applications-2 M**



Applications.
There are two types of WLL :- 1 LMDS2 MMDS
Applications **:LMDS** provides services :- High speed internet access , Real time multimedia file transfer, remote access to local area network, interactive video , video on demand , video conference , telephone services

MMDS can transmit videos, voice or data signals at rate 1.5 to 2 Mbps downstream and 320 Kpbs to upstream

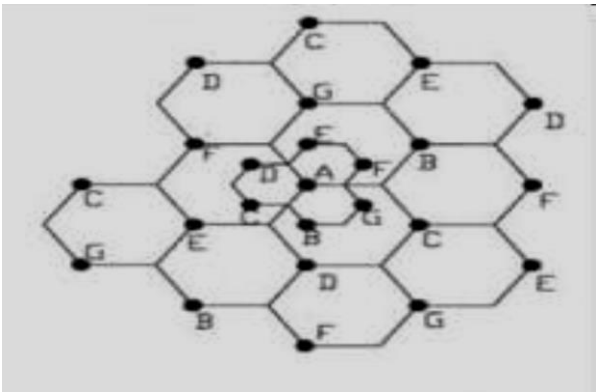
(Or student can write relevant WLL applications in other way)

e)	**SS-7 protocol architecture. Write any two features of SS-7.**	**4 Marks**
Ans:		**Diagram - 2Mark , Any two features-2 Mark**

		Features of SS7 are as under: • The control messages are routed through the network for different functions such as set up, maintenance management, termination etc. • The control signaling is implemented using the packet switching technology network (PSTN). • The mode used is associated channel mode but the use of disassociated mode is also possible.	
Q. 4	A)	**Attempt any THREE:**	**12 Marks**
	a)	**List the objectives of IMT 2000.**	**4 Marks**
	Ans:	Objectives of IMT 2000 system are as follows: 1) Common spectrum worldwide (1.8 – 2.2 GHz band) 2) Date rates of :9.6 Kbps or higher for global (mega cell),144 Kbps or higher for vehicular(macro cell),384 Kbps or higher for pedestrian (micro cell) and up to 2 Mbps for indoor environments (pico cell) 3) Global seamless roaming. 4)Multiple environments, that are not only confined to cellular, but also includes cellular,cordless, satellite, LANs, wireless Local loop (WLL) 5) Enhanced performance and security. 6) Wide range of telecommunications services (voice, data, multimedia etc) 7) Flexible radio bearers for increased spectrum efficiency 8) Full integration of wireless and wireline systems.	**Four objectives -4 marks(one mark each)**
	b)	**Write the important features of GSM and state the services offered by GSM.**	**4 Marks**
	Ans:	**The important features of GSM**	**Features - 2Mark , Services-2 Mark**

Sr. No.	Parameter	Specification
1.	Reverse Channel Frequency	890-915 MHz
2.	Forward Channel Frequency	935-960 MHz
3.	ARFCN Number	0 to 124 and 975 to 1023
4.	Tx/Rx Frequency Spacing	45 MHz
5.	Tx/Rx Time slot Spacing	3 Time slots
6.	Modulation Data rate	270.8333 kbps
7.	Frame Period	4.615ms
8.	User per Frame (Full rate)	8
9.	Time Slot Period	576.9 µs
10.	Bit Period	3.692 µs
11.	Modulation	0.3 GMSK
12.	ARFCN Channel Spacing	200 kHz

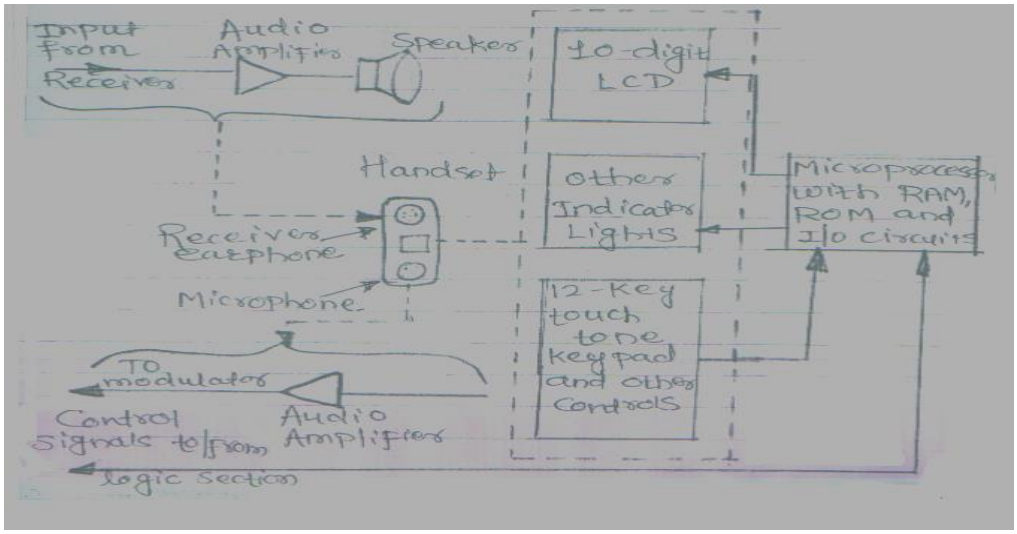
		The services offered by GSM **Telephone Services:** Teleservices include 1. Standard mobile telephone 2. Mobile-originated 3. Base-originated traffic 4. emergency calling 5. Fax 6. Videotext 7. Tele text 8. SMS 9. MMS. **Supplementary ISDN services:** This service are digital in nature and include 1. Call diversion 2. Caller line ID 3. Closed user group 4. Call barring 5. Call waiting 6. Call hold 7. Connected line ID 8. Multiparty (Teleconferencing) 9. Call charge advice This service also include the Short Messaging Service (SMS) which allow SM subscriber and BS to transmit alphanumeric pages of limited length (160 -7 ASCII characters) while simultaneously carrying normal voice traffic.	
	c)	**State any four features of HSCSD for 2.5G GSM.**	**4 Marks**
	Ans:	1) As the name implies, High Speed Circuit Switched Data is a circuit switched technique that allows a single mobile subscriber to use consecutive user time slots in the GSM standard. 2) GSM TDMA standard, HSCSD allows individual data users to commandeer (officially take possession or control) consecutive time slots in order to offer higher speed data access to the GSM network. 3) HSCSD relaxes the error control coding algorithms originally specified in the GSM standard for data transmissions, and increases the available application data rate to 14,400 bps, as compared to the original 9,600 bps in the GSM specification. 4) By using up to 4 consecutive time slots, HSCSD is able to provide a raw transmission rate of up to 57.6 kbps to individual users, and this enhanced data offering can be billed as a premium service by the carrier. 5) HSCSD is ideal for dedicated streaming internet access or real-time interactive web sessions, and simply requires the service provider to implement a software change at existing GSM base stations.	**4 features 4Mark (one mark each)**
	d)	**Define the term cell splitting.**	**4 Marks**
	Ans:	**Concept:** The cell splitting achieve the capacity improvement by essentially rescaling	**Diagram - 2Mark ,**

		the cellular system □By decreasing the cell radius R and keeping the co-channel reuse ratio D/R unchanged, cell splitting increases the number of channels per unit area □The cell splitting is the process of subdividing a congested cell into small cells with its own base station having the corresponding reduction in the antenna heights and the transmitted power Cell. 	**Defination -2 Mark**
	B)	**Attempt any ONE:**	**06 Marks**
	a)	**Define the term handoff. State the different types of handoff used in cellular system. Explain MAHO.**	**6 Marks**
	Ans:	**Handoff:** When a mobile moves into a different cell while a conversation is in progress, the MSC automatically transfers the call to a new channel belonging to the new base station. This process of transferring call to a new base station is called as Hand off. **Types of Hand off** 1. Mobile Assisted Hand off 2. Intersystem Hand off 3. Delayed Handoff (Two level Hand off) 4. Queued Handoff 5. Hard hand off 6. Soft hand off 7. Inter system handoff **Hand off Process:** □The term hand-off does not mean a physical change in the assigned channel but rather than a different base station handles the radio communication task. □Hand-off is a process of automatically transferring the call to a new frequency channel belonging to a new base station, when the cellular mobile phone moves into a different frequency zone so that the conversation can be continued in a new frequency zone without dialing. In **Mobile Assisted Handoff (MAHO)** every mobile station measures the received power from surrounding base stations and continually reports the results of these measurements to the serving base station. • A handoff is initiated, when the power received from the base station of a neighboring cell begins to exceed the power received from the current base station by a certain level or for a certain period of time.	**Definition -2mark, types of hand off-2mark, MAHO explanation -2 Mark**

		• In MAHO method call handed over between base stations is much faster than first generation analog systems .As handoff measurements are made by each mobile . MSC no longer constantly monitors signal strengths. MAHO is particularly suited for microcellular environments where handoffs are more frequent. During the course of a call, if a mobile moves from one cellular system to a different cellular system controlled by a different MSC, an intersystem handoff becomes necessary. • An MSC engages in an intersystem handoff when a mobile signal becomes weak in a given cell and the MSC cannot find another cell within its system to which it can transfer the call in progress. •	
	b)	**Describe signalling traffic control tasks in SS-7.**	**6 Marks**
	Ans:	**i)Call origination from mobile –** Signaling System 7 (SS7) is an international telecommunications standard that defines how network elements in a public switched telephone network (PSTN) exchange information over a digital signaling network. Nodes in an SS7 network are called signaling points. SS7 consists of a set of reserved or dedicated channels known as signaling links. There are three kinds of network points signaling points: Service Switching Points (SSPs), Signal Transfer Points (STPs), and Service Control Points (SCPs). SSPs originate or terminate a call and communicate on the SS7 network with SCPs to determine how to route a call or set up and manage some special feature. Traffic on the SS7 network is routed by packet switches called STPs. SCPs and STPs are usually mated so that service can continue if one network point fails. SS7 uses out-of-band signaling, which means that signaling (control) information travels on a separate, dedicated 56 or 64 Kbps channel rather than within the same channel as the telephone call. Historically, the signaling for a telephone call has used the same voice circuit that the telephone call traveled on (this is known as in-band signaling). Using SS7, telephone calls can be set up more efficiently and special services such as call forwarding and wireless roaming service are easier to add and manage. **ii)Inter MSC hand off** Handover mechanism is extremely important in cellular network because of the cellular architecture employed to maximize spectrum utilization.Handover is the procedure that transfers an ongoing call from one cell to another as the users moves through the coverage area of cellular system. One way to improve the cellular network performance is to use efficient handover prioritization schemes when user is switching between the cells. Some advance schemes namely, guard channels, call admission control and handover queuing are utilized. All these of prioritizations schemes have a common characteristic reducing the call dropping probability at the expense of increased call blocking probability. Efficient prioritization scheme accommodates a number of new calls while guarantees the quality of service (QOS) of handover call. This idea is based on the neighboring cells have an overlapping (the area served by more	**Complete Explanation-6Mark**

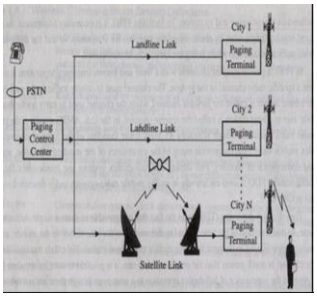
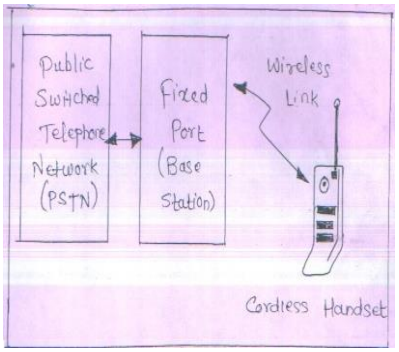
Signaling load for call setup and Handoff in GSM	
Call originating from mobile	Load
Information on the originating MSC and the terminating Switch	120 bytes
Information on the originating MSC and the associated VLR	550 bytes

Call terminating at a mobile	Load
Information on the switch and terminating MSC	120 bytes
Information on the terminating MSC and associated VLR	612 bytes
Information on the originating switch & HLR	126 bytes
Inter MSC handoff	Load
Information on the new MSC and associated VLR	148 bytes
Information on the new MSC and the old MSC	383 bytes

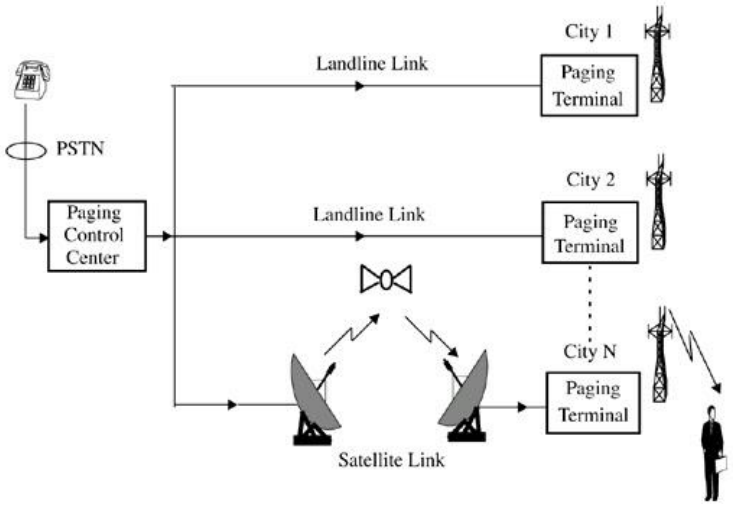
Q.5		**Attempt any FOUR.**	**16 Marks**
	a)	**Draw block diagram of control unit with handset. Explain its operation.**	**4 Marks**
	Ans:	 The control unit contains handset with speaker and microphone. It also contains a complete touch tone dialing circuit. It is operated by a separate microprocessor drives the LCD display and other indicator .It also implements all manual control functions .The microprocessor memory permits storage of often called numbers and an auto dial features .The demodulated signal coming from the receiver is amplified by an audio amplifier and applied to the loudspeaker whereas the electrical equivalent of voice signal is produced by the microphone & amplified by the audio amplifier. This signal acts as the modulating signal and applied to the modulator.	**Block diagram:-2M, Operation :-2M**

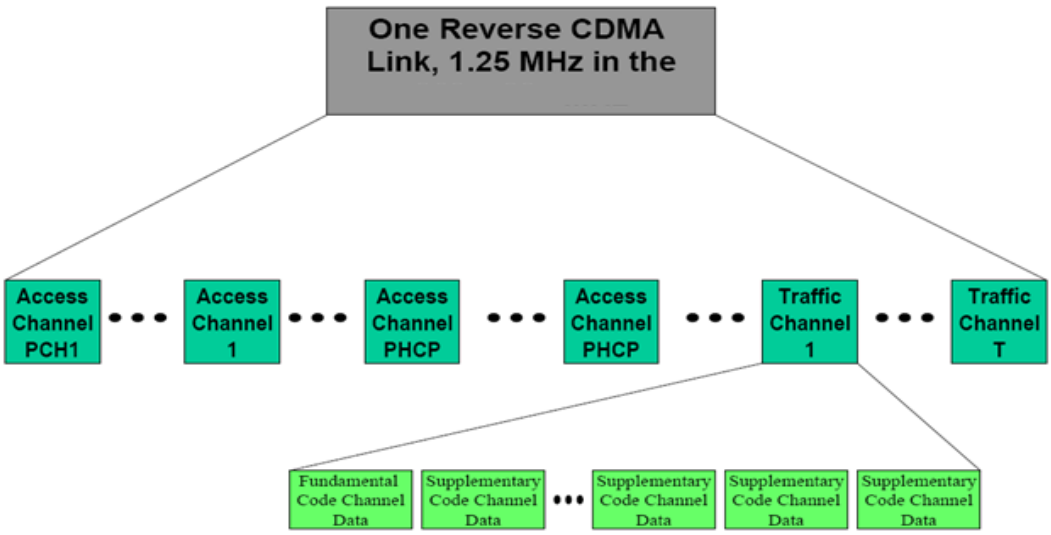
b) **Differentiate between paging system and cordless telephone system. (any four points)** **4 Marks**

Ans: **Any four points:- 4M(1 M each)**

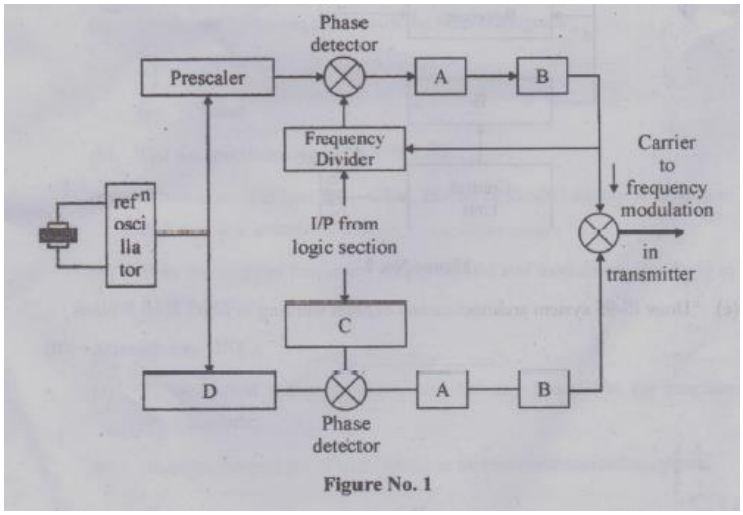
Sr No	Parameter	Paging system	cordless telephone system.
1	Coverage Range	Since paging covers a limited range of 2 to 5 km	Typical second generation base stations provide coverage range up to a few hundred meters.
2	Operation	Paging system transmits the message known as page along with paging system access number throughout the service area using base station on a radio link.	Early cordless telephones operate solely as extension telephones to a transreciever connected to a subscriber line on the PSTN but modern cordless telephones are sometimes combined with paging receivers so that a subscriber may first be paged and then respond to the page using the cordless telephone.
3	Block Diagram	 **Please refer the image given below**	
4	System requirement	PSTN, paging control center satellite links and paging receivers. Though paging receivers are simple and inexpensive, the transmission system required is quite sophisticated.	Cordless Telephone Systems are systems that use radio to connect aportable handset to a dedicated base station, which is also connected to a dedicated telephone line with a specific telephone number on PSTN.
5.	Applications	Pager is most useful option of one way communication and provides value added services such as sports line, news line, helpline, bilingual paging and intercity paging.	Cordless telephone system includes residential cordless setups, public telepoint systems and wireless PBX and key systems.

		6	Communication System	Simplex	Full Duplex



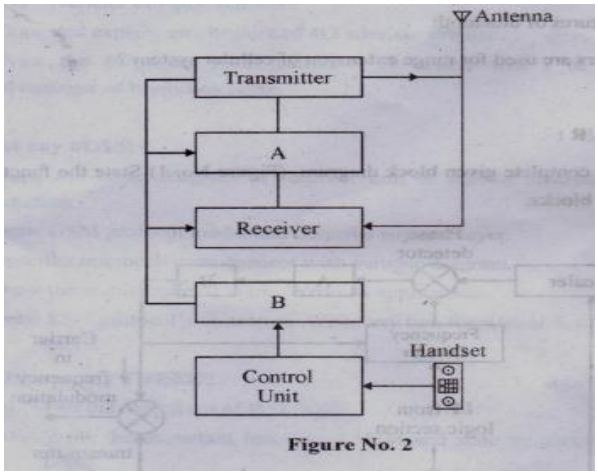
c)	**Draw reverse channel structure of IS-95 CDMA. Write function of each channel in it.**	**4 Marks**
Ans:	 **Reverse channel** is a communication channel used for transmission of information from Mobile station(MS) to Base station(BS) **Access channel:** On access channel mobile users communicate short messages such as information registration, call origination, and responses to pages, or providing other data to cell site. When mobile user places a call, it uses the access channel to inform the serving base station. **Reverse Traffic channel:** This traffic channel carries the user speech or data. It is similar to the forward traffic channel and is intended to transfer dedicated user data. The traffic channels in reverse channel are unique to each mobile user.	**Diagram:-2M,Function of Access channel:-1M, Traffic channel:-1M**

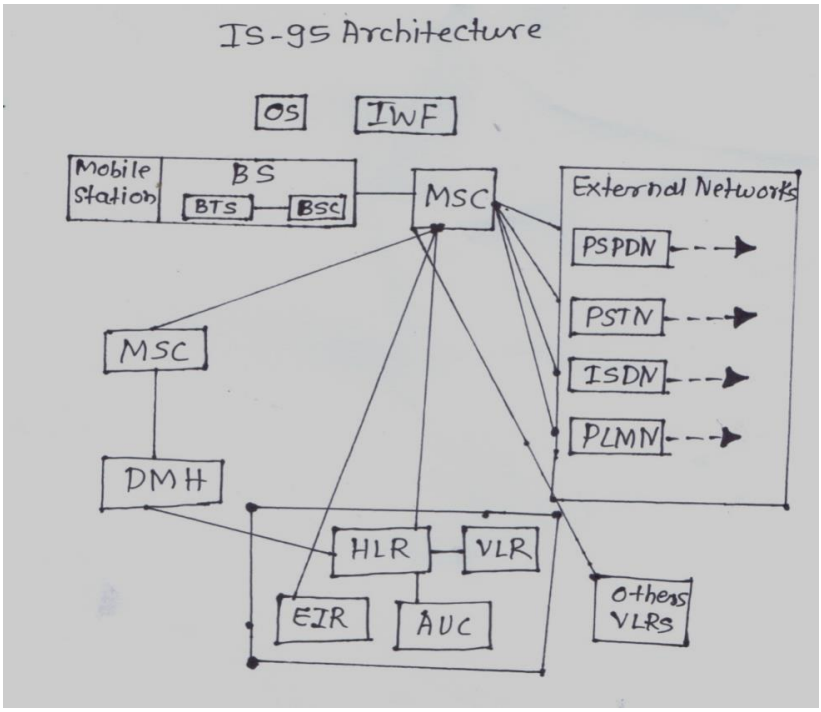
<table>
<tr><td></td><td>d)</td><td>Describe 3G-TD-SCDMA with respect to spectrum, utilization, bandwidth,data rate and antenna.</td><td>4 Marks</td></tr>
<tr><td></td><td>Ans:</td><td><table>
<tr><td>Spectrum utilization</td><td>Less spectrum utilization,5ms frame is used and divided into seven time slot and assigned to user</td></tr>
<tr><td>Bandwidth</td><td>High,1.6 MHz</td></tr>
<tr><td>Data rate</td><td>Up to 384kbps of packet data rate</td></tr>
<tr><td>Antenna</td><td>Smart Antenna</td></tr>
</table></td><td>1 M Each Parameter</td></tr>
<tr><td></td><td>e)</td><td>State the features of Bluetooth.</td><td>4 Marks</td></tr>
<tr><td></td><td>Ans:</td><td>1. Replacing chords that connect devices to one another with an invisible, low power, short range wireless connection is one of the important features.
2. Ability to move equipment throughout an area.
3. Allows collaborative communication between individuals, their appliances and environment.
4. Bluetooth devices can communicate at range of up to 10 meters.
5. Bluetooth devices do not need to be in direct sight of each other.
6. Each Bluetooth device has the capability of sharing all of its features with other Bluetooth devices in the surrounding area.
7. Audio, text, data & even video is contemplated in Bluetooth standard.
8. Bluetooth phone can share information with a Bluetooth-enabled computer or printer, just like one Bluetooth-enabled computer can link to another
9. Bluetooth-enabled computer, sharing all the features, such as the Internet.</td><td>1 M each (Any 4 points)</td></tr>
<tr><td></td><td>f)</td><td>How repeaters are used for range extension of cellular system?</td><td>4 Marks</td></tr>
<tr><td></td><td>Ans:</td><td><u>Use of Repeater for range extension.</u>
• It is often necessary provide the dedicated coverage of cellular mobile system. For hard-to-reach areas, such as within building or in valley and tunnels.
• The radio Transmitter known as repeaters, are often used to provide such range extension capabilities. Therepeaters are bidirectional in nature.
• They simultaneously send signal to and receive signals from base station.
• The repeater work using air signals so that they may be installed anywhere and are capable of repeating and entire cellular and personal communication (PCS) band.
• The repeaters amplifiers and reradiates the base signal, to the specific coverage region after receiving signals from a base station forward link.
• At the same time, the receiver noise and interreference are also radiated by the repeater on both the forward and reverse link.
• Therefore, we must take care proper care to place the repeater properly and to adjust various forward and reverse link amplifier levels and antenna pattern properly.
• In practice the directional antennas or distributed antenna systems (DAS) are connected to the inputs or outputs of repeaters for localized for spot coverage,</td><td>Explanation:-4M</td></tr>
</table>

		particularly tunnels and buildings. • The repeaters do not add capacity to cellular system, but it simply serves to radiate the base station signals into specific locations. • The repeater is increasingly used to provide coverage into and around buildings, where coverage has been traditionally weak.	
Q.6		**Attempt any FOUR.**	**16 Marks**
	a)	**Identify and complete given block diagram. (Figure No. 1) State the function of identified blocks.**  **Figure No. 1**	**4 Marks**
	Ans:	The above block diagram is – Frequency Synthesizer A- Low Pass Filter(LPF) B- Voltage controlled Oscillator(VCO) C- Frequency Divider D- Prescaler **Function of Identified Block-:**Low Pass Filter(LPF)-A low-pass filter is a filter that passes signals with a frequency lower than a certain cutoff frequency and attenuates signals with frequencies higher than the cutoff frequency **Voltage controlled Oscillator(VCO)-:**The output of VCO-2 is used as a local oscillator frequency for the first mixer in the receiver.The outputs of the two VCOs are mixed together to produce the transmitter output frequency. **Frequency Divider-:** Frequency dividers are used to generate a frequency that is a multiple of a reference frequency. These frequencies are then used for transmitters and receiver section The frequency divider block receives the divide by numbers from the logic section. **Prescaler-:** A prescaler is an electronic counting circuit used to reduce a high frequency electrical signal to a lower frequency by integer division.The purpose of the prescaler is to allow the timer to be clocked at the rate a user desires.	**Identify and completeblock diagram:-2M, function of identified blocks:-2M**
	b)	**Compare GSM with CDMA with respect to following points:** **(i) Hand off used** **(ii) Modulation used**	**4 Marks**

		(iii) Number of users **(iv) Channel Bandwidth**	
	Ans:		**1 M Each Parameter**

Parameter	GSM	CDMA
Hand off used	Hard	Soft
Modulation used	GMSK	QPSK/BPSK
Number of users	8 user per channel	20 to 35 per channel
Channel Bandwidth	200KHZ	1250KHZ or 1.25MHZ

	c)	**Describe the concept of channel blockage and call drops.**	**4 Marks**
	Ans:	There are two types of blockage Set up channel blockage-Information regarding Set up channel blockage cannot be obtained for cell site because the mobile unit will be searching for the busy/idle bit of a forward set up channel in order to set up its call. If busy bit does not change after 10 call attempts in 1s,a busy tone is generated, and no mobile transmit can take place. In another case the mobile transmit take place as soon as the idle bit is shown. The set up channel blockage should be at least less than half of the specified blockage (usually 0.02) in the mobile cellular system. Voice channel blockage - Voice channel blockage can be evaluated at the cell site. When all call come in, some are refused for service because there are no available voice channels. Call drops (Dropped Call rate)-Call drops are defined as call drop for any reason after the voice channel has been assigned. Sometimes call drops due to weak signals are called lost calls. The drop call rate is partially based on the handoff-traffic model and partially based on signal coverage. **Note: - Any relevant answer/Description shall be considered**	**Description of channel blockage:-2M, call drops:-2M**
	d)	**Identify and complete given block diagram. State function of each block.**  **Figure No. 2**	**4 Marks**
	Ans:	**Block diagram of mobile unit** **A-** Frequency Synthesizer **B-** Logic Unit	**Identify and completebl**

		Transmitter: It is low power FM unit operating in the frequency range of 825 to 845MHz.There are 666, 30 KHz transmit channel. The carrier is furnished by a frequency synthesizer is a phase modulated by voice signal. **Receiver:** The receiver is a dual conversion super heterodyne. The incoming signal frequency is down converted twice to frequency of 455KHz or 10.7MHMz with the help of mixer and IF amplifier stages. The signal is then demodulated deemphasized and filtered and given to loudspeaker. **Frequency Synthesizer:** This block generates all the signals used by transmitter and receivers. It uses standard PLL circuits and a mixer. **Logic Unit:** 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. **Control unit:** The control unit contains the handset with speaker and microphone. The control unit is operated by a separate microprocessor that drives the LCD display and other indicators.	**ock diagram:-2M, function of Block:-2M**
	e)	**Draw IS-95 system architecture and explain working of MSC & HLR block.**	**4 Marks**
	Ans:	 **Mobile Switching Center:** It co-ordinates the activities of the entire base stations and connect the entire cellular system to the PSTN. A typical MSC handles 100,000 cellular subscribers and 5,000 simultaneous conversations at a time, and accommodates all billing and system maintenance functions as well. **Home Location Register:** Permanent database about mobile subscribers in a large service area.Database contains subscriber & location information. Database contains prepaid/postpaid, roaming restrictions, supplementary services.	**Architecture:- 2M** **working of MSC:-1M** **working of HLR:-1M**