MODEL ANSWER
WINTER– 18 EXAMINATION

Subject Title: Mobile Communication

Subject Code: 17657
3 Hours / 100 Marks

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 judgment 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)	**Describe use of multiple access technologies. List multiple access technologies used for cellular System.**	**4M**
	Ans:	• In wireless communication systems, it is often desirable to allow the subscriber to send information simultaneously from the mobile station to the base station while receiving information from the base station to the mobile station. • The main aim in the cellular system design is to be able to increase the capacity of the channel, i.e., to handle as many calls as possible in a given bandwidth with a sufficient level of quality of service. • Multiple access techniques are used to allow a large number of mobile users to share the allocated spectrum in the most efficient manner. • So to increase the system capacity of the system, multiple access techniques are used. 1. TDMA (Time Division Multiple Access) 2. FDMA (Frequency Division Multiple Access) 3. CDMA (Code Division Multiple Access)	**3M Explanation** **1M List**

b)	**List the following specification of IS-95B for 2.5 G CDMA standards.** **(i) Data rate** **(ii) Modulation Technique** **(iii) Duplexing Technique** **(iv) Handoff method**	**4M**
Ans:	Specification of IS-95B are; (i) Data Rate --115kbps (ii) Modulation Technique--QPSK /BPSK (iii) Duplexing technique—FDD (iv) Handoff method—Hard Handoff	**1 mark each**
c)	**Compile the advantages of EDGE with respect to –** **(i) Modulation Technique** **(ii) Error Control** **(iii) Channel Bandwidth** **(iv) Duplexing Method**	**4M**
Ans:	(i) Modulation Technique- GMSK, 8PSK (ii) Error Control - turbo codes are used. these are a class of high-performance forward error correction (iii) Channel bandwidth – 200 KHz (iv) Duplexing method - FDD	**1M Each.**
d)	**Compare system used around the world (AMPS, IS – 95, GSM and NAMPS) with the following points:** **(i) Year of introduction** **(ii) Frequency Range used** **(iii) Modulation used** **(iv) Channel Bandwidth**	**4M**

Ans:

	AMPS	**IS – 95**	**GSM**	**NAMPS**
Year of introduction	1986	1995	1993	1991
Frequency Range	869 to 894 MHz and 824 to 849 MHz	869 to 894 MHz and 824 to 849 MHz	890-915 MHz 935-960 MHz	869 to 894 MHz and 824 to 849 MHz
Modulation used	FM	Quadrature phase-shift keying (QPSK)	0.3 GMSK	FM
Channel Bandwidth	30 kHz	1.25 MHz	200 kHz	30 kHz

1M for each parameter

	(B)	**Attempt any ONE :**	**6 Total Marks**
	(a)	**Write GSM Air interface specification for the following parameters :** **(i) Reverse channel frequency** **(ii) Forward Channel frequency** **(iii) ARFCN number** **(iv) Modulation** **(v) TX/RX Frequency spacing** **(vi) Users per frame**	**6M**
	Ans:		**1M Each**

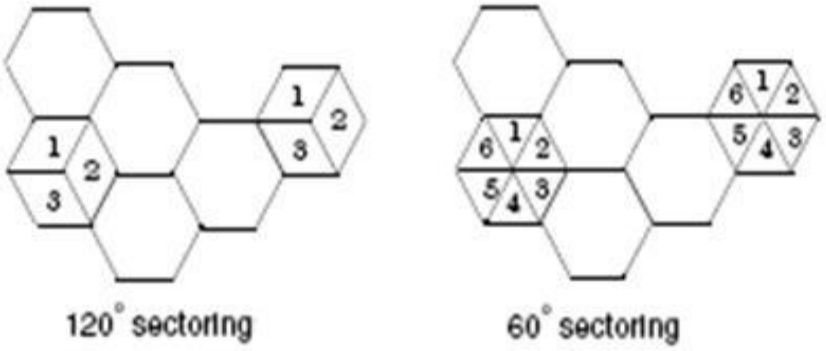
Sr. No.	Parameter	Specification
1.	Reverse Channel Frequency	890-915 MHz
2.	Forward Channel Frequency	935-960 MHz
3.	ARFCN Number	0 to 124 and 975 to 1023
4.	Modulation	0.3 GMSK
5.	Tx/Rx Frequency Spacing	45 MHz
6.	User per Frame (Full rate)	8

	(b)	**Describe the call processing in cellular phone for mobile originated call with timing diagram.**	**6M**
	Ans:	• When a mobile originates a call, a call initiation request is sent on the **reverse control channel**. With this request the mobile unit transmits its telephone number (MIN), Electronic Serial Number (ESN) and the telephone number of the called party. • The base station receives the MIN, ESN of called party along with Station Class Mark (SCM) which indicates what the maximum transmitting power level is. The received details are forwarded to MSC. • The MSC validates the request by checking the MIN, ESN etc. in its records. after validation, MSC instructs the originating Base station to move mobile to a unused pair of voice channels(FORWARD & REVERSE VOICE CHANNEL). • The called party telephone number, is then broadcast as paging message over all **forward control channel** throughout the cellular system (*If the called number is another mobile phone*) . • The mobile receives the Paging message sent by base station which it monitors, and matches the received MIN with its own MIN. • With MIN the called mobile phone number receives the instruction of moving itself to unused pair of voice channel. and then it makes connection to the called party. • *This connection is made with the called party through the PSTN, if the called party number is a landline telephone.*	**3M Explanation** **3M Diagram**

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

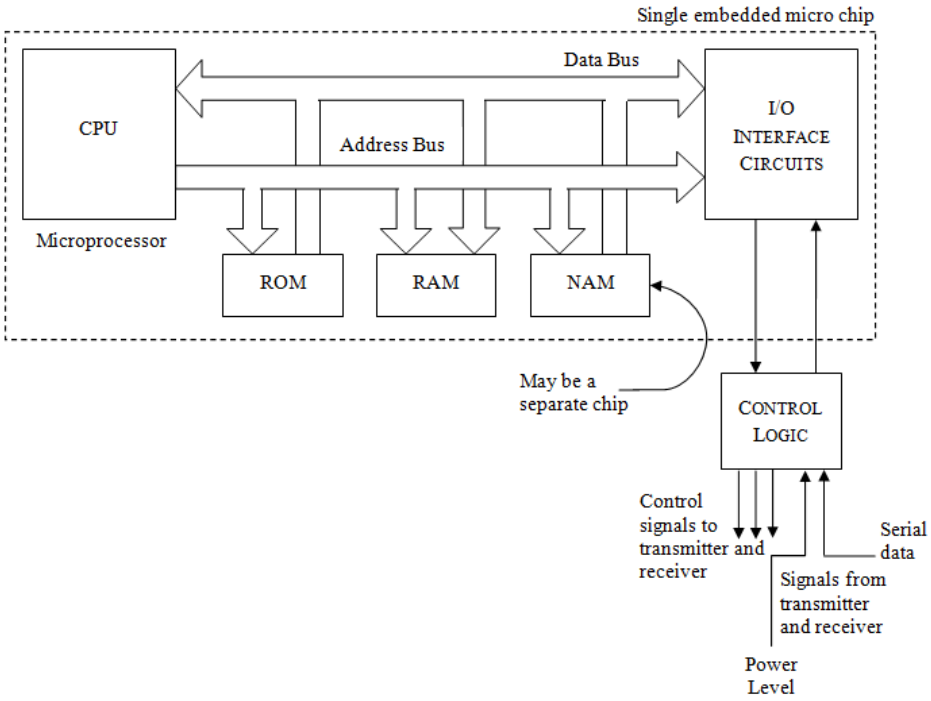
Timing diagram illustrating how a call initiated by mobile is established

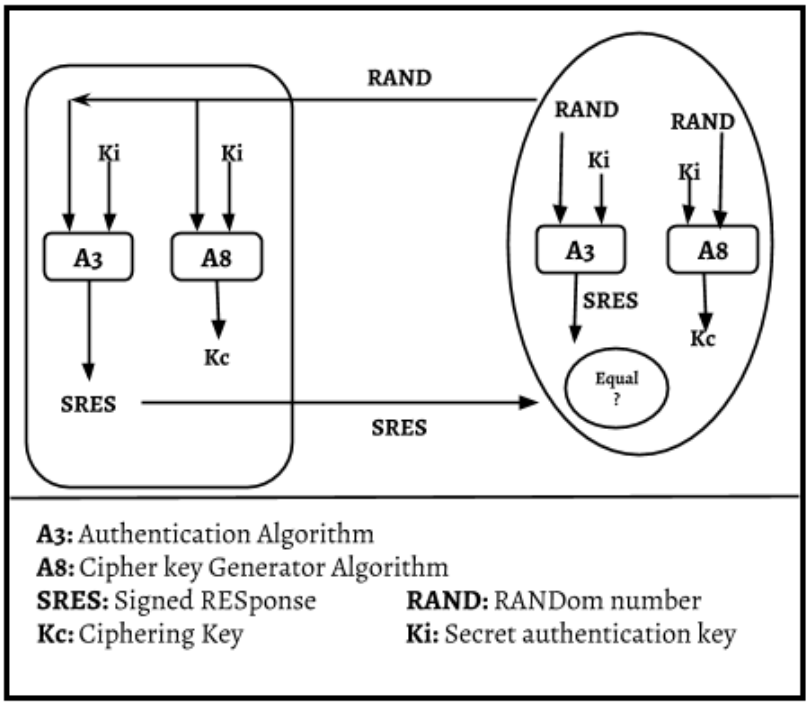
Q 2		**Attempt any FOUR of the following :**	**16-Total Marks**
	a)	**How cell sectoring improve capacity in cellularsystem?**	**4M**
	Ans:	**Cell Sectoring** The technique for decreasing the co- Channel interference and thus increasing system performance by using directional antenna is called Sectoring. To increase capacity in cellular systems, the cell radius is unchanged and seek methods to decrease D/R ratio. This is done by Cell Sectoring. Sectoring increases SIR so that the cluster size may be reduced. First the SIR is improved using directional antennas, and then capacity improvement is achieved by reducing the number of cells in a cluster, thus increasing frequency reuse. To achieve this, it is necessary to reduce the relative interference without decreasing the transmit power. The co-channel interference in a cellular system may be decreased by replacing a single omni-directional antenna at the base station by several directional antennas, each radiating within a specified sector. The factor by which the co-channel interference is reduced depends on the amount of sectoring used. A cell is normally partitioned into three 120° sectors or six 60° sectors	Explanation – 3marks Diagram- 1 mark

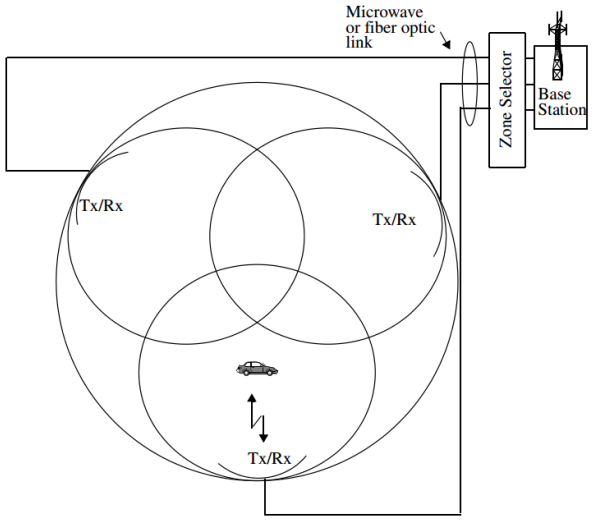
		as shown in figure. In sectoring, the channels used in a particular cell are broken down into sectored groups and are used only within a particular sector.  Assuming seven-cell reuse, for the case of 120° sectors, the number of interferers in the first tier is reduced from six to two. This is because only two of the six co-channel cells receive interference with a particular sectored channel group.	
	b)	**List four specification of 3G W- CDMA (UMTS).**	**4M**
	Ans:	**Ans:** Specifications of UMTS are: 1. It is more robust for multipath delays. 2. It provides higher immunity towards frequency selective fading. 3. It has very high packet data rates of 2.048Mbps. 4. It has very high channel bandwidth of 5 MHz. 5. It has backward compatibility with the GSM systems. 6. It has high frame structure of 16 slots per frame. 7. It gives signals of higher voice and data quality and also small bit-error rates. 8. It has a common world-wide spectrum band. 9. It can operate in multiple radio environments such as cellular, cordless, satellite, LAN etc. 10. It has a wide range of telecommunication services such as voice, data, multimedia, internet etc. 11. It has global seamless connectivity (roaming).	**(1 mark each specification) (any 4 specifications)**
	c)	**Write four applications of MANET.**	**4M**

	Ans:	Note: Any other Relevant applications can be considered.
		Any 4 Applications.
		• Personal area networking
		  ○ cell phone, laptop, ear phone, wrist watch
		• Military environments
		  ○ soldiers, tanks, planes
		• Civilian environments
		  ○ car network
		• meeting rooms
			1M Each

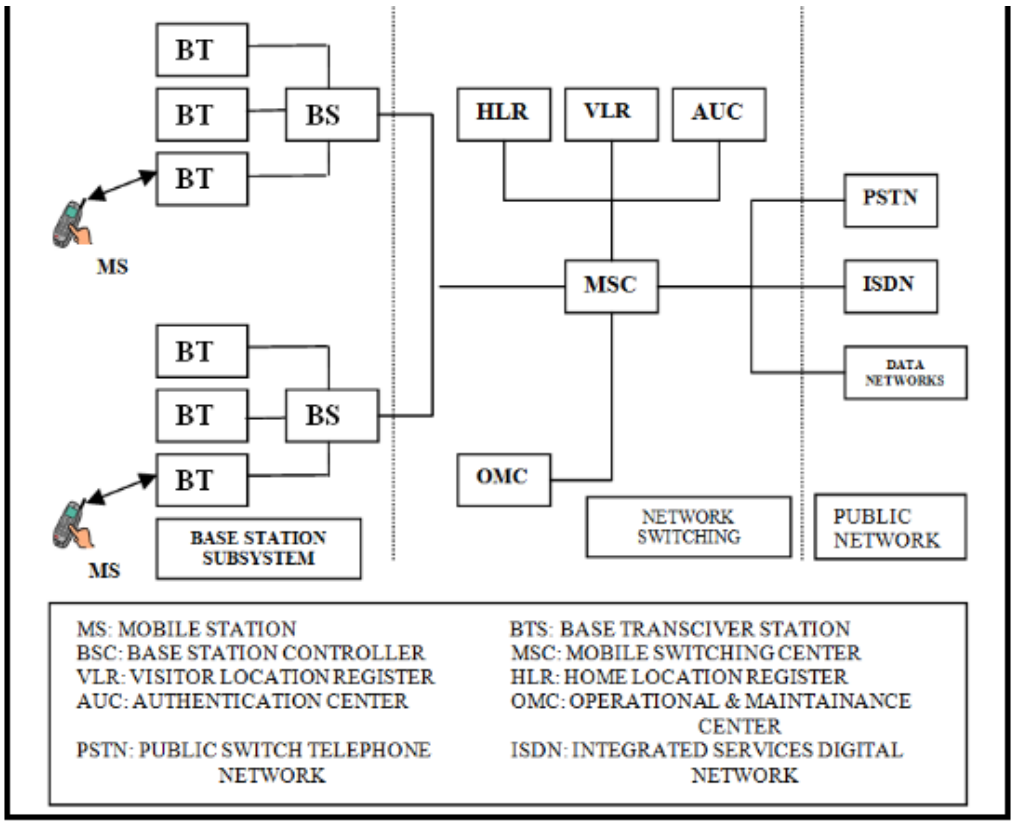
		○ sports stadiums ○ boats, small aircraft • Emergency operations ○ search-and-rescue ○ policing and fire fighting	
	d)	**State Data communication standards for GPRS using following Points :** **(i) Channel Bandwidth** **(ii) Duplexing Technique** **(iii) Infrastructure change** **(iv) Requirement of new Spectrum**	**4M**
	Ans:	**(i) Channel Bandwidth-**200KHZ **(ii) Duplexing Technique**: frequency division duplex (FDD) **(iii) Infrastructure change:** the modem is an external piece of equipment (iv) **Requirement of new Spectrum:** Data rate is increased up to 114 Kbps	**1mark each**
	(e)	**State four features of Bluetooth.**	**4M**
	Ans:	**Ans:** 1. Each Bluetooth device has the capability of sharing all of its features with other Bluetooth devices in the surrounding area. 2. Bluetooth-enabled computer, sharing all the features, such as the Internet. 3. Bluetooth devices can communicate at ranges of up to 10 meters (Class B) 4. Bluetooth devices do not need to be in direct sight of each other. 5.Frequency – 2.4 GHz 6. Maximum Transmission rate is less than 1 Mbps	**(any 4 features- 1 Mark each)**
	(f)	**If 20 MHz of total spectrum is available for duplex system which uses 225 kHz simplex channels to provide full duplex voice and control channels, compute number of channels available per cell if a system uses seven cell frequency reuse pattern.**	**4M**
	Ans:	**The data given is improper. Hence the no. of channels is fractional. Students may be awarded marks if the procedure and formula of calculation is correct** Total BW = 20 MHz Channel BW = 225KHz*2 simplex channels = 450 KHz /duplex channel Total available channels =20000KHz/450KHz = 44.4 channels For N=7 , Total no. of channels available per cell is 44.4/7= 6.34 channels	**1M for channel BW 1.5 M each for total channels and channels / cell**

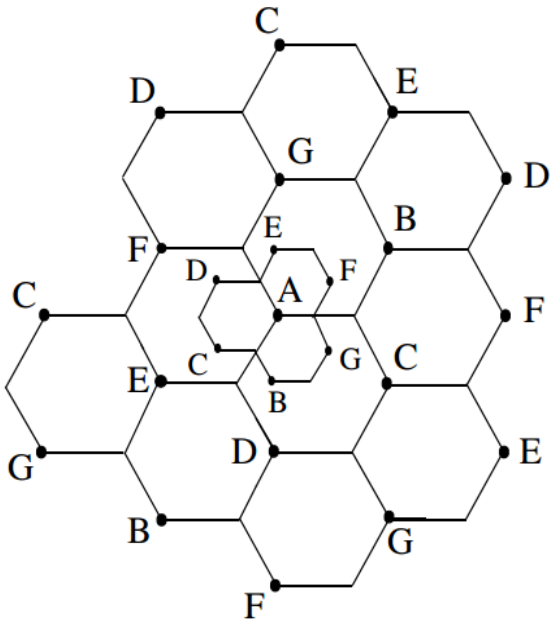
Q.3		Attempt any FOUR of the following :	16-Total Marks
	(a)	**Draw and describe the operation of logic unit in mobile unit.**	4M
	Ans:		**Diagram – 2marks**
		• It is made up of an embedded microprocessor with both ROM & RAM plus additional circuitry used for interpreting signals from MTSO and cell site & generating control signal for the transmitter & receiver. • A cellular radio contain a programmable read only memory chip called "Number Assignment Module (NAM)". The NAM contains the Mobile Identification Number (MIN), which is the telephone number assigned to the unit. The NAM PROM is 'burned' when the Cellular Radio is purchased & the MIN is assigned. • This chip allows the radio to identify itself when a call is initiated or when the radio is interrogated by the MTSO. • All cellular mobile radios are fully under control of the MTSO through the cell site. The MTSO sends a serial data stream at 10 kbps through the cell site to the radio to control the transmitter & receiver frequency & transmitter power. • The MTSO monitors the received cell signal strength at the cellular radio by way of RSSI signal & it monitors the transmitter power level. These are transmitted back to the cell site & MTSO. Audio tones are also used for signaling purpose.	**Explanation – 2marks**

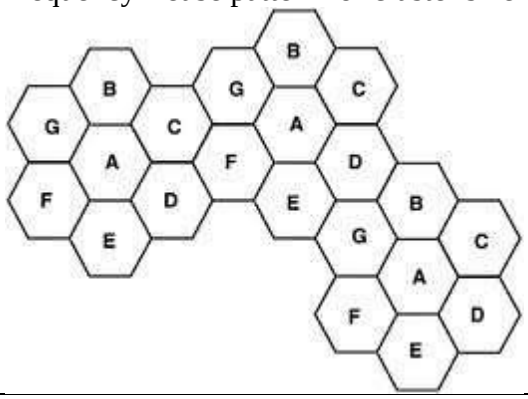
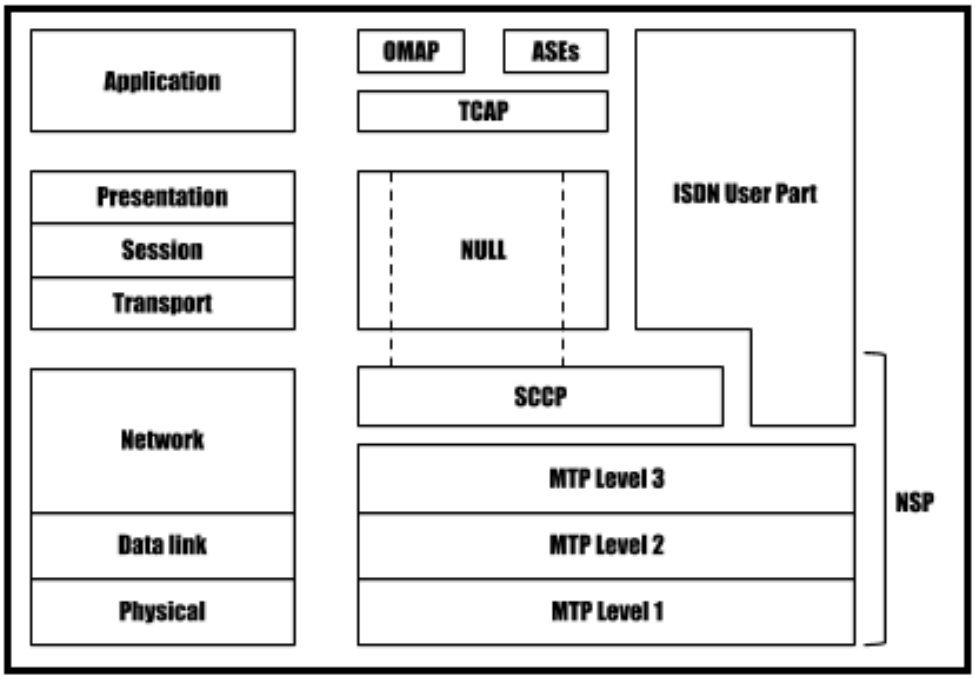
	(b)	**Describe authentication process in GSM With A3 Algorithm.**	**4M**
	Ans:	**Note: Any other relevant Diagram can be considered.**  **Explanation** Authentication refers to process by which station confirms the identity of mobile station. It protects GSM network against unauthorized access. The Authentication 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.	**Diagram – 2marks** **Explanation – 2marks**

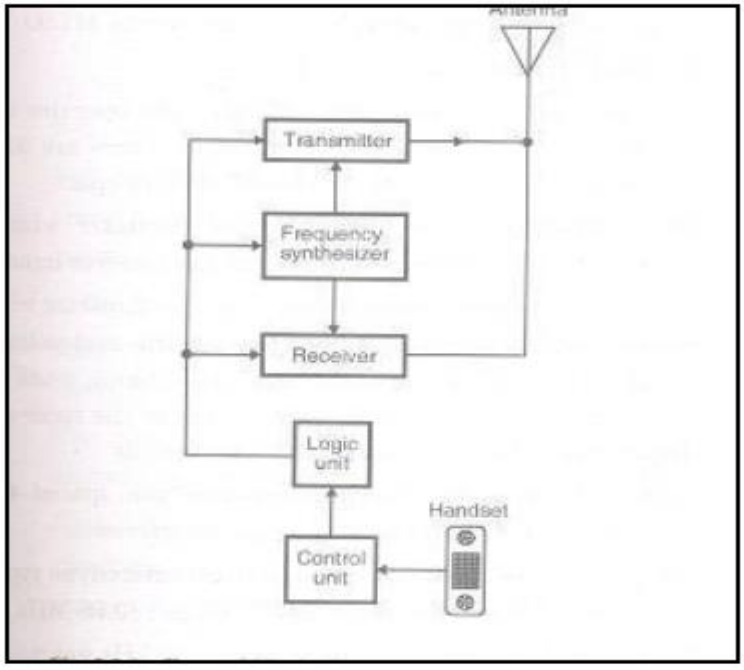
(c)	**Illustrate microcell zone concept with neat sketch.**	**4M**
Ans:	 • The problem associated with the sectoring is the number of handoffs. This puts additional load on the switching and control link elements of the mobile system. A solution to this problem is based on microcell concept for seven 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 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.	**Diagram – 2marks and** **Explanation – 2marks**
(d)	**State feature of 3G TD- SCDMA. (Any four)**	**4M**
Ans:	Note: any other Relevent feature can be considered. (1) Bandwidth: 1.6MHZ (2) Data Rate: Up to 384kbps of packet data rate, (3) Multiple Access: Time division synchronous code division multiple access technology. (4) Backward Compatibility: GSM (5) Developed by: China academy at telecomm (CATT) and seimens corporation jointly developed. (6)uplink signals are synchronized at the base station receiver	Any 4 features – 1mark each

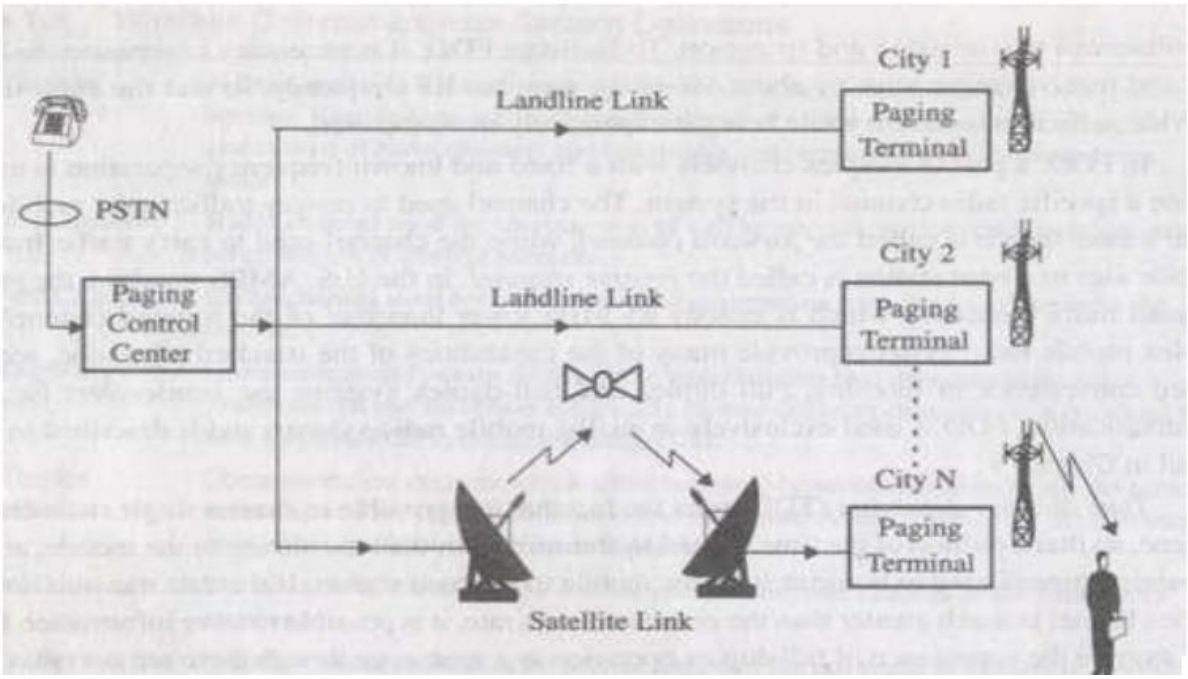
		(7) Reduces the interference between users of the same timeslot using different codes by improving the orthogonality between the codes	
	(e)	**Describe various SS7 Services.**	**4M**
	Ans:	**SS7 Services:** • **Touchstar:** o This kind of service is also known as CLASS and is a group of switch-controlled services that provide its users with certain call management capabilities. o Services such as call return, call forwarding, repeat dialing, call block, call tracing and caller ID are provided. • **800 Services:** o 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. o The costs associated with the processing of the calls are paid by the service subscriber. o The service is offered in two plans known as the 800-NXX plan and the 800 database plan. o In the 800-NXX plan the first six digits of an 800 call are used to select the interexchange carrier (IXC). o 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):** o 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** o 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 implementation. • **Congestion control In SS7 networks:** 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.	Any 4 SS7 services - 1mark each

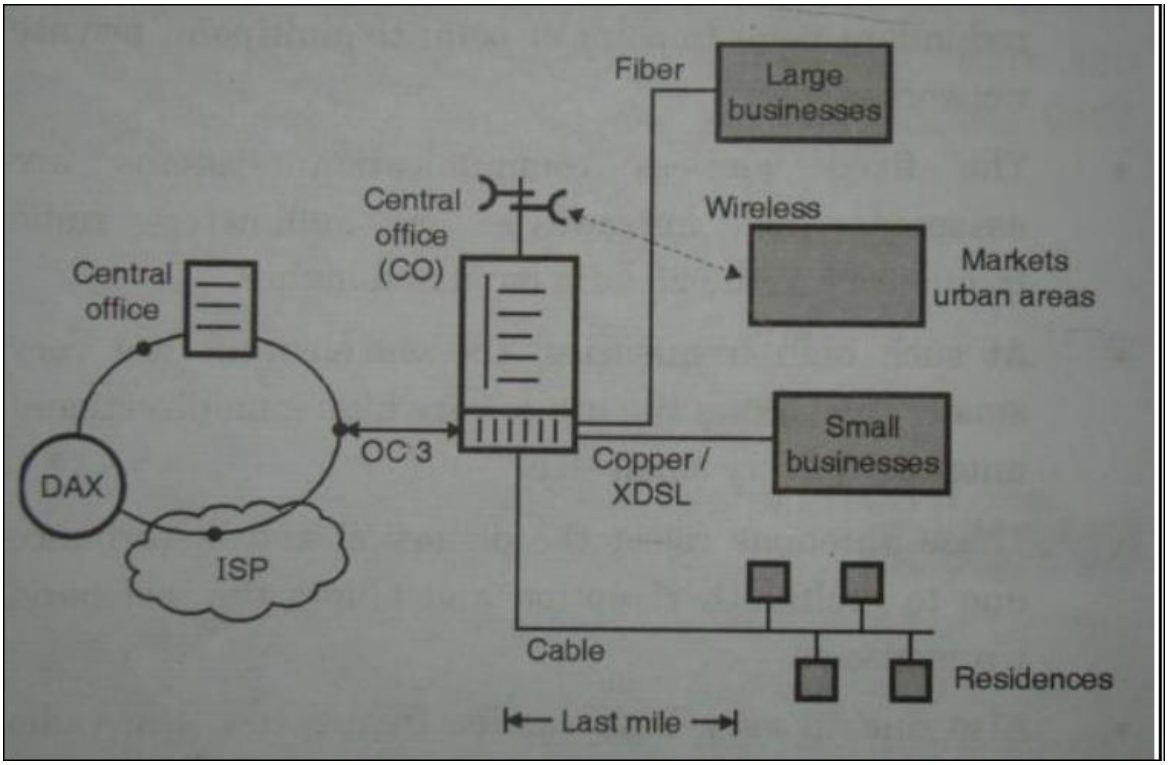
Q.4	(A)	Attempt any THREE of the following :	12-Total Marks
	(a)	**List vision of IMT 2000.**	4M
	Ans:	***(Any 8)*** ***IMT-2000 Vision*** • Common spectrum worldwide (1.8-2.2 GHz band) • Multiple radio environments (cellular, cordless, satellite, LANs) • Wide range of telecommunications services (voice, data, multimedia, internet) • Flexible radio bearers for increased spectrum efficiency • Data rates up to 2 Mb/s (phase 1)—for indoor environments • Maximum use of IN capabilities (for service provision and transport) • Global seamless roaming • Enhanced security and performance • Integration of satellite and terrestrial systems	Any 8 – ½ mark each
	(b)	**Draw Label diagram of GSM architecture.**	4M
	Ans:	 **Figure: Architecture of GSM network**	**3M diagram** **1M Labelling**

	(c)	**State the following specification of HSCSD 2.5 G with respect to** **(i) Data rate** **(ii) Backward compatibility** **(iii) Duplexing method** **(iv) Channel Bandwidth**	**4M**
	Ans:	(i) Data rate :14400 bps (ii) Backward compatibility : GSM (iii) Duplexing method : TDMA / TDD **(iv)** Channel Bandwidth : 57.6 kbps	1 mark each
	(d)	**What is cell splitting? State its type.**	**4M**
	Ans:	Note: Any other relevant diagram/ Explanation can be considered.  • Cell splitting is the process of subdividing a congested cell into smaller cells, each with its own base station and a corresponding reduction in antenna height and transmitter power. • Cell splitting increases the capacity of a cellular system since it increases the number of times that channels are reused. By defining new cells which have a smaller radius than the original cells and by installing these smaller cells (called microcells) between the existing cells, capacity increases due to the additional number of channels per unit area.	**2M for diagram and 2M for What is cell splitting**
	(B)	**Attempt any ONE :**	**6 Total Marks**
	(a)	**What is Cell? Describe the concept of frequency Reuse. Draw frequency Reuse patteren with cluster size 7.**	**6M**
	Ans:	**Cell:** Each cellular base station is allocated group of radio channels to be used within a small geographic area called “cell”	**1M**

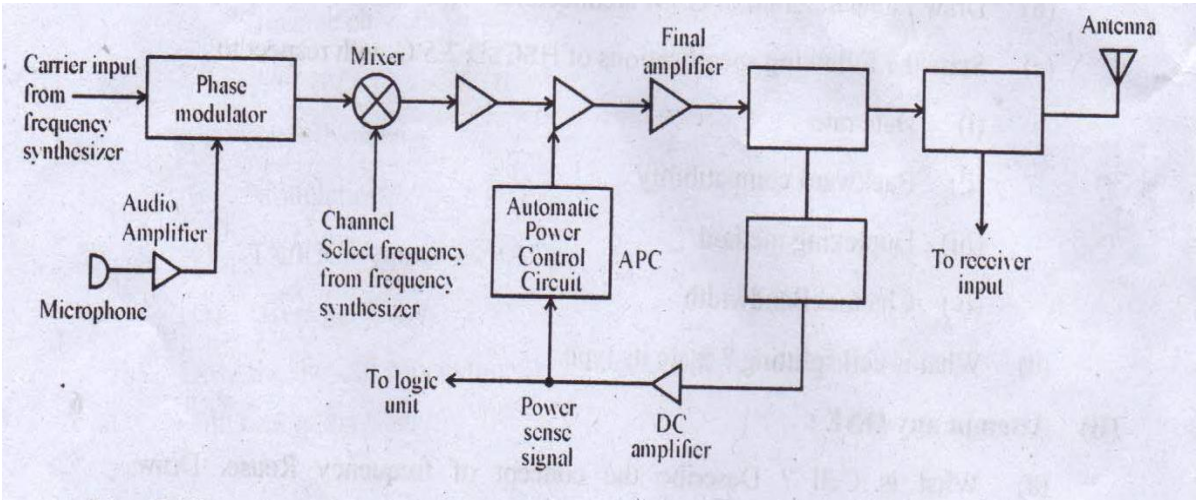
		Base stations in adjacent cells are assigned channel group which contains completely different channels than neighboring cell. By limiting coverage area to within the boundaries of cell, the same group of channels may be used to cover different cells that are separated from one another by distance large enough to keep interference level within tolerable limits. The design process of selecting and allocating channel groups for all the cellular base station within a system is called **frequency reuse** or **frequency planning.** Frequency reuse is important as the spectrum allocated for cellular transmission is limited and demand is increasing rapidly. Frequency Reuse pattern for cluster size 7 	**2M** **3M**
	(b)	**Draw SS7 protocol architecture. Describe MTP of SS7.**	**6M**
	Ans:	 **FIGURE: SS7 PROTOCOL ARCHITECTURE** **MESSAGE TRANSFER PART (MTP) OF SS7:** • The function of MTP is to ensure that signaling traffic can be transferred and	**3M Diagram** **3M Descript**

		delivered reliably between the end-users and the network. • MTP is provided at three levels. **1. Signaling Data Link Functions (MTP Level 1):** • This level provides an interface to the actual physical channel over which communication takes place. • Physical channels may include copper wire, twisted pair, fiber, mobile radio or satellite link. • This level uses 64 kbps transmission. **2. Signaling Link Function (MTP Level 2):** • It provides a reliable link for the transfer of traffic between two directly connected signaling points. • Variable packet messages, called message signal units (MSUs) are defined in MTP level 2. • MTP level 2 also provides flow control data between two signaling points as a means of sensing link failure. **3. Signaling Network Function (MTP Level 3):** • It provides procedures that transfer messages between signaling nodes. • There are two types of MTP Level 3 functions: signaling message handling and signaling network management.	**ion**
Q.5		**Attempt any FOUR :**	**16- Total Marks**
	a)	**Draw label diagram of mobile unit. State the function of frequency synthesizer.**	**4M**
	Ans:		**(3M diagram**

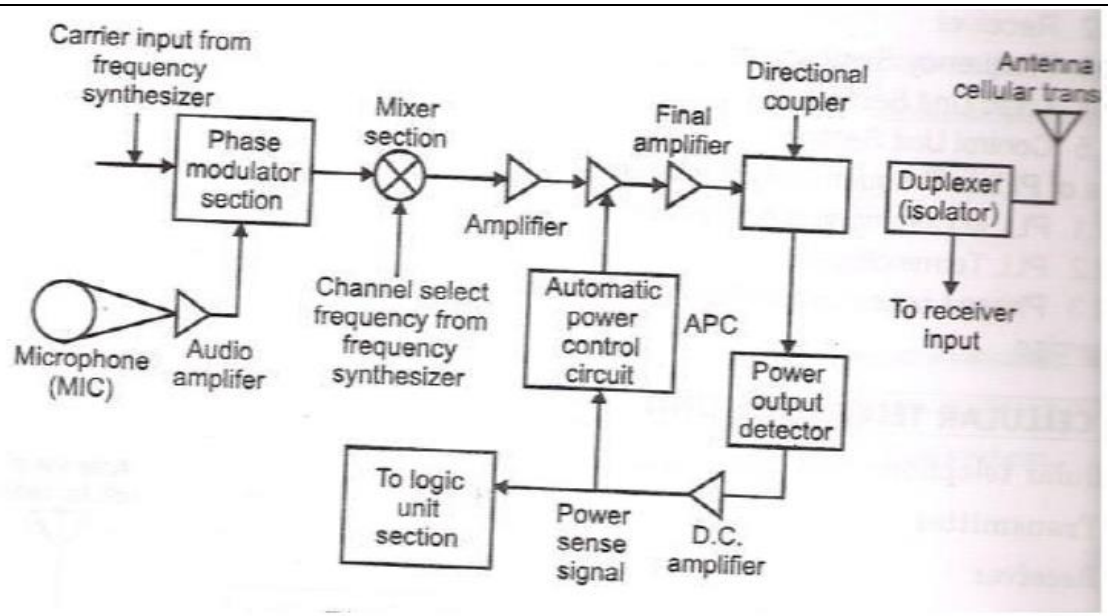
		Frequency Synthesizer: This block generates all the signals used by transmitter and receivers. It uses standard PLL circuits and a mixer. OR 1) The two output produced by frequency synthesizer are applied to the modulator box in the transmitter and the first mixer in receiver respectively. 2) The frequency synthesizer thus act as local oscillator which can produce a wide range of frequencies with high stability.	**1M Function**
	b)	**Describe the procedure for working of paging system.**	**4M**
	Ans:	 • Pager is a Simplex Communication Device. • Paging Systems are communication systems that send messages to a subscriber. • Message can be numeric or alphanumeric. • Paging Systems are used to notify a subscriber of the need to call a particular telephone number or to travel to a location to receive further instructions. • In modern paging systems, news headlines, faxes can also be sent. • A message is sent to a paging subscriber via the paging system access number with a telephone keypad or modem. The issued message is called a „Page". • The paging system then transmits the page throughout the service area using base stations which broadcast the page on a radio carrier. • The coverage area of a simple paging system ranges from 2 to 5 km while a wide paging system can have a worldwide coverage area. • Whenever a sender wants to send a message to a receiver he dials the 10 digit pager number of receiver through his telephone. Then this call is accepted by the operator present in the paging control center.	**2Marks for diagram &** **2M for description**

		• Then the operator will broadcast the message and the receiver paging number to all the paging terminals or the base stations. • Then a particular base station under the area where the receiver is present will transmit the message to the receiver pager. • Then the receivers' pager device will receive all messages and will verify whether the sender number is stored in its memory or not. If it is stored then the pager device will give beep which indicates the receiver that a message is sent by sender to his pager and the message will be displayed in the LCD.	
	c)	**State the features of IS -95 with respect to** **(i) Diversity** **(ii) Power Control** **(iii) Soft Hand off** **(iv) Soft Capacity**	**4M**
	Ans:	Improved speech quality and reduced interference by having different multiple levels of diversity like: Frequency diversity, Spatial diversity, path diversity and time diversity. Efficient power control scheme. Soft Handoffs. Variable rate vocoder. Bandwidth recycling.	**1M each point**
	(d)	**Describe operation of WLL with suitable diagram.**	
	Ans:		**2M for diagram, 2m for description**

		(i) WLL stands for wireless local loop. Microwave wireless links can be used to create a Wireless Local loop. (ii) Local Loop is a network that resides between the central office (CO) and the individual (iii)homes and business in close proximity to the central office (CO) (iv). In most developed countries, copper or optical fiber cable already has been installed to residence and business. (v) One more advantage of WLL is that we have to pay only once for that wireless equipment, after there is no additional costs involved. (vi)System WLL is based on Cellular, satellite, microcellular. (vii) The WLL can greatly improve the telecommunication facilities and services in an inexpensive way. (vii)It provides- High bandwidth is available Faster deployment Lower deployment costs Lower network maintenance, management and operating cost	
	(e)	**State feature of 4G wireless Architecture.**	**4M**
	Ans:	Features of 4G: 1.Faster and more reliable data rates than 100 Mb/s 2. It has a Low cost in comparison to other generations (1G, 2G, 3G networks) 3. It supports Bluetooth, Wi-Fi, Wired and Wireless Ad-Hoc Networking 4. It supports for multimedia services like teleconferencing and wireless internet. 5. They have wide bandwidth. 6. 4G networks are completely packet-switched networks. 7. They have high internet speeds. 8. Provide global mobility and service portability.	**1M for each feature**
	(f)	**Define the following terms :** **(i) Base Station** **(ii) Control Channel** **(iii) Mobile Station** **(iv) Page**	**4M**

		Define the following terms : **i) Base Station:** – A fixed station in a mobile radio system used for radio communication with mobile stations. Base stations are located at the center or on the edge of a coverage region and consist of radio channels and transmitter and receiver antennas mounted on a tower. **ii) Control Channel:** Control channel: It is defined as the radio channel used for the transmission of beacons such as call set up, call request, call initiation as well as the control information. **iii) Mobile Station:** Mobile station: It is defined as a station in the cellular radio service which is used when in motion at an unspecified location. Mobile stations can be portable hand held personal units or they can be the ones installed in vehicles. **iv) Page:** A message is sent to a paging subscriber via the paging system access number with a telephone keypad or modem. The issued message is called a „Page". The paging system then transmits the page throughout the service area using base stations which broadcast the page on a radio carrier.	**1mark for each definition**
Q.6		**Attempt any FOUR :**	**16- Total Marks**
	(a)	**Identify and compete given block diagram. State the function of APC.**  	**4M**

Ans:



This is the block diagram of cellular **transmitter.**

Automatic Power Control Circuit and DC amplifier:

The automatic power control circuit controls the o/p power of the transmitter automatically, with the help of power o/p detector & DC amplifier.
Transmitter o/p is fed to duplexer.

OR

The receiver picks up the special control signals and sends them to the APC (automatic power control) circuit which sets the transmitter output power level to one of the possible eight levels.
Due to APC, the received signal from the cell site becomes adequately strong and the interference is reduced with the other stations in the same or adjacent cells.

Identification - 1M Completion of Block - 2M,

Function of APC- 1M)

(b) **Difference GSM and IS – 95 w.r.t.**

- **(i) Frequency range**
- **(ii) Channel Bandwidth**
- **(iii) Radio Interface**
- **(iv) Hand off**

4M

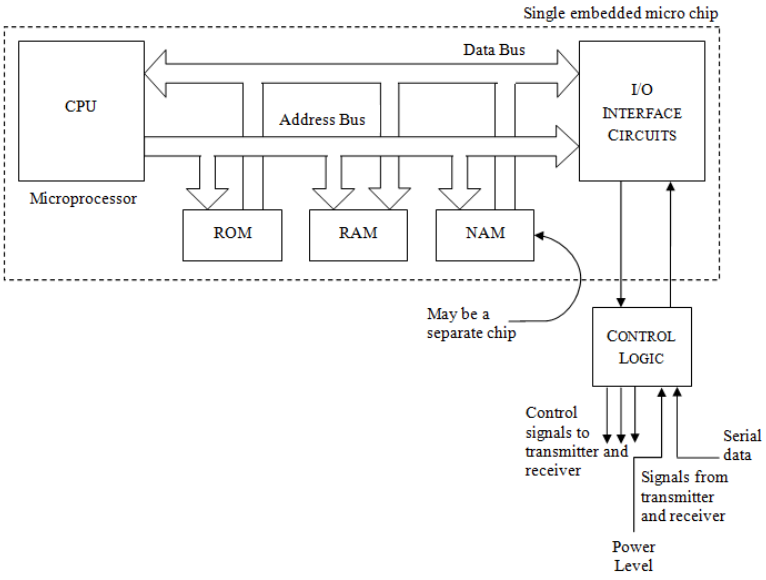
Ans:

Parameters	**IS-95 system**	**GSM system**
Frequency range	800 or 1900 MHz	880-915 MHz 935-960MHz
Channel Bandwidth	1250KHz	200KHz
Radio Interface	CDMA	FDMA or TDMA

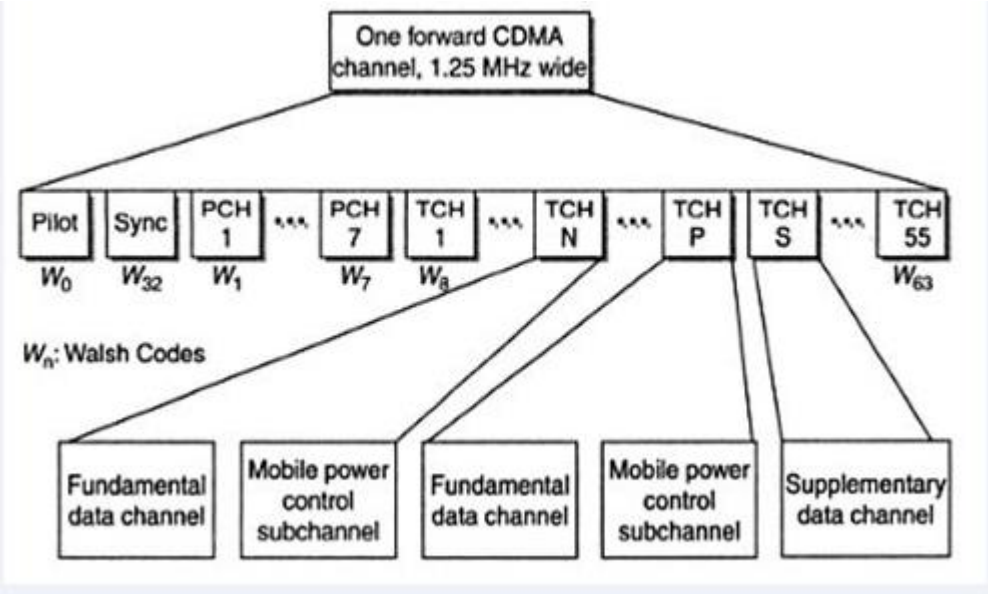
1M for each difference

		Hand off | Soft | Hard	
	(c)	**Compare 3G and 4G wireless system with respect to** **(i) Frequency Band used** **(ii) Data rate** **(iii) Access Technique** **(iv) Switching used**	**4M**
	Ans:	**(1M each)**	**1 M for each comparison**

Parameters	3G wireless system	4G wireless system
Frequency Band used	**16-25 GHz**	**2-8 GHz**
Data rate	**385** kb**ps-2Mbps**	**100 Mbps-1 Gbps**
Access Technique	**WCDMA/CDMA2000**	**MC-CDMA or OFDM**
Switching used	**Circuit/Pac**ket	**Pac**ket

	(d)	**With neat diagram describe logic unit of mobile phone. State the function of NAM.**	**4M**
	Ans:		**(Diagram -3M Function- 1M)**

- A cellular radio contain a programmable read only memory chip called “Number Assignment Module (NAM)”.
- The NAM contains the Mobile Identification Number (MIN), which is the telephone number assigned to the unit.
- The NAM PROM is „burned“ when the Cellular Radio is purchased & the MIN is assigned.

	(e)	Describe IS – 95 forward link channel structure.	4M
	Ans:	The IS-95 forward Channel structure consists of four types of logical Channels - **pilot Channel, synchronization Channel, paging Channel, and forward traffic Channels.** Each forward carrier Channel contains one pilot, one synchronization Channel, up to seven paging Channels, and a number of forward traffic Channels.  **The pilot Channel (Channel 0):** It is an un-modulated Channel. This Channel allows the mobile phone to acquire timing information, provides phase reference for the demodulation process, and provides a means for signal strength comparison for the purpose of hand-off determination. The pilot Channel consists of all logical zeros. **The sync Channel (Channel 32**): It has low-rate data that is convolutionally encoded and interleaved. It is used with the pilot Channel to acquire initial time synchronization. It is a 1200-bps Channel used by the mobile user to obtain identification information about the system (system time, long-code state, protocol revision, etc.). **The paging Channel (Channels 1 to 7):** It has low rate data that is also encoded and interleaved. Prior to being spread, the paging data is randomized with a scrambler that is specific to the mobile user for which the page is intended. The paging Channel provides system information and instructions to the MSs **The forward traffic Channel (Channels 8 to 31 and 33 to 63):**It is FEC encoded and interleaved and then scrambled with a sequence that is specific to the intended mobile user, the signaling and control bits are multiplexed with the forward traffic Channel which is meant for adjusting the power of the mobile transmitter The process that are carried out on the forward channel are as follows 1. Encoding of user data.	**(Diagram :2M Explanation:2 M)**

		2.IInterleaving 3. Block of 6 bits are converted to one of the 64 Walsh codes. 4.Data is spread using a42bit user specific code. This code is known as the channel identifier. This code is different for each user	