MODEL ANSWER

SUMMER– 19 EXAMINATION

Subject Title: OPTICAL FIBER AND MOBILE COMMUNICATION

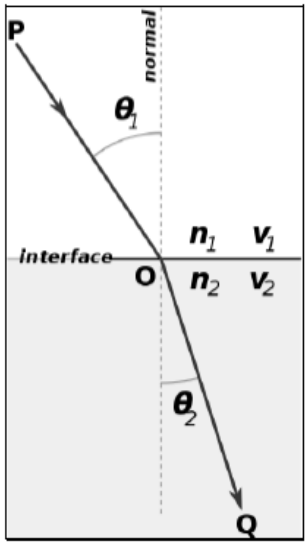
Subject Code: 17669

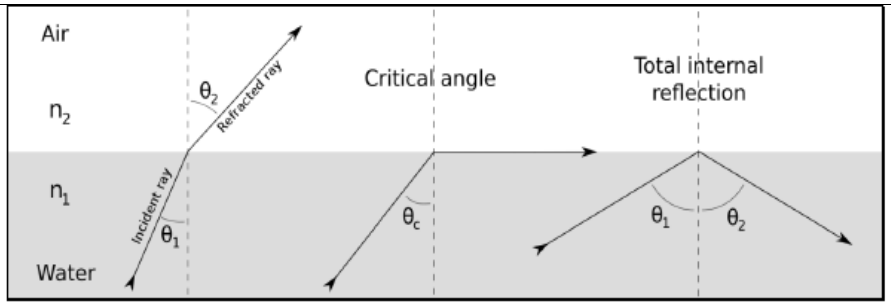
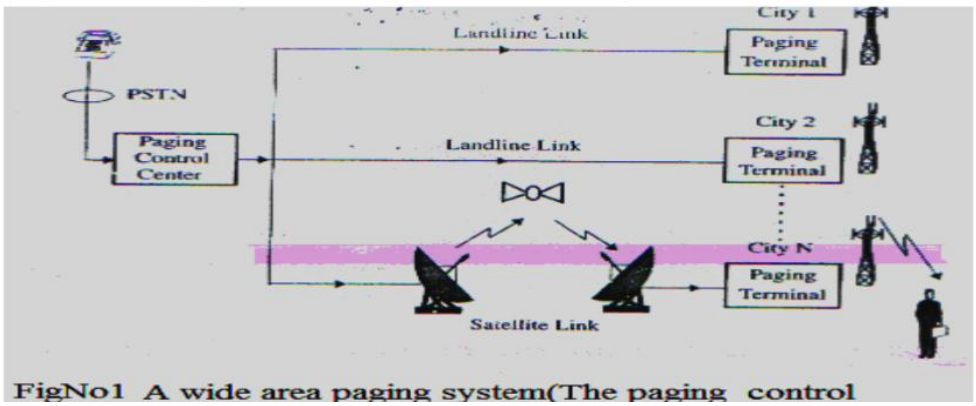
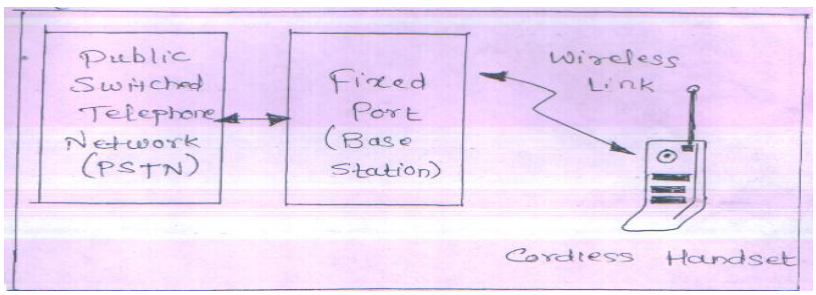
Important Instructions to examiners:

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 anyequivalent 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		Attempt any Three :	12-Total Marks
	a)	**State four limitations of LED as a source to optical fiber.**	4M
	Ans:	• Coupling losses are high for LED • Radiant output power for a LED is less so it can be used for short distances. • LED's supports less bit rates (few hundred of mbps) as switching speed is slow. • LED has wide spectral width hence chromatic dispersion loss is present. **For Any other relevant limitation of LED, marks should be credited.**	1M for each limitation
	b)	**Calculate critical angle of incidence between two substances with different refractive indices n1**	4M
	Ans:	i) **Critical angle:** $\theta_c = \text{Sin}^{-1}\left(\frac{n2}{n1}\right)$ So critical angle $=\sin^{-1}(1.36/1.4) = 76.26°$	Formula :1M correct ans :3M

c)	**State the advantages of optical fiber communication**.	4M
Ans:	**Advantages:--** • **High Bandwidth** – The higher the bandwidth the grater the information carrying capacity. A higher bandwidth allows for higher data rates more users and longer distance. • **Easy Upgrade:--** Fiber Optic cable allows for easy future upgrades because a variety of transmissions can use fiber optic, it is only necessary to change the electronics .The cable can stay in place no need to pull new cable in the future. • **Low Attenuation:- This is** a reduction of signal strength or loss of light power over the length of the fiber .Fiber optic cable usually has low attenuation can be affected by extrinsic(environmental and physical bends),intrinsic (absorption and scattering) and wavelength. The longer the wavelength, the lower the attenuation. • **EMI/RFI Immunity:--** Since fiber optic cable transmit light instead of electrical current immunity to electromagnetic and radio frequency interference provides better signal quality ensuring low bit error rates and/or low noise on the system. • **Security:**-- Again since there is no electrical signal fiber optic transmission is almost for easier installation especially when conduit and/or raceway space is at a premium. • **Light weight:--** Fiber optic cable is smaller and lighter than copper cable allowing for easier installation especially when conduit and/or raceway space is at a premium. • **Low power Loss:--**An optical fiber **offers** low power loss. This offers for longer transmission distances. In comparison to copper in a network the longest recommended copper distance is 100m while with fiber, it is 2000m. • **Interference:**-- Fiber optic is immune to electromagnetic interference it can also be run in electrically.	Any 4 advantage 1mark each
d)	**Define Mobile station, Base station & Control station.**	4M
Ans:	**Mobile Station** : -Mobile stations may be hand – held personal units (portables) or installed in vehicles(mobiles) A station in the cellular radio service intended for use while in the motion at unspecified locations. or **Mobile station**. ... A mobile station (MS) comprises all user equipment and software needed for communication with a mobile network. **Base Station** :- A fixed station in the 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	As there are 3 definition and 4M assessor can judicially give marks

		consist of radio channels and transmitters and receiver antennas mounted on a tower. **Control station:-** It controls one or more base transceiver stations (BTS), also known as base stations or cell sites. Key BSC functions include radio network management (such as radio frequency control), BTS handover management and call setup.	
	B	Attempt any One :	6-Total Marks
	a)	**State and explain Snell's law with neat diagram. How does total internal reflection takes place in optical fiber? Explain with neat diagram.**	6M
	Ans:	**Statement Of Snell's Law:--** Snell's law states that the ratio of the sines of the angles of incidence and refraction is equivalent to the ratio of phase velocities in the two media, or equivalent to the reciprocal of the ratio of the indices of refraction. $\frac{\sin\theta_1}{\sin\theta_2} = \frac{v_1}{v_2} = \frac{n_2}{n_1}$	1M
		Diagram: **1M**  	1M
		Explanation: **1M** As light passes the border between media, depending upon the relative refractive indices of the two media, the light will either be refracted to a lesser angle, or a greater one. These angles are measured with respect to the *normal line* represented perpendicular to the boundary. If a ray travels from a medium of lower refractive index into a medium of higher refractive index, it is bent toward the normal; if it travels from a medium of higher refractive index to a medium of lower index, it is bent away from the normal.	1M
		Total internal reflection: **1M** Total internal reflection is a phenomenon that occurs when light travels from a more optically dense medium (or a medium with higher refractive index) to a less optically dense one (lower index), such as glass to air or water to air. When light travels from an optically dense medium to a less optically dense medium, the light refracts away from the normal. If the angle of incidence is gradually increased, one will notice that at a certain point, the refracted ray deviates so far away from the normal that it reflects rather than refracts. This results whenever the refracted angle predicted by Snell's Law becomes greater than 90 degrees.	1M

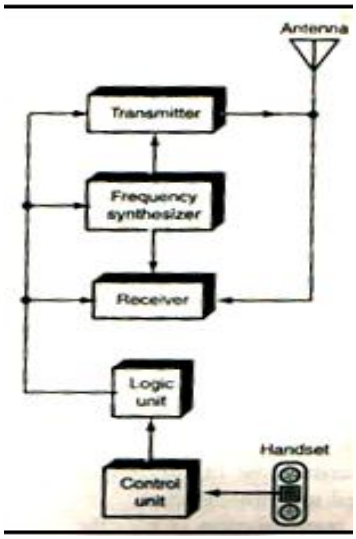
		 2M	2M
b)	**Explain any three mobile radio system around the world.**		6M
Ans:	**1]Pager**  FigNo1 A wide area paging system(The paging control **Explanation of Pager**: • Sends brief messages to Subscribers • messages may be numeric message , alpha numeric message , voice message. • In modern paging systems news headlines stock quotation , and faxes may be sent • A message is sent to a paging subscriber via the paging system access number (usually a toll-free telephone number) with a telephone keypad or modem. • Page is transmitted throughout the service area by BS on radio carrier • Covers a limited range of 2-5 km, or may even be confined to within individual buildings , wide area paging system can provide worldwide coverage • Wide area paging system consist of a network of telephone lines many base station transmitters and a large radio tower that simultaneously broadcast a page from each base station **2]Cordless telephone system** 	2M :Each system

Explanation of Cordless telephone system:

- Cordless telephone system are full duplex communication system that use radio to connect a portable handset to a dedicated base station .which is then a specific telephone line with a specific telephone no. on the Public Switched Telephone No. (PSTN).
- In 1G portable unit communication only to the dedicated base unit and only over a distance of a few tens of meter .
- In 2G It allow subscribers to use handsets at many outdoor locations within the urban centers such as london or HongKong
- Modern cordless telephones are sometimes combined with paging receivers so that the subscriber may first be paged and responded to page using the cordless telephones .

It provides the user with limited range and mobility and it provide coverage range up to a few hundred meter.

3]Mobile:



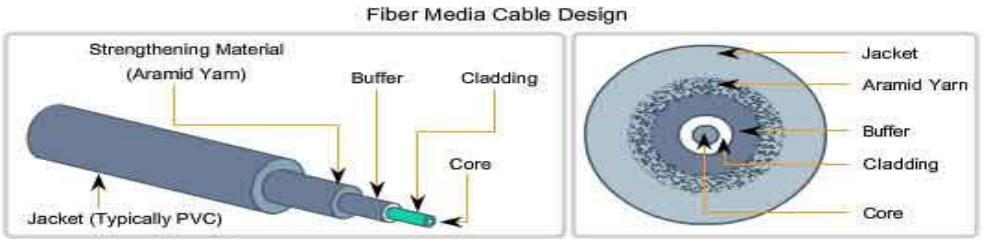
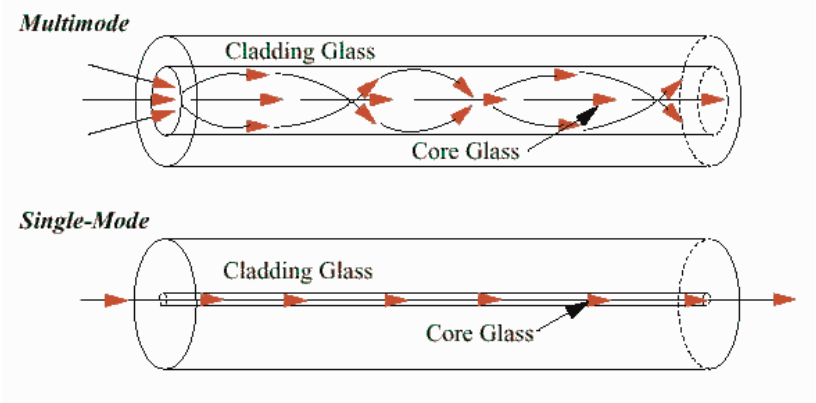
Transmitter: It is low power FM unit operating in the frequency range of 825 to 845MHz. There are 666, 30 KHz transmit channel. The carrier is furnished by a frequency synthesizer is a phase modulated by voice signal.

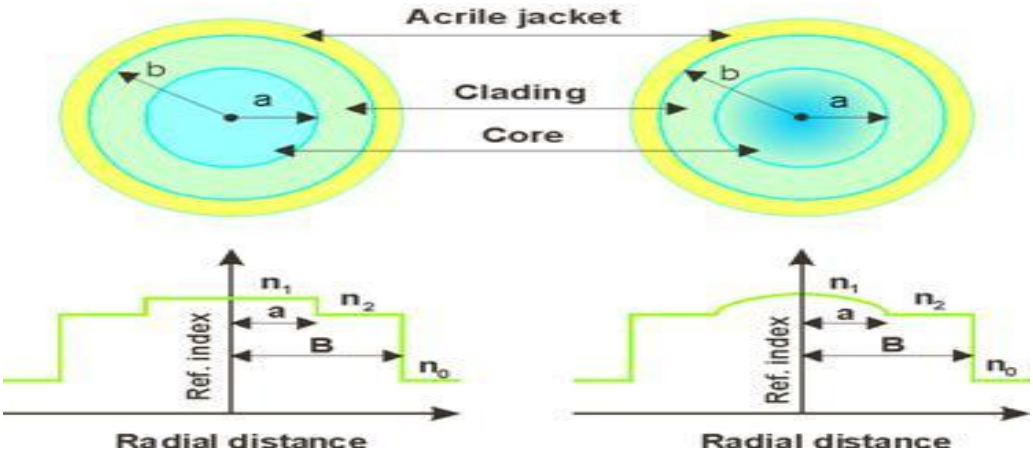
Receiver: The receiver is a dual conversion super heterodyne. The incoming signal frequency is down converted twice to frequency of 455KHz or 10.7MHMz with the help of mixer and IF amplifier stages. The signal is then demodulated deemphasized and filtered and given to loud speaker.

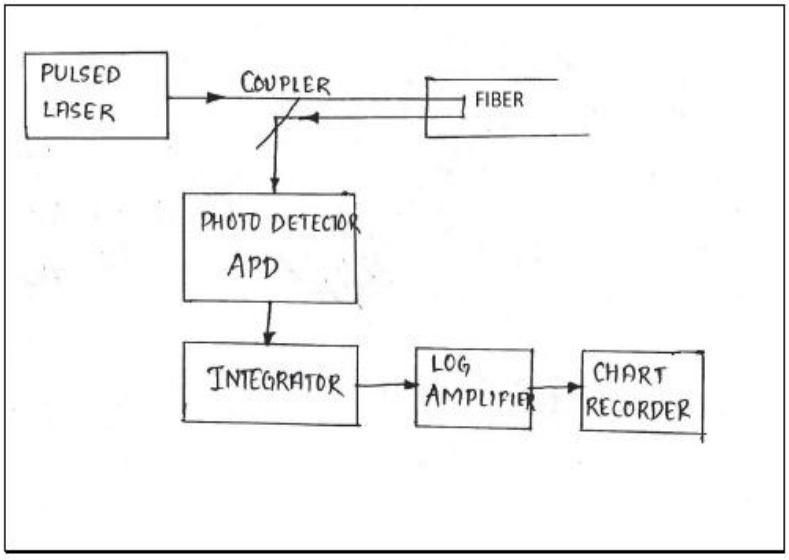
Frequency Synthesizer: This block generates all the signals used by transmitter and receivers. It uses standard PLL circuits and a mixer.

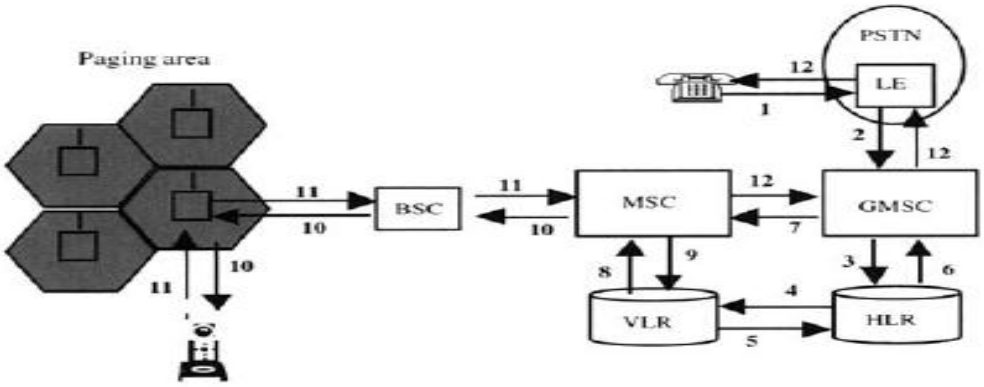
Logic Unit: This unit contains master control circuit for a cellular radio. It is made up of microprocessor with RAM and ROM and additional circuit used for interpreting signals from MSC and BS and generates control signal for the transmitter and receiver.

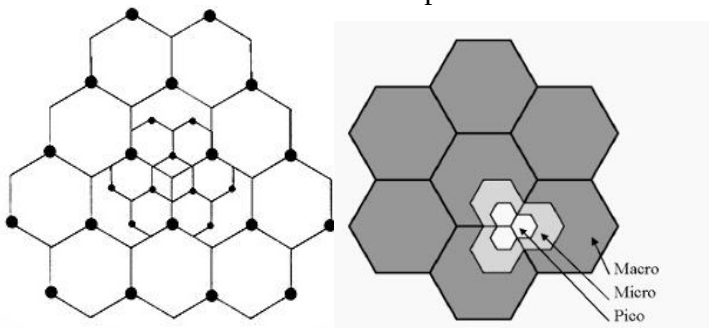
Control unit: The control unit contains the handset with speaker and microphone. The control unit is operated by a separate microprocessor that drives the LCD display and other indicators.

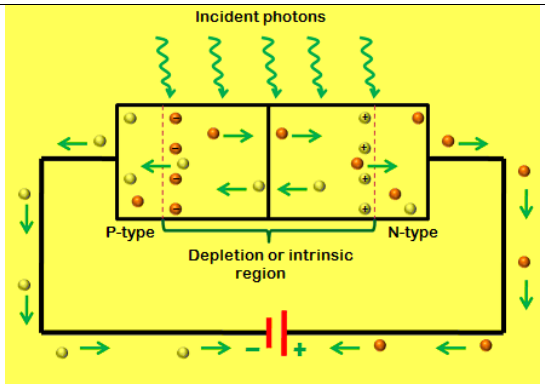
Q.2	**Attempt Any Four:**	16M
a)	**Draw the constructional sketch of fiber optic cable and give its classification.**	4M
Ans:	 **Classification Of Optical Fibe**r:-- Optical fiber is classified into two categories based on:-- 1) The number of modes 2) The refractive index **On the basis of number of modes of propagation the optical fiber are clasiified into two types:--** 1) Single mode fiber(SMF) 2) Multi-mode fiber(MMF)  **On the basis of Refractive index:--** **There are two types of optical fiber:--** **1) Step-index optical fiber** **2) Graded index optical fiber**	Constructional-2M classification.-2M



	b)	**Draw and explain the block diagram of OTDR.**	4M
	Ans:	**Diagram:** **2M**  **Explanation:** **2M** • OTDR is optical time domain reflectometer used for finding faults, splices and binds in fiber optic cables. • OTDR consists of a light source and receiver, data acquisition and processing modules and an information storage unit for retaining data in external or internal memory disk and display. • A light pulsed is launched into the fiber in forward direction from an injection laser using coupler or beam splitter. • Beam splitter or coupler makes possible to couple the optical excitation power impulse into the tested fiber and to deviate the backscattered power to the optical receiver. • The backscattered light is detected using an avalanche photodiode which drives integrator which is then fed to logarithmic amplifier and average measurements for successive points within the fibers are plotted as a chart recorder.	Diagram: 2M Explanation2M

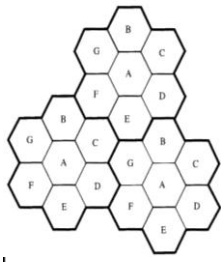
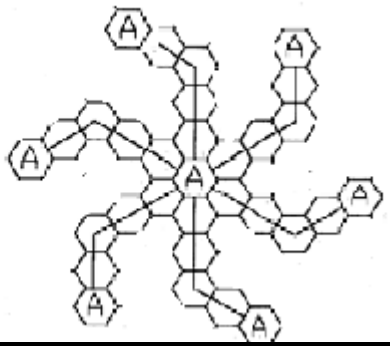
	c)	**Explain the process of call initiation from landline telephone to cellular phone.**	4M
	Ans:	 **1.** The PSTN user diales the MSISDN of the called user in GSM. **2.** The LE routes the call to the GMSC of the called GSM user. **3.** The GMSC uses the dialed MSISDN to determine the serving HLR for the GSM user and interrogates it to obtain the required routing number. **4.** The HLR requests the current serving VLR for the called MS for a MSRN (MS Roaming Number) so that the call can be routed to the correct MSC. **5.** The VLR passes the MSRN to the HLR. **6.** The HLR passes the MSRN to the GMSC. **7.** Using the MSRN, the GMSC routes the call to the serving MSC. **8.** The MSC interrrogates the VLR for the current Location Area Indentity (LAI) for the MS. **9.** The VLR provides the current location (LAI) for the MS. **10.** The MSC pages the MS via the appropriate BSS. The MS responds to the page and sets up the necessary signaling links. **11.** When the BSS has established the necessary radio links, the MSC is informed and the call is delivered to the MS. **12.** When the MS answers the call, the connection is completed to the calling PSTN user.	Diagram: 2M Explanation2M
	d)	State different techniques usedto improve capacity and coverage in cellular system. Describe cell splitting in detail.	4M
	Ans:	Techniques usedto improve capacity and coverage in cellular system : 1. Cell splitting 2. Cell Sectoring	Techniques-1M cell

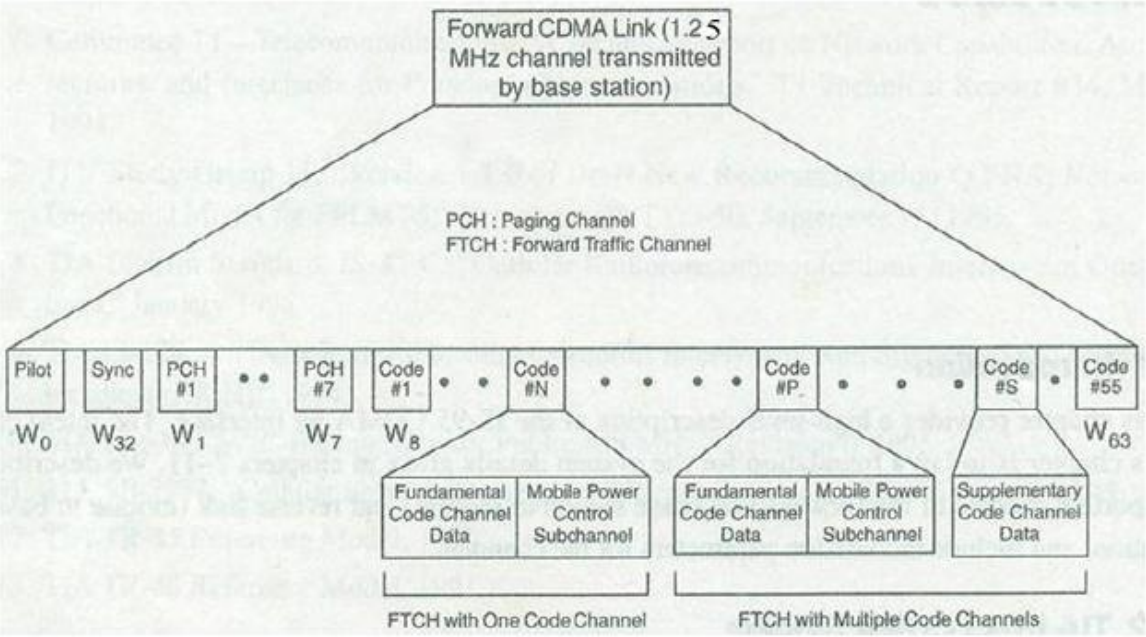
		3. Micro zone concept 4. Repeaters 1]Cell Splitting: subdividing a congested cell into smaller cells. The process of cell splitting is used to expand the capacity (number of channels) of a mobile communication system. As a network grows, a quite large number of mobile users in an area come into picture  Fig b. Cell Splitting. The concept of cell splitting can further be applied to the split cells as well. That is, the split up cells can further be split into a number of smaller cells to improve the efficiency of the BS even more. Here, the master cells which have been split up into smaller cells are known as macro cells. The split up cells are known as micro cells. The innermost cells, split up by splitting the micro cells are known as pico cells.	splitting explanation-3M
Q.3		**Attempt any Two:**	**16-Total Marks**
	a)	**State four requirements ofoptical detector. Describe working principle of photo diodes.**	**8M**
	Ans:	**Photodetector Requirements for Performance** ➢ High sensitivity at the operating wavelength of the source ➢ Short response time to obtain a desirable bandwidth ➢ Minimum noise contribution ➢ Compatible size for efficient coupling and packaging ➢ Linear response over a wide range of light intensity ➢ Stability of performance characteristics ➢ Low bias voltage ➢ Low cost	Any four requirements of optical detector-4M Dig-2M Explanation-2M



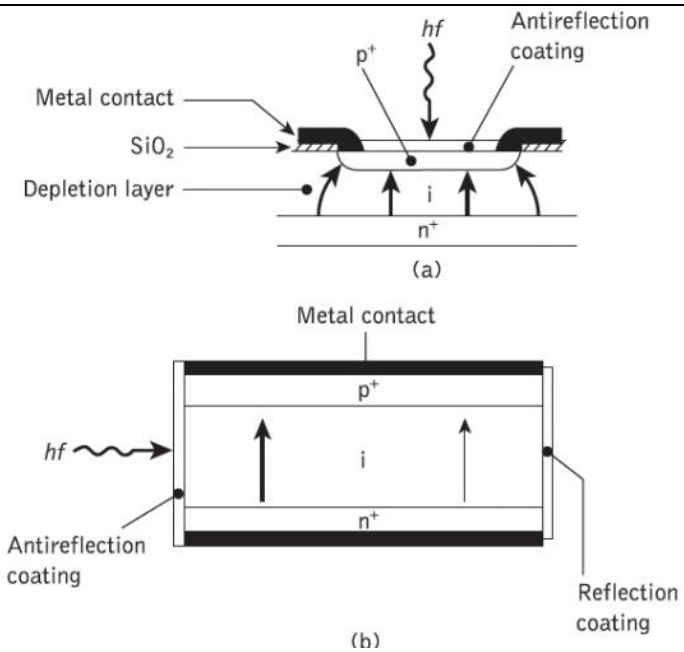
Working of **Photodiode**. :
The **working** principle of a **photodiode** is, when a photon of ample energy strikes the **diode**, it makes a couple of an electron-hole pair.
Therefore, holes in the region move toward the anode, and electrons move toward the cathode, and a photocurrent will be generated.

b) (i)	**State working principle of receiver unit.State signicance of RSSI signal.**	**4M**
Ans:	**Note:** **In question as no particular receiver is mentioned marks should be credited to general principle of receiver or any specific receiver.** **general principle of receiver: In** mobile receiver the received signal will be first down converted in kHz ,then demodulated and finally fed to audio section and loud speaker. RSSI is the relative received signal strength in a wireless environment, in arbitrary units. RSSI is an indication of the power level being received by the receive radio after the antenna and possible cable loss. Therefore, the higher the RSSI number, the stronger the signal.	principle of receiver 2M Significance of RSSI 2M
ii)	**For mobile unit how many signals are obtained from frequency synthesizer? State the use of these signals?**	**4M**
Ans:	. A frequency synthesizer is an electronic circuit that generates a range of frequencies from a single reference frequency. Two signals are obtained from frequency synthesizer. 1. Carrier to frequency modulator in transmitter 2. to first mixer in receiver. Frequencies should be different to ensure full duplex system and to avoid interference. It is also useful to use single antenna in mobile handset.	1M for number of signals 3M for use of signals
c) (i)	**State significance of frequency reuse in cellular system. Write procedure to select cell for frequency reuse.**	**4M**
Ans:	**Frequency reuse** in mobile cellular systems **means** that **frequencies** allocated to the service area are **reused** in a regular pattern of cells, each covered by one base station. The repeating regular pattern of cells is called cluster. To select cell for frequency reuse.we ned to have co channel .	frequency reuse-2M procedure to select

		 **Procedure of locating co-channel cell:** • Move i cells through the center of successive cells. • turn 60degree in a clockwise direction • move j cells forward through the center of successive cells • Assume i &j are non negative integer with values ex, *i=3* and *j=2*. 	cell-2M
	(ii)	**A mobile communication system is allocated RF spectrum of 25MHz with RF channel b/w 25kHz and service area is divided into 40 cells with cluster size4. Compute the system capacity.**	**4M**
	Ans:	**Given:** RF spectrum = 25MHz RF channel b/w =25kHz service area is divided into =40 cells Cluster size=4. **To find**: system capacity **Solution:** One duplex channel = 2 x 25 = 50 kHz of spectrum**.[1M]** Hence the total available duplex channels are = 25 MHz / 50 kHz = 500 in number. **[1M]** For N = 4, total channels per cell = 500/4 = 125. **[1M]** Cluster Size= 4 clusters are replicated M=10 times as service area is divided into 40 cells **System capacity=10 X 500=5000 total channels. [1M]** **(Note:-- If student considers only simplex channel marks to be credited)**	4M
Q.4	**A)**	**Attempt any THREE :**	**12-Total Marks**
	a)	**Describe the effect of co-channel interference in cellular system. How it effects system capacity?**	**4M**

	Ans:	**Ans: (Definition 1 mark, 1 ½ marks for causes and 1 ½ marks for effects)** **Co-channel cells:** Frequency reuse implies that in a given coverage area, there are several cells that use the same set of frequencies. These cells are called co-channel cells. **Causes:** i) Reduction of D/R ratio, which reduces distance between two co-channels. ii) Use of omnidirectional antennas at the base station. iii) Increasing the antenna height at the base station. Effects of co-channel interference on system capacity: The parameter Q, called the co-channel reuse ratio, is related to cluster size N, $Q=D/R=\sqrt{3N}$ A small value of Q provides larger capacity since the cluster size N is small, whereas a large value of Q implies smaller level of co-channel interference. Thus with reduction in co-channel interference there will reduction in system capacity.	Definatio n 1M,1.5M for causes,1.5 for effects
	b)	**Draw the forward channel structure ofIS-95. Write function of each channel in it.**	**4M**
	Ans:	Ans: **(Specification - 2 marks, information available - 2 marks)** **Channel specifications:** Forward link frequency - 869 to 894 MHz Reverse link frequency - 824 to 894 MHz The maximum user data rate is 9.6 kbps It uses spread spectrum technology.  • Information on the forward traffic channel includes 1) the primary traffic (voice and data) 2) secondary traffic (data) and 3) signaling	
	c)	**Describe operation principle of PIN diode.**	**4M**

Ans:



2M for diagram ,2M for operation

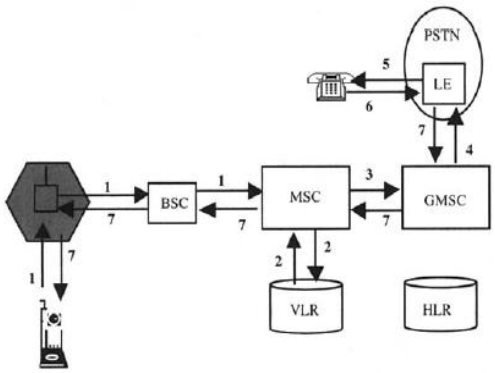
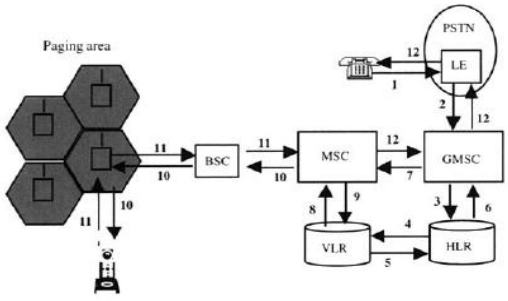
The working principle of the PIN diode exactly same as a normal diode. When the PIN diode is connected in forward biased, the charge carriers are very much higher than the level of intrinsic carrier's attention. Due to this reason the electric field and the high level injection level extends deeply into the region. This electric field assists in speeding up of the moving of charge carriers from P to N region, which consequences in quicker operation of the PIN diode, making it an appropriate device for high frequency operations.

d) Compare between LED & LASER. **4M**

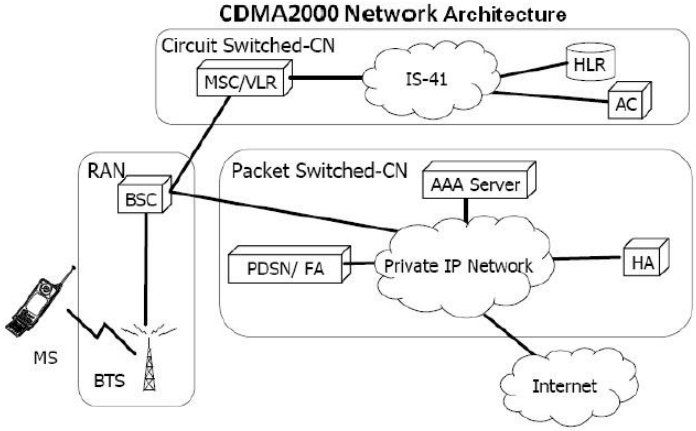
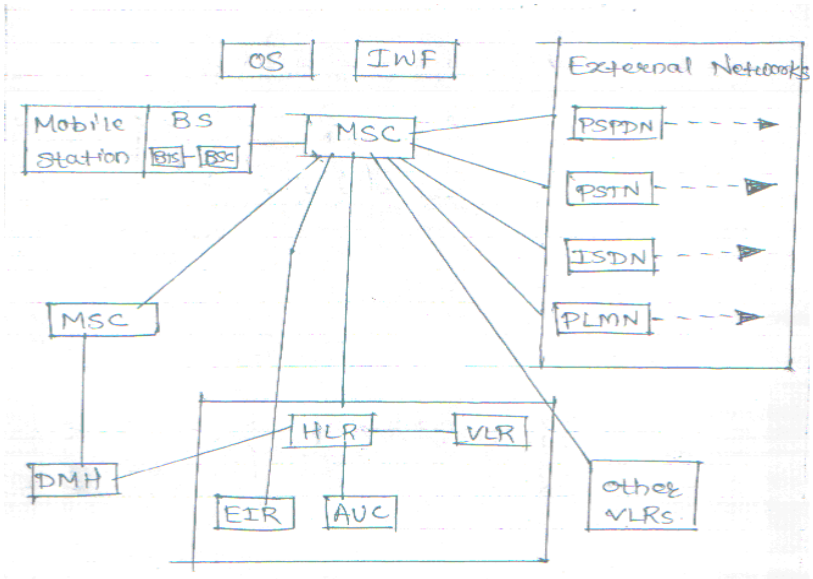
Ans:

Any 4 point: 1M each

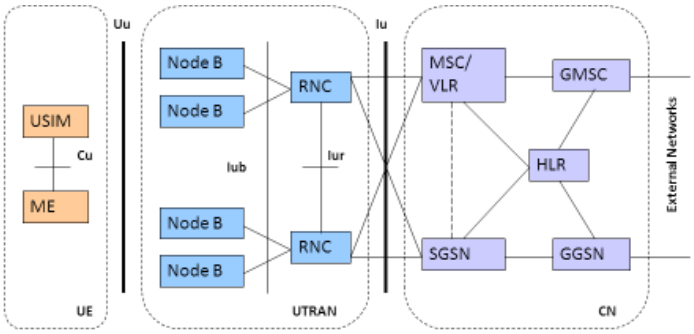
Sr. No.	LED	LASER
1.	LED- Light emitting diode	LASER- Light amplification by stimulated emission of radiation
2.	LED's are small in size, longer life, reliable & require little power.	Laser's are bigger in size, longer life, less reliable & require more power than LED.
3.	Generation of photon by spontaneous emission	Generating photon by stimulated emission.
4.	LED's produce a divergent & incoherent light beam.	Laser produces a monochromatic & coherent light beam.
5.	Types of LED (a) surface emitter (b) Edge emitter	Types of LASER (a) semiconductor Laser (b) Gas Laser
6.	Their response is fast.	Their response is faster than LED.
7.	Bandwidth of LED is moderate	Bandwidth of Laser is higher
8.	Here require drive current is 50 to 100mA	Here require drive current is Threshold current of 5-40mA.
9.	Feedback is not required in LED.	Proper feedback is essential in LASER to be treated as an optical source.

(B)		**Attempt Any ONE:**	**6**
	(a)	**Describe various stages of call processing in GSM system with the help of neat diagram.**	
	Ans:	**(Note**: **marks to be credited for call process from mobile to landline or landline to mobile**.) **Call process from mobile to landline**  1. The MS sends the dialed number indicating service requested to the MSC (via BSS). 2. The MSC checks from the VLR if the MS is allowed the requested service. If so, MSC asks the BSS to allocate necessary resources for the call. 3. If the call is allowed, the MSC routes the call to GMSC. 4. The GMSC routes the call to the Local Exchange of called user. 5. The LE alerts (applies ringing) the called terminal. 6. Answer back (ring back tone) from the called terminal to LE 7. Answer back signal is routed back to the MS through the serving MSC which also completes the speech path to the MS. **OR** **Call process from landline to mobile:**  	Diagram: 3M Explanation:3M

		1. The PSTN user diales the MSISDN of the called user in GSM. 2. The LE routes the call to the GMSC of the called GSM user. 3. The GMSC uses the dialed MSISDN to determine the serving HLR for the GSM user and interrogates it to obtain the required routing number. 4. The HLR requests the current serving VLR for the called MS for a MSRN (MS Roaming Number) so that the call can be routed to the correct MSC. 5. The VLR passes the MSRN to the HLR. 6. The HLR passes the MSRN to the GMSC. 7. Using the MSRN, the GMSC routes the call to the serving MSC. 8. The MSC interrrogates the VLR for the current Location Area Indentity (LAI) for the MS. 9. The VLR provides the current location (LAI) for the MS. 10. The MSC pages the MS via the appropriate BSS. The MS responds to the page and sets up the necessary signaling links. 11. When the BSS has established the necessary radio links, the MSC is informed and the call is delivered to the MS. 12. When the MS answers the call, the connection is completed to the calling PSTN user.	
	(b)	State significance of IMT 2000 & state vision of IMT 2000(any 4 points)	2+4
	Ans:	Significance of IMT 2000 : **IMT-2000**. International Mobile Telecommunications for the year **2000** (**IMT-2000**) is a worldwide set of requirements for a family of standards for the 3rd generation of mobile communications. IMT 2000 provide:-Small, light weight and convenient pocket communication and terminal mobility. • Common spectrum worldwide (1.8-2.2 GHz band) • Multiple radio environments (cellular, cordless, satellite, LANs) • Wide range of telecommunications services (voice, data, multimedia, and 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 • High level of flexibility • Cost-effectiveness in all operating environments • Commonalty of design worldwide • Operation within the designated MT-2000 frequency bands	For 2M-Significance of IMT 2000 any 4 points of vision 2M

Q.5		**Solve any TWO :**	**16-Total Marks**
	a)	**Describe the processing units in CDMA 2000 system. How do these units differ from those in a CDMA one system?**	**8M**
	Ans:	 **Processing units in CDMA 2000 system**  **Processing units in CDMA One system** IS-95 standard supports CDMA Circuit Switched Data. CDMA 2000 supports high speed packet swtching. IS-95 is based on 2G CDMA and CDMA2000 is based on 3G CDMA. **(Note:--Marks should be given to other relevant difference)**	Dig4M& expl 2M 2M

	b)	**Draw the architecture of UMTS & state important parameters of WCDMA & CDMA 2000**	**8M**
	Ans:	**Architecture of UMTS**	architectu re of UMTS-4M parameter s of WCDMA -2M parameter s of CDMA-2000-2M



Parameters of WCDMA:[any 2]

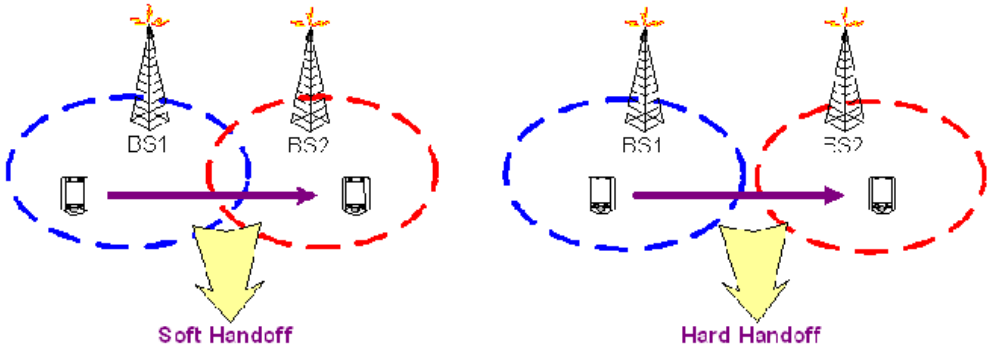
Multiple Access Method	DS-CDMA
Duplexing Method	FDD/TDD
Base Station Synchronization	Asychronous Operation
Channel Separation	5MHz
Chip Rate	3.84 Mcps
Frame Length	10 ms
Service Multiplexing	Multiple Services with different QoS Requirements Multiplexed on one Connection
Multirate Concept	Variable Spreading Factor and Multicode
Detection	Coherent, using Pilot Symbols or Common Pilot
Multiuser Detection, Smart Antennas	Supported by Standard, Optional in Implementation

Parameters of CDMA2000:[any 2]

CDMA2000 uses Frequency Division Duplexing-Multicarrier (FDD-MC) mode.

CDMA2000 includes −

- 1x — uses a spreading rate of 1.2288 Mcps.
- 3x — uses a spreading rate of 3 × 1.2288 Mcps or 3.6864 Mcps.
- 1xEV-DO (1x Evolution – Data Optimized) — uses a spreading rate of 1.2288 Mcps, optimized for the data.
- WCDMA/FDD-DS — Wideband CDMA (WCDMA) Frequency Division

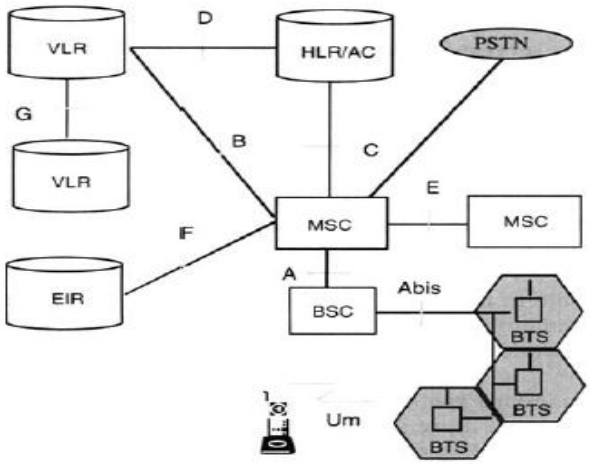
		Duplexing-Direct Sequence spreading (FDD-DS) mode. This has a single 5 MHz channel. WCDMA uses a single carrier per channel and employs a spreading rate of 3.84 Mcps.	
c)		**Compare the following:**	**8M**
		i) Hard Handoff and Soft handoff	4M
		ii) Delayed handoff and Queued handoff.	4M
	Ans:	**Hard handoff:** 1) Break-before-make 2) The mobile connects only to a single BS at a time **Soft handoff:--** 1) Make-before-break 2) The mobile receives from & transmits to multiple BSS simultaneously 3) The signal of the best of all connected channels is utilized 4) Generally used in CDMA systems  **Delayed Hand Off** The hand off is necessary, when the level of the received signal becomes weak. It is implemented with two level hand-off algorithms and the hand-off is requested after certain delay of time. This is called delayed hand-off. The main purpose of delaying in hand-off is to provide more opportunity for successful hand-off. **Queued Hand off** The MTSO will queue the requests of hand-off cells instead of rejecting them, if the new cell sites are busy or the call traffic is heavy. This operation is called as queuing or hand-off. A queuing scheme becomes effective only when the requests for hand-off arrive at the MTSO in batches or bundles. If the hand off requests arrives at the MTSO uniformly, then the queuing system is not needed.	2M 2M

Q.6		**Attempt any FOUR:**	**16-Total Marks**
	a)	**State important features of IS-95.**	**4M**
	Ans:	1. **Diversity** • The cellular system are having tendency to multipath fading and diversity methods of some are required to mitigate the effect of fading. • Type of diversity in CDMA is: ➢ Time diversity: - Provided by symbol interleaving, error detection& correction coding ➢ Frequency diversity: - provided by 1.25MHz ➢ Space (path) diversity: - Multipath signals accepted by Receiver 2. **Power control** • For the CDMA system to work efficiently the RF power in the system need to be controlled. • All the transmission from mobile must receive at base station receiver at approximately the same strength (within 1dB). • To maximize the no. of users sharing a cell, only minimum RF power required for reliable communication. 3. **Soft handoff** • The soft handoff in a CDMA system results from system capability to simultaneously deliver signal to mobile through more than one cell. 4. **System capacity** • Key parameters that determine capacity of CDMA are as follow: ➢ Processing gain ratio of spreading code information data rate (W/R). ➢ Ratio of energy per bit to noise power (Eb/No) ➢ Voice activity factor	Any 4 features :1M each
	b)	**For IS-95,write the meaning and their sequence of following:** **Call processing state, system access state, system idle state, traffic channel state, system initialization state.**	**4M**

	Ans:	**Call Processing Operation:** The operation of call processing in IS-95 CDMA system is as follows: d) System initialization state: ➢ The mobile acquires a pilot channel of a CDMA system. ➢ It searches all the PN offset possibilities and selects the strongest pilot signal. ➢ It acquires the synchronization channel and detects the pilot channels. ➢ It obtains the system configuration and timing information for the CDMA system. ii) System idle state: ➢ The mobile performs the monitoring procedure of paging channel. ➢ It transmits an acknowledgement in the response to any message received that addressed to this mobile. ➢ It also maintains all active registration timers. e) System access state: ➢ If cell is being placed or received by the mobile it enters into the access, it exchange the necessary parameters. ➢ The mobile transmit its response messages or request message to the base station on the access channel and receives the message from the base station on the paging channel. ➢ Similarly the base station transmits its messages to the mobile, the paging channel and receive message from the mobile on the access channel. ➢ The entire process of transmitting one message and receiving an acknowledgement for that message is called an access attempt .the access attempt ends after an acknowledgement is received. f) Traffic channel state: ➢ If the access attempt is successful, then the mobile enters into the last state called as traffic state in which the transactions of voice and data take places. ➢ The mobile station communicates with the base station using forward and reverse traffic channels.	Brief explanation:1M for sequence. 3M
	c)	**List out specifications of 2.5a GSM.**	**4M**

	Ans:	**i)GPRS for 2.5 G GSM** • General packet Radio services (GPRS) is packet based data network. • GPRS is well suited for non-real time internet usage including retrieval of email, faxes and asymmetric web browsing. • GPRS supports multi user network sharing of individual radio channels and time slots. • GPRS supports more user than HSCSD but in a bursty manner . • GPRS standards provides a packet network on dedicated GSM or IS-136 radio channel. • GPRS retains the original modulation formats specified in original 2G TDMA standards but uses completely redefined air interface in order to better handle packet data access • GPRS subscribers are automatically instructed to tune to dedicated GPRS radio channel • In GPRS individual users is able to achieve data rate as much as 171.2kpbs • Implementation of GPRS requires the GSM operator to install new routers and internet gateway at the base station and new software. • GPRS is most popular new packet data solution for 2G TDMA based technologies. • The dedicated peak 21.4 kpbs per channel data rate specified by GPRS works well with both GSM and IS136.		Any 4 specifications: 1M each
	d)	**State function of following blocks of GSM and using sketch show their interconnection:** **(i) HLR** **(ii) VLR** **(iii)MSC** **(iv)BSC**		**4M**
	Ans:	Home Location Register (HLR). • The HLR represents a centralized database that has the permanent data fill about the mobile subscribers in a large service area . • one HLR is deployed for each GSM network for administration of subscriber • It is referenced using the SS7 signaling capabilities for every incoming call to the GSM • network for determining the current location of the subscriber [i.e., for obtaining the mobile station routing number (MSRN) so that the call may be routed to the mobile station's serving MSC]. • The HLR is kept updated with the current locations of all its mobile subscribers, including those who may have roamed to another network operator within or outside the country. • The routing information is obtained from the serving VLR on a call-by-call basis,		Function of block 1/2M & interconnection 2M

so that for each incoming call the HLR queries the serving VLR for an MSRN.



Visiting Location Register (VLR).

- VLR Represents temporary data store, and generally there is one VLR per MSC.
- This register contains information about the mobile subscribers who are currently in the service area covered by the MSC/VLR.
- VLR also contains information about locally activated features such as call forward on busy.

Thus, the temporary subscriber information resident in a VLR includes:

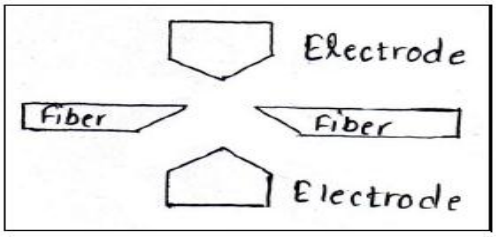
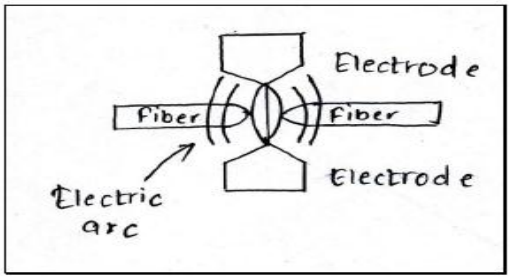
- features currently activated
- temporary mobile station identity (TMSI)
- current location information about the MS (e.g., location area and cell identities)

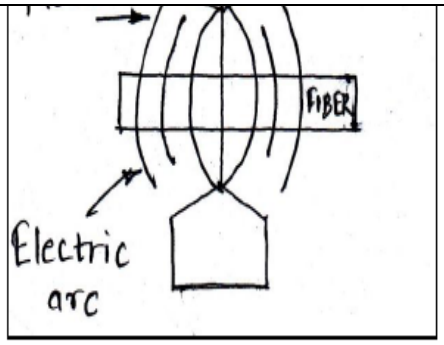
MSC performs the following major functions:

- Call setup, supervision, and release
- Digit collection and translation
- Call routing
- Billing information collection
- Mobility management :registration ,location updating ,inter-BSS and inter-MSC call handoffs
- Paging and alerting
- Management of radio resources during a call
- Echo cancellation
- Manage connections to BSS, other MSCs, and PSTN/ISDN
- Interrogation of appropriate registers (V/HLRs

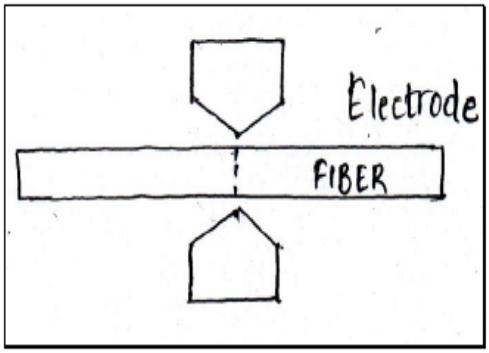
Functions performed by the BSS :

- Radio resource control
  configuration of radio channels ,selection, allocation, and deallocation of radio channels
  monitoring of radio channel busy/idle status
  encryption of radio interface
- Frequency hopping and power control

		assignment of frequency-hop sequence and start time assignment of effective radiated power (ERP) values to mobile stations • Handoff management collect signal quality data from adjacent BSSs analyze signal quality data and determine handoff need keep MSC informed regarding handoff activity • Digital signal processing transcoding and rate adaption channel coding and decoding	
	e)	**What are different types of splicing techniques? Explain fusion splicing techniques?**	**4M**
	Ans:	TWO BROAD CATEGORIES of splicing : • Fusion Splicing or Welding Accomplished by applying localized heating (a flame or an electric arc) at the interface between two butted, prealigned fiber ends causing them to soften and fuse. • Mechanical Splicing Fibers are held in alignment by some mechanical means □ Achieved by various methods; Tube Splices Groove Splices **Fusion splicing techniques:** **1. Initial setting:**  **2. Arrangement of smooth surface by prefusion:**  **3. Pressed together:**	types of splicing 1M fusion splicing 3M



4. **Accomplishment of splice:**



Explanation:

- Fusion splices are made by thermally bonding together fiber end.
- The fiber ends are prealigned and buttered together in order to achieve good continuity of the transmission medium at the junction point. This is done by grooved fiber holder or microscope with micro manipulator. The butt joint is then heated with an electric or a laser and hence bonded together.
- It (this method) provides very low splices losses
  - Consistent.
  - Easily controlled heat with adaptability for use under field conditions.