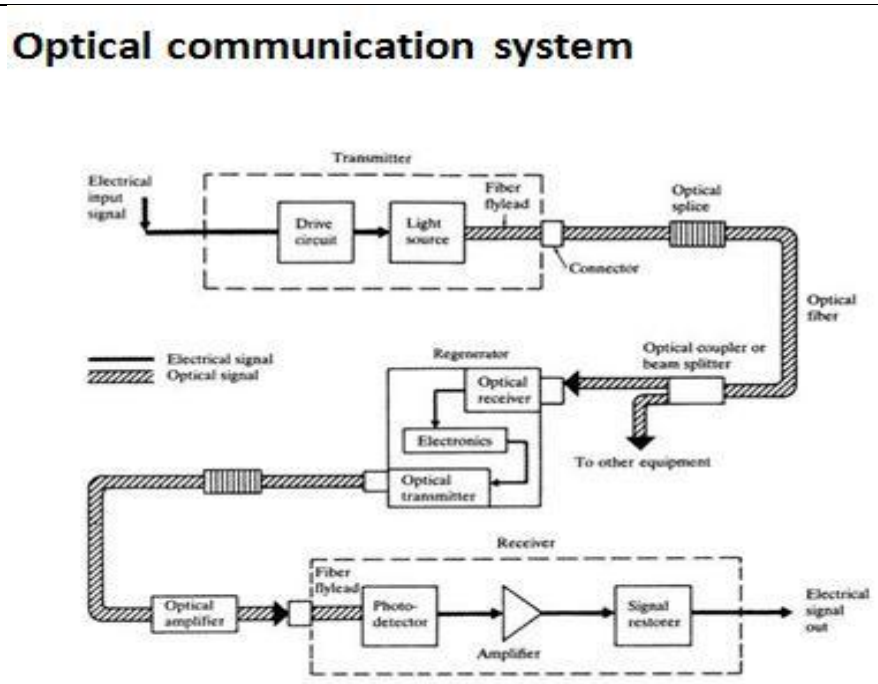
MODEL ANSWER
SUMMER– 18 EXAMINATION

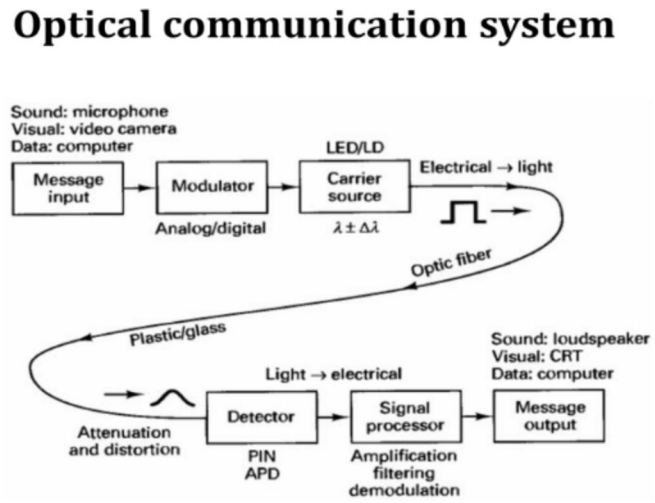
Subject Title:- Optical Fiber & Mobile Communication **Subject Code:-** 17669

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 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 Marks
	a)	**Draw and explain block diagram of fiber optical communication.**	4 Marks
	Ans:		dig -2m exp-2m

Or

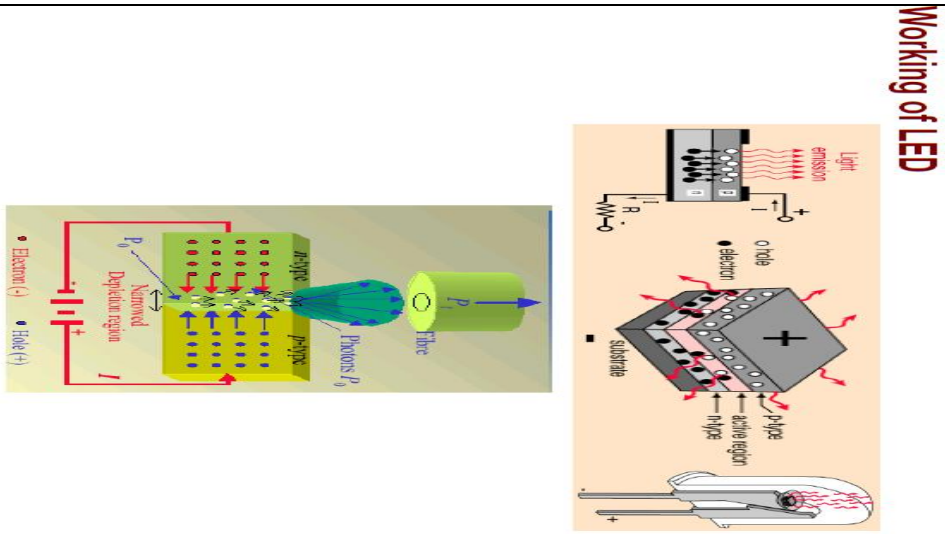


It consists of :

- optical transmitter: It converts electrical signal to light signal and couple it in fiber optic cable.
- optical regenerator : It converts light signal to electrical signal regenerate it and convert it to light and send to optical receiver.
- optical receiver: It converts light signal to back original electrical signal .

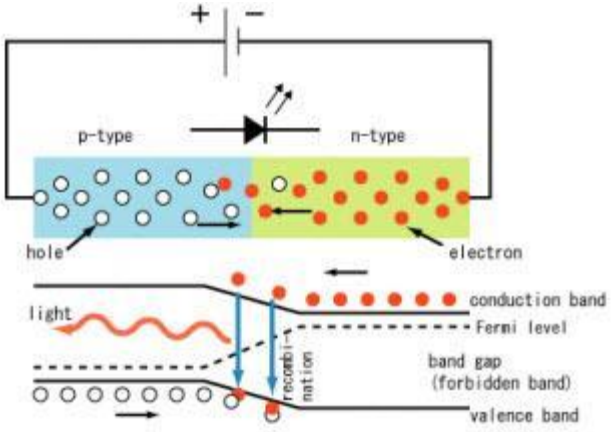
b) **Explain with neat diagram working principle of LED.** **4 Marks**

Ans: **Dig -2m** **Exp-2m**

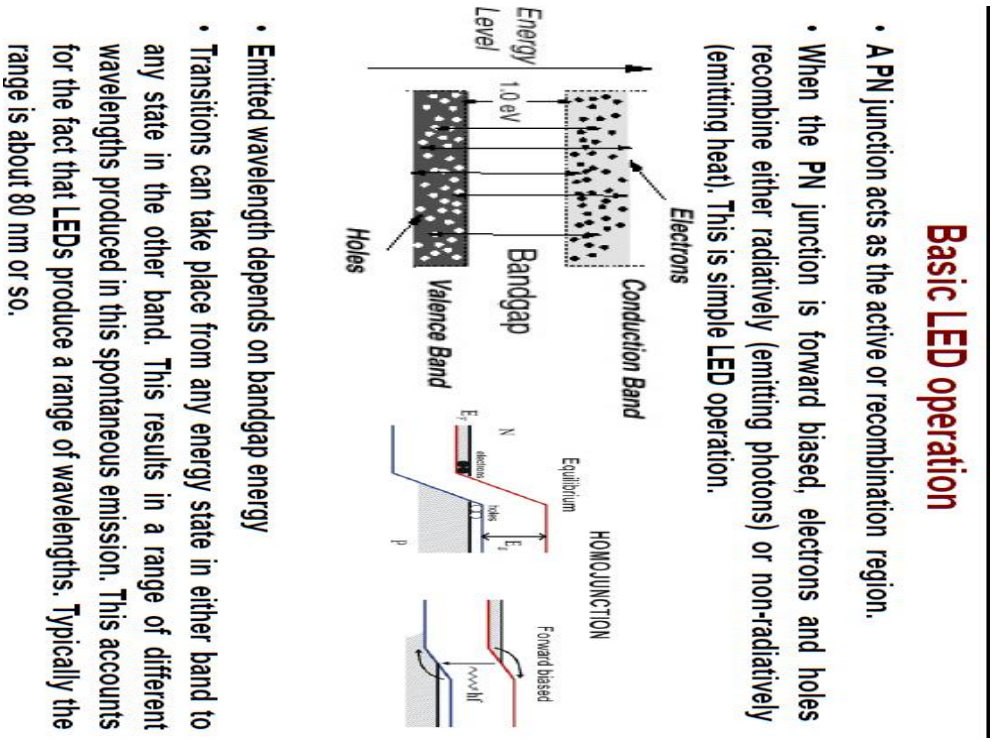


A light-emitting diode (**LED**) is a two-lead semiconductor light source. It is a p–n junction diode that emits light when activated. When a suitable voltage is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons.

Or

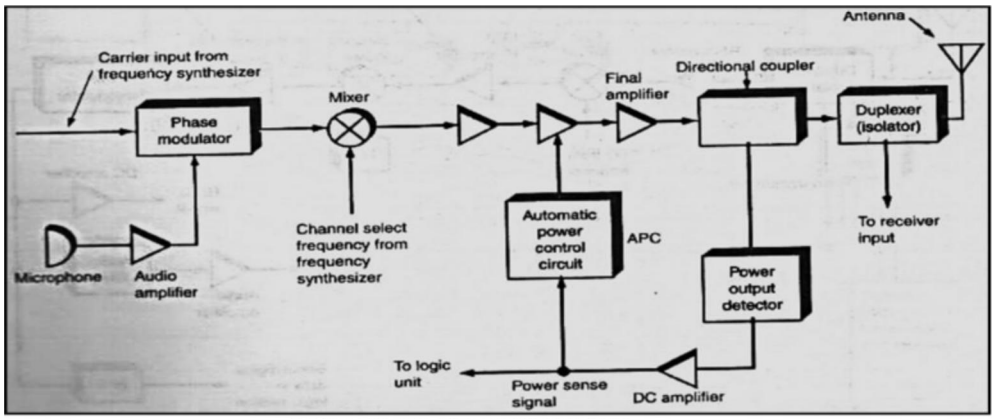


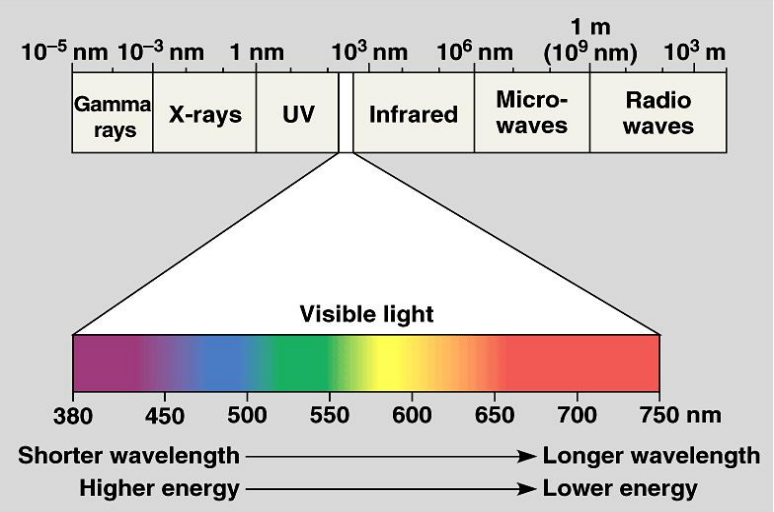
Or



Marks can be credited if surface emitting LED is explained

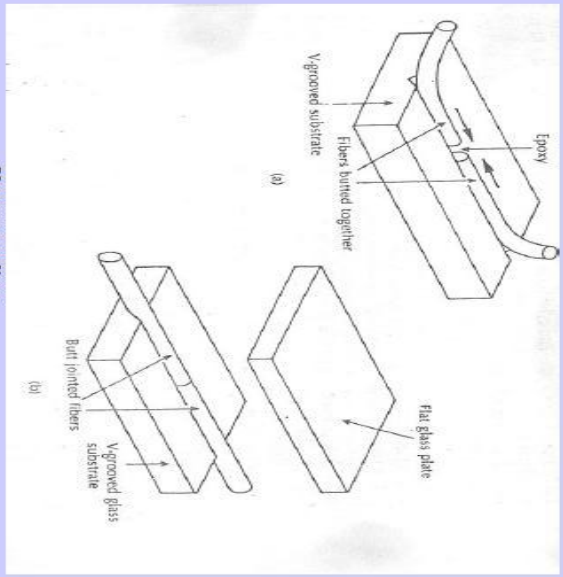
	c)	**State the four requirement of optical detector.**	**4 Marks**
	Ans:	**Characteristics of good optical detector** • Light Sensitivity-The minimum optical power of light detector can receive and still produce a usable electrical output signal. • Responsivity -the ratio of the output current of a photodiode to the input optical power.	**(Any four characteristics-1**

		• Dark current-The leakage current that flows through a photo diode with no light input. • Transient time-The time optical detector takes a light induced carrier to travel across the depletion region of semi-conductor • Spectral response – the range of wavelength to which optical detector may respond.	**M each)**
	d)	**State the advantages of cellular mobile services.**	**4 Marks**
	Ans:	• Higher bandwidth • Higher information • Solves the problem of spectral congestion and user capacity. • Offer very high capacity in a limited spectrum without major technological changes. • Large coverage area • Efficient use of limited spectrum • Reuse of radio channel in different cells. ***Marks to be credited for any other relevant advantages***	**Any 4 advantage-1m each**
	e)	**Draw and explain cellular mobile transmitter in detail.**	**4 Marks**
	Ans:	 CELLULAR TRANSMITTER • he carrier signal generated from frequency synthesizer[FS] is phase modulated with respect to the input signal from the microphone. • Channel select frequency from FS is mixed with phase modulator input further amplified and given to directional coupler for only couple power flowing in one direction. • Output of directional coupler is feed to Duplxer to route signals from the transmitter to the antenna and from the antenna to the receiver, without allowing signals to pass directly from transmitter to receiver. • An isolator is used to shield equipment on its input side from the effects of conditions on its output side.	**dig -2m** **exp-2m**

		And finally the output is feed to antenna for transmission	
	B)	**Attempt any ONE :**	**6 Marks**
	a)	**Draw the frequency spectrum for communication and show the region for optical fiber communication and explain.**	**6 Marks**
	Ans:	 • The visible spectrum is the portion of the electromagnetic spectrum that is visible to the human eye. • Electromagnetic radiation in this range of wavelengths is called visible light or simply light. • A human eye will respond to wavelengths from about 390 to 700 nm	**Dig: 2m** **OpticalRegion-1m** **Exp:-3m**
	b)	**What is splicing of an optical fiber ? Explain any two methods of splicing in detail.**	**6 Marks**
	Ans:	• When two fibres are joint together it is called fiber joint. • There are two types of joint :permanent joint and temporary joint. • A permanent joint formed between two fibre is called **splicing.** • Types of splicing :V groove splice ,prefusion splicing	**Def-2m Dig and exp of each method-2m each**

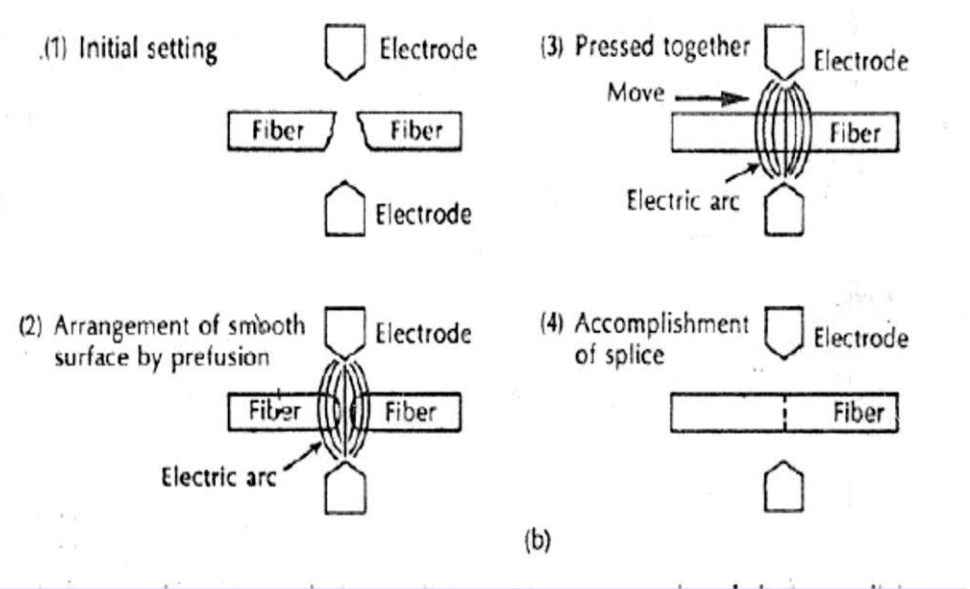
Groove Splices

- Use of grooves to secure the fibers to be jointed
  - better alignment to the prepared fiber ends.

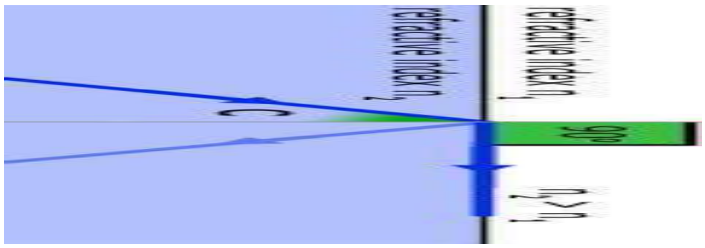
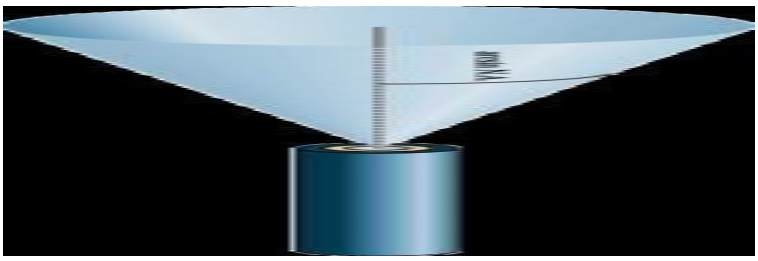
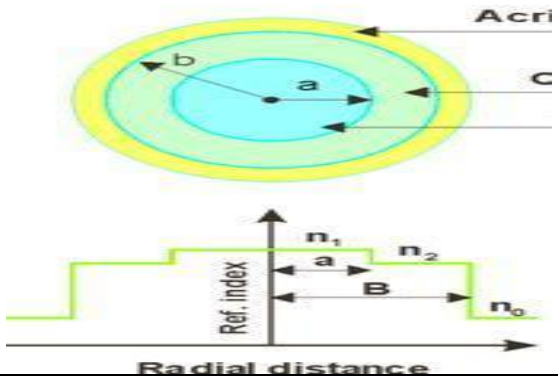


V-groove splices

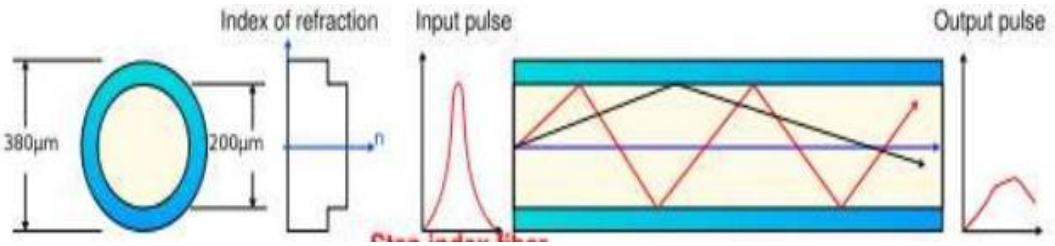
- Insertion losses ≈ 0.1 dB using jigs for producing V-groove splice



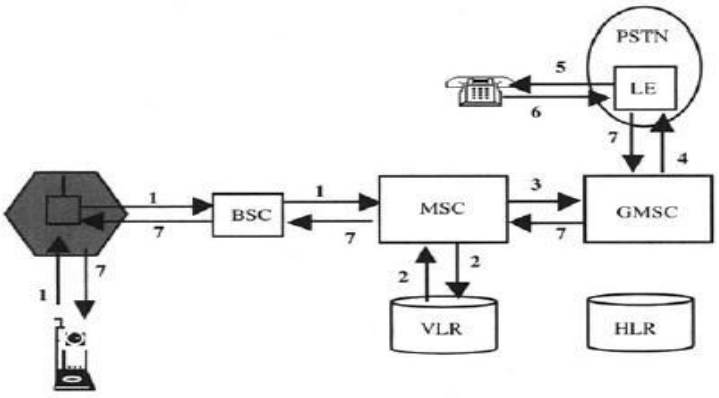
Prefusion method for accurate splicing

Q 2		Attempt any FOUR :	16 Marks
	a)	**Define :** **(i) Critical angle** **(ii) Numerical Aperture**	**4 Marks**
	Ans:	• **Critical angle:** It is that angle of incidence at which angle of refraction becomes 90 degree.  • **Numerical Aperture:** Light gathering capacity of fibre optic cable is called numerical aperature. 	**Def-2m** **Dig-2m**
	b)	**Draw and explain step index fiber with example.**	**4 Marks**
	Ans:		**Dig-2m** **Exp-2m**

Or



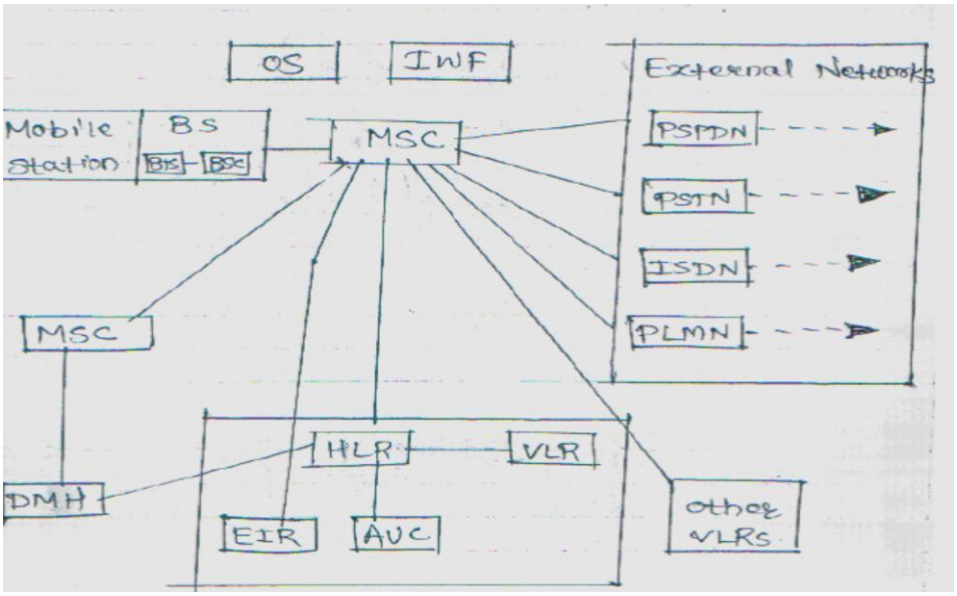
- Single mode fiber has a core diameter of nominally 9µm.
- For the fibers we use, the cladding is always 125µm while the protective coating has a diameter of 250µm.
- Other buffers and jacketing materials help build the fiber up to more practical and rugged cable structures.
- The higher the fiber's bandwidth and the lower the attenuation (loss in dB per kilometer).
- Attenuation(dB/km) for 850nm Not applicable

	c)	**Describe the call making procedure from mobile handset to landline phone unit.**	**4 Marks**
	Ans:		**Dig-2m** **Exp-2m**

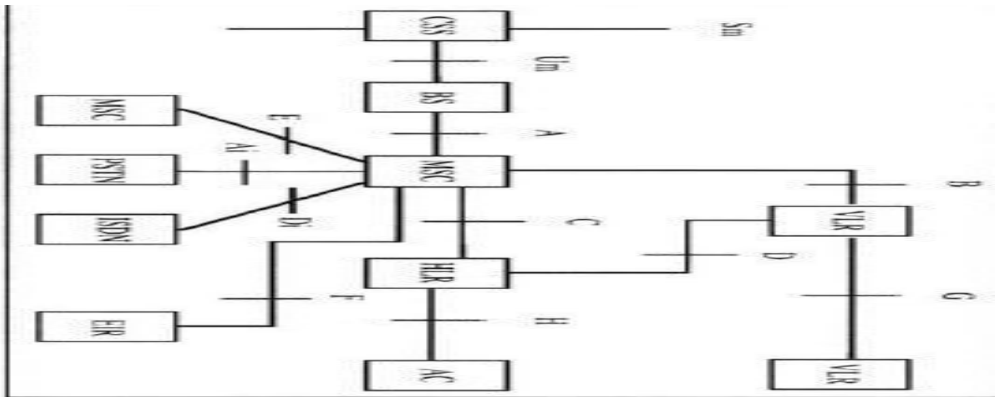
1. The MS sends the dialed number indicating service requested to the MSC (via BSS).
2. The MSC checks from the VLR if the MS is allowed the requested service. If so, MSC asks the BSS to allocate necessary resources for the call.
3. If the call is allowed, the MSC routes the call to GMSC.
4. The GMSC 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.

Marks to be credited if GSM based procedure is given

	d)	**Draw and explain basic typical cellular telephone system.**	**4 Marks**
	Ans:	 It provides a wireless connection to the PSTN for any user location within the radio range of the system This system accommodates a large no. of users over a large geographical area called as 'cell' so that same radio channels may be reused by another base station located some distance away. It consists of : 1. Mobile station 2. Base station 3. Mobile Switching Center (MSC) or Mobile Telephone Switching Office (MTSO) 4. Forward voice channel (FVC) :- for voice transmission from the BS to MS. 5. Reverse voice channel (RVC) :- voice transmission from MS to BS.	**Dig-2m** **Exp-2m**
	e)	**Explain CDMA system with its architecture.**	**4 Marks**
	Ans:	**CDMA is IS -95 system:**	**Dig-2m** **Exp-2m**


OS
INF
External Networks
Mobile station
BS
BTS
BSC
MSC
PSPDN
PSTN
ISDN
PLMN
MSC
HLR
VLR
DMH
EIR
AUC
other VLRs

Or


OMC
MSC
VLR
HLR
AC
EIR

When mobile phone user calls tries to gain access to service from the network. The BSC is the control and management system for one or more BTS's.

a) The BSC exchanges the messages with both the BTS and MSC.

b) The MSC is an automatic system that interfaces the user traffic from wireless network with the wire line network or other wireless networks. MSC provides radio contact to a call.

c) Mobile station communicates with BSS for radio resources which in turn communicate with MSC for necessary channels.

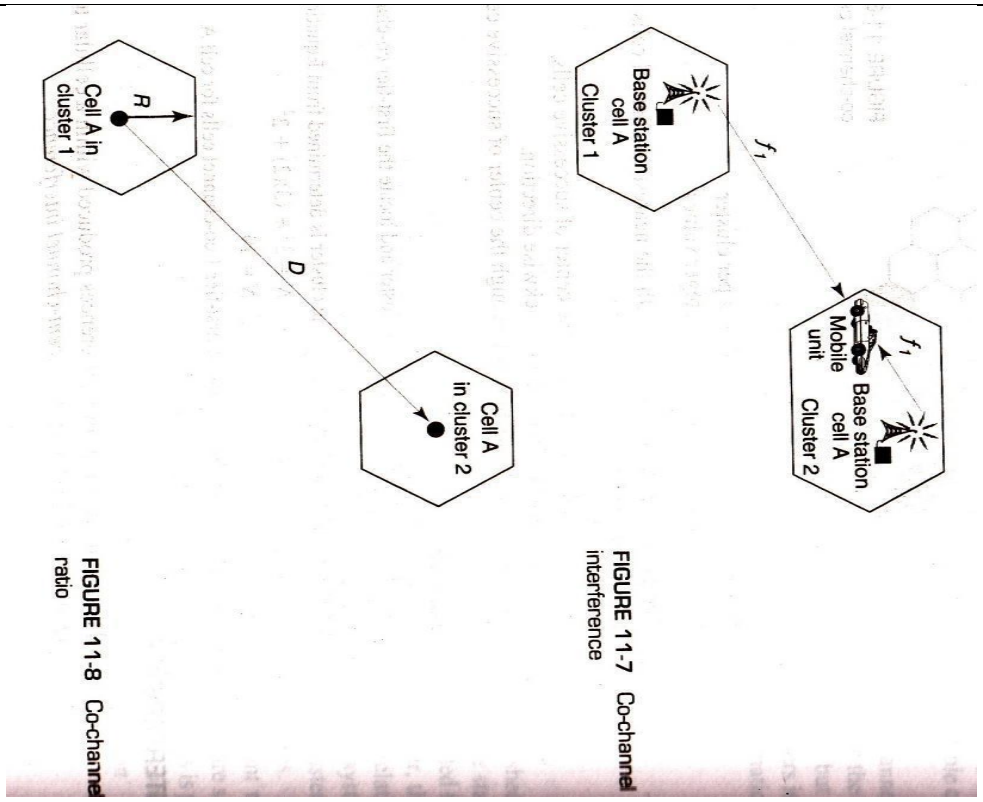
d) When a roaming MS enters a new service area covered by the MSC, information is stored in VLR.

e) HLR maintains all subscriber-related information.

f) Data Message Handler (DMH) for collects the billing data.

g) Authentication Centre (AUC): The AUC manages the authentication associated with individual subscriber.

h) Inter working Function (IWF): The IWF enables the MSC to communicate with other networks. (PSTN), (ISDN), (PLMN) and Public Switched Packet Data Network (PSPDN).

	f)	**Describe co-channel interference in cellular system.**	**4 Marks**
	Ans:	 FIGURE 11-7 Co-channel interference FIGURE 11-8 Co-channe ratio	**Dig-2m** **Exp-2m**

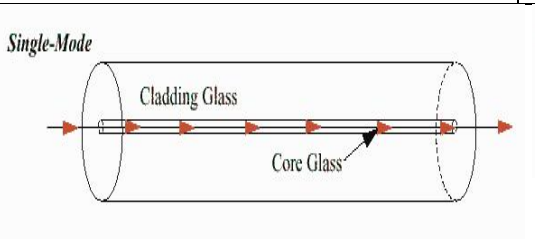
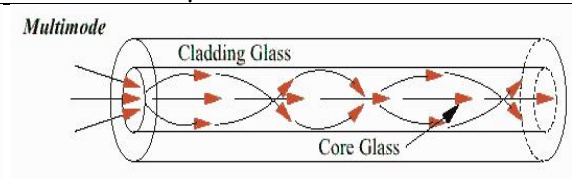
Co-channel interference:

- When frequency reuse is implemented, several cells within a given coverage area use the same set of frequencies.
- Two cells using the same set of frequencies are called co-channel cells, and the interference between them is called co-channel interference.
- Unlike thermal noise, co-channel interference cannot be reduced by simply increasing transmit power because increasing the transmit power in one cell increases the likelihood of that cell's transmissions interfering with another cell's transmission.
- To reduce co-channel interference, a certain minimum distance must separate co-channels.

Q. 3 **Attempt any FOUR :** **16 Marks**

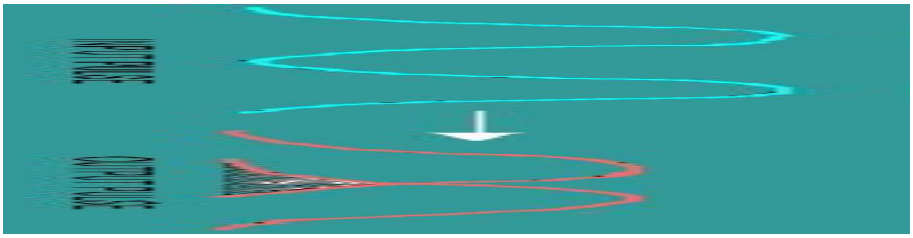
a) **Differentiate between single mode and multimode fiber.** **4 Marks**

Ans: **any 4 points- 1m each**

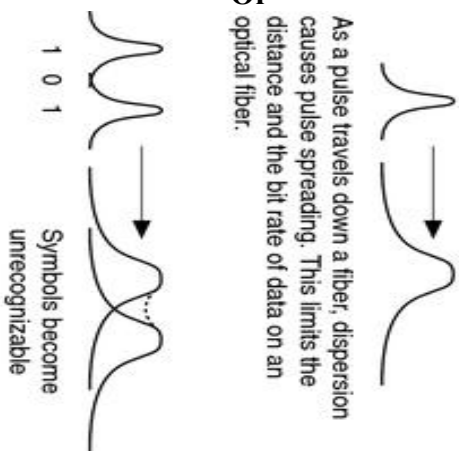
Single mode fiber	Multi mode fibre
Single mode fiber has a core diameter of nominally 9µm	multimode fiber has either a 50µm or 62.5µm c diameter.
the cladding is always 125µm while the protective coating has a diameter of 250µm.	the cladding is always 125µm while the protecti coating has a diameter of 250µm.
higher fiber's bandwidth	lower fiber's bandwidth
lower attenuation (loss in dB per kilometer).	higher tattenuation (loss in dB per kilometer).
Attenuation(dB/km) for 850nm Not applicable	Attenuation(dB/km) for 850nm-> 2.5dB/Km Multimode fiber of Core diameter 50µm 850nm-> 3.5dB/Km Multimode fiber of Core diameter 62.5µm
	

b) **Explain intramodel dispersion in optical fiber.** **4 Marks**

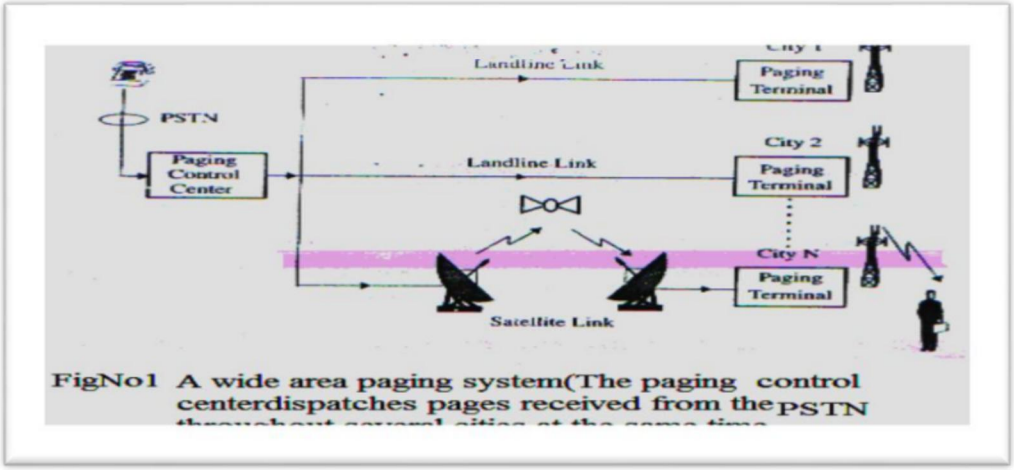
Ans: **Dig-2m Exp-2m**

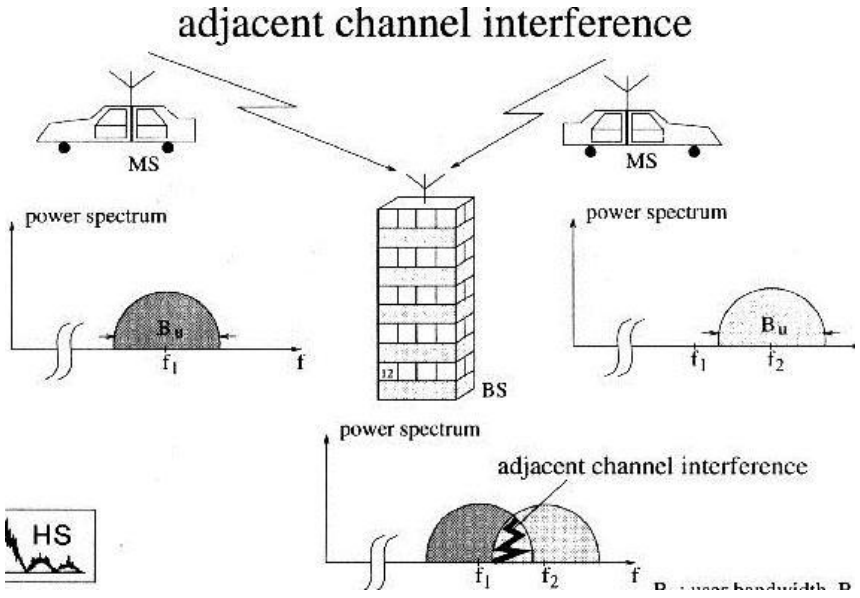


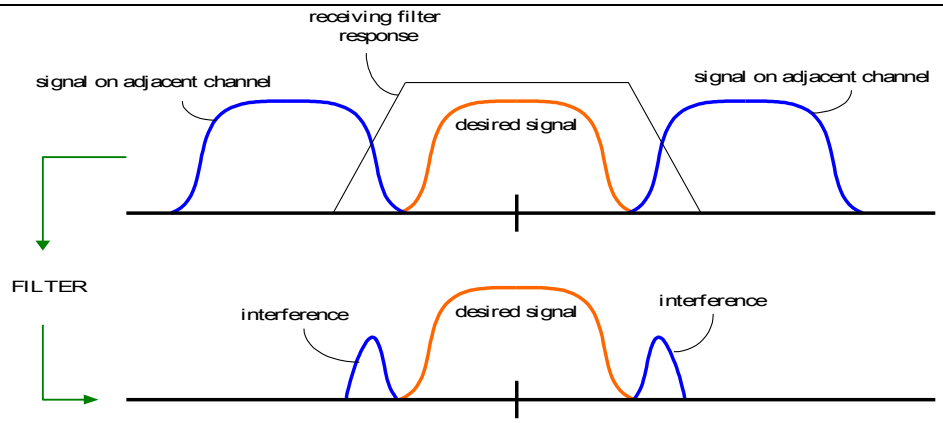
Or



- It is pulse spreading which is within a single mode.
- It is due to material dispersion and waveguide dispersion.
- Material dispersion is due to variation in refractive index of core because of which pulse spreading occurs even when different wavelength follows same path.
- Wavelength dispersion due to practically as 80% optical power is confined to core & rest 20% Optical power is lost into clad.

	c)	**Draw the labelled block diagram of paging system and explain its operation.**	**4 Marks**
	Ans:	 FigNo1 A wide area paging system(The paging control centerdispatches pages received from the PSTN	**Dig-2m Exp-2m**

		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	
d)		**State four way to improve coverage and capacity of cellular system.**	**4 Marks**
Ans:		**Improve coverage and capacity of cellular system.** 1]Cell Splitting 2]Sectoring 3] Coverage Zone/ Microcell Zone Concept 4] Repeaters For Range Extension	**1m-each method**
e)		**Describe the adjacent channel interference in cellular system.**	**4 Marks**
Ans:		**Adjacent Channel Interference**  **or**	**Dig-2M Exp-2m**



•Adjacent channel interference:
its interference from adjacent frequency to the desired signal.

- Imperfect receiver filters allow nearby frequencies to leak into the passband
- Performance degrade seriously due to *near-far* effect.

•. Adjacent channel interference may be caused by inadequate filtering, such as incomplete filtering of unwanted modulation products in frequency modulation (FM) systems, improper tuning, or poor frequency control, in either the reference channel or the interfering channel, or both.

- Adjacent channel interference can be minimized through careful filtering and *channel assignment*.
- Keep the frequency separation between each channel in a given cell as large as possible
- A channel separation greater than six is needed to bring the adjacent channel interference to an acceptable level.

Q. 4	**A)**	**Attempt any THREE :**	**12 Marks**
	a)	**State the features of GSM.**	**4 Marks**
	Ans:	• fully digital system utilizing the 900 MHz frequency band • TDMA over radio carriers (200 kHz carrier spacing) • 8 full-rate or 16half-rate TDMA channels per carrier • user/terminal authentication for fraud control • encryption of speech and data transmissions over the radio path • full international roaming capability • low speed data services (up to 9.6kb/s) • compatibility with ISDN for supplementary services • support of short message service (SMS)	**Any 4 features- 1m each**

System Parameter	Value (GSM)
Multiple access	TDMA/FDMA/FDD
Uplink frequency (mobile-to-base)	890–915 MHz
Downlink frequency (base-to-mobile)	935–960 MHz
Channel bandwidth	200 kHz
Number of channels	124
Channels/carrier	8 (full rate), 16 (half rate)
Frame duration	4.6 ms
Interleaving duration	40 ms
Modulation	GMSK
Speech coding method	RPE-LTE convolutional
Speech coder bit rate	13 kb/s (full rate)
Associated control channel	Extra frame
Handoff scheme	Mobile-assisted
Mobile station power levels	0.8, 2, 5, 8 W

Marks to be credited even if GSM air parameter are given ad features

b) State the various services offered by GSM in detail. — **4 Marks**

Ans:

GSM services: ***tele- services , bearer services and supplementary services***

Tele- services supported by GSM– are telephony. Other services derived from telephony are *emergency calling* and *voice messaging.*

Teleservices based on bearer services :

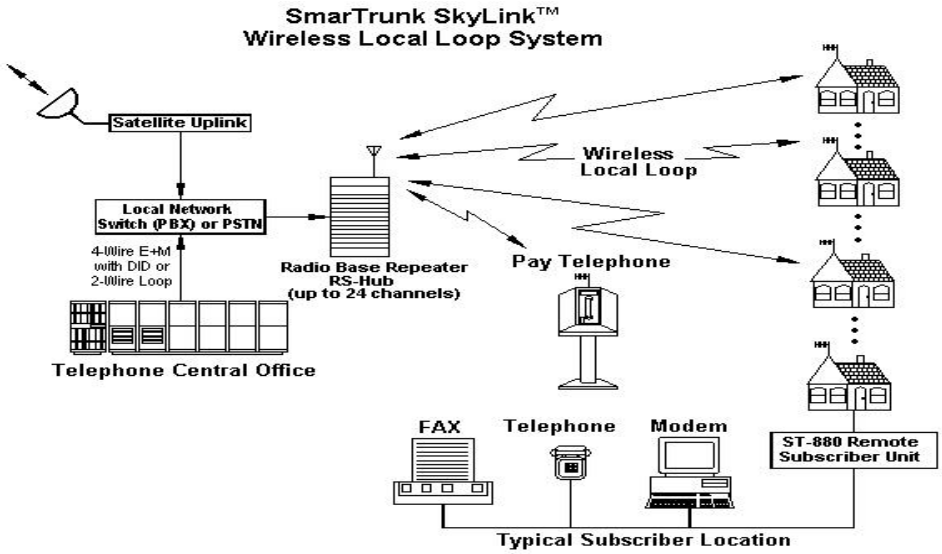
- group 3 fax
- short message service (SMS).
- high speed circuit-switched data (HSCSD)
- general packet radio service (GPRS).

Bearer services supported in GSM-- include various asynchronous and synchronous data services for information transfer between GSM and other networks (i.e., PSTN, ISDN, CSPDN, PSPDN) at rates from 300 to 9600 b/s.

supplementary services supported by GSM include the following:

- call offering services—call forwarding
- call restriction services—call barring
- call waiting service
- call hold service
- multi party service—tele conferencing
- calling line presentation restriction services

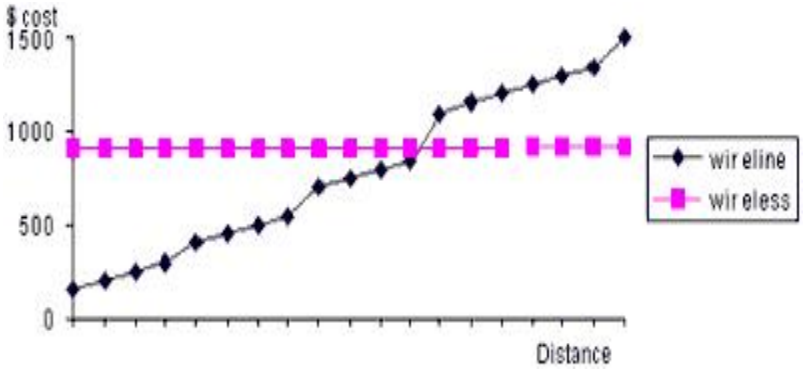
Stating services- 1m
Description of each service- 1m

		• advice of charge service • closed user group service	
	c)	**What is WLL ? Describe with suitable diagram.**	**4 Marks**
	Ans:	 **Or** **- WLL is a system that connects subscribers to the local telephone station wirelessly.** • Systems WLL is based on: – Cellular – Satellite (specific and adjunct) – Microcellular • Other names – Radio In The Loop (RITL) – Fixed-Radio Access (FRA). WLL services: • Desirable: – Wireless feature should be transparent – Wireline Custom features – Business related • Hunt groups, • Call transfers • Conference calling – Calling cards, coin phones – Toll-quality service – Expand from a central office to about 5 miles	**Dig-2m** **Exp-2m**

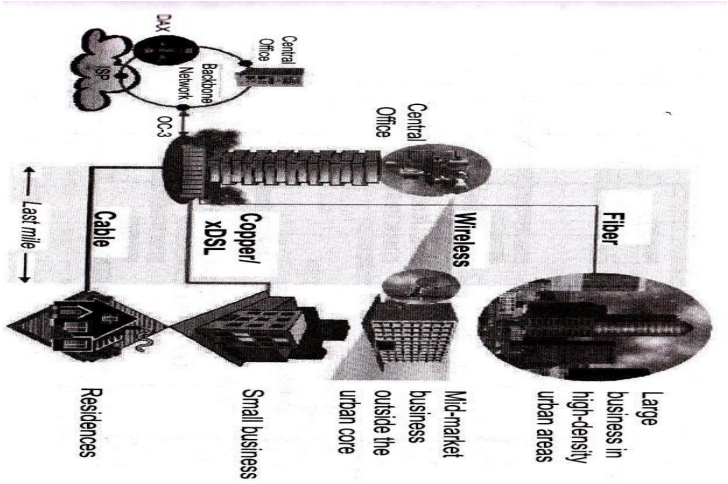
- Low license cost
- Subscriber costs equivalent or better than copper
- V.29 (9600bps)
- ISDN (64kbps)

Cost Considerations:

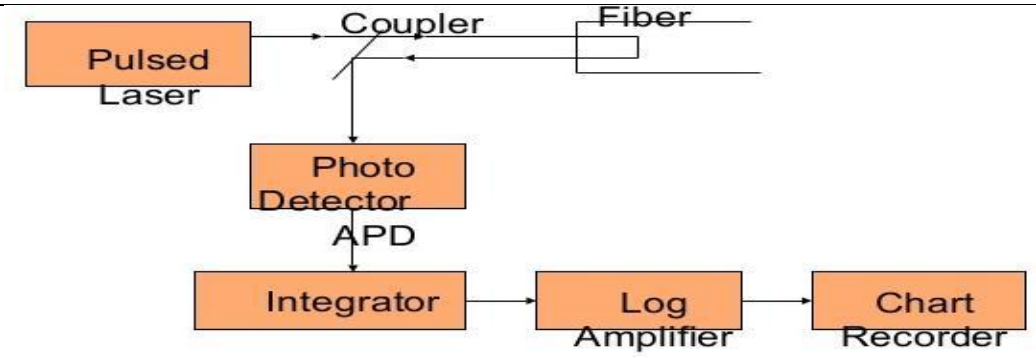
- Wireless cost is constant over distance for WLL
- Wireline depends on distance AND terrain

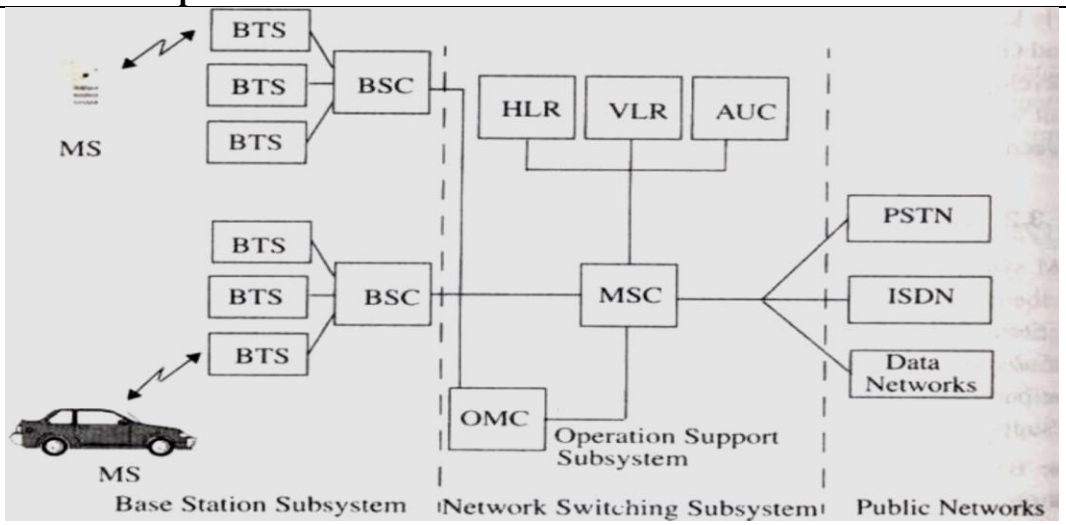


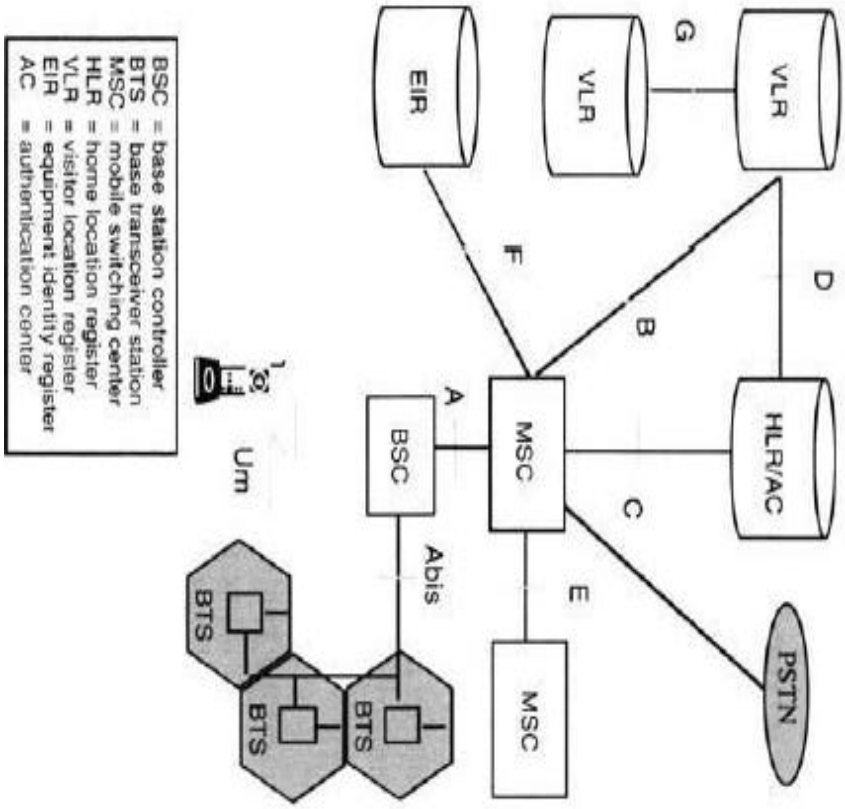
- **or**



- Fixed wireless equipment is extremely well suited for rapidly deploying a broadband connection.
- Modern fixed wireless systems are usually assigned microwave or millimeter radio frequency in the 28 GHz band and higher which is greater than 10 times the carrier frequency of 3G terrestrial cellular telephone network.
- At higher frequencies i.e., in GHz, wavelengths are extremely small, which in turn allows very high gain directional antennas to be fabricated in small physical form factor.
- The used high gain antennas have spatial filter properties which reject multipath signals that arrive from directions other than the desire light-of-sight (LOS) and supports transmission of very wide bandwidth signals without distortion.
- Microwave wireless links are used to create WLL.

		• Benefit of WLL is that, once wireless equipment is paid for there are no additional costs for transport between central office (CO) and customer premise equipment (CPE).	
	d)	**Explain in brief IMT 2000.**	**4 Marks**
	Ans:	• Common spectrum worldwide (1.8-2.2 GHz band) • Multiple radio environments (cellular, cordless, satellite, LANs) • Wide range of telecommunications services (voice, data, multimedia, • 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 • Commonality of design worldwide • Operation within the designated MT-2000 frequency bands	**Any 4 features -1m each**
	B)	**Attempt any ONE :**	**6 Marks**
	a)	**Draw and explain the block diagram of OTDR.**	**6 Marks**
	Ans:	 OTDR is optical time domain reflect meter used for finding faults, splices and binds in fiber optic cables. ii) 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. iii) A light pulsed is launched into the fiber in forward direction from an injection laser using	**Dig-3m Exp-3m**

		coupler or beam splitter. iv) 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. v) 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	
	b)	**Draw and explain GSM Reference Architecture.**	**6 Marks**
	Ans:	 **Or**	**Dig-3m Expl-3m for brief Function of each block**



. BSS:

- Radio resource control
- Frequency hopping and power control
- Handoffmanagement
- Digital signal processing

2. Home Location Registers (HLR)

 Permanent database about mobile subscribers in a large service area (generally one per GSM network operator)

 Database contains subscriber & location information

 Database contains IMSI (International Mobile Subscriber Identity), prepaid/postpaid, roaming restrictions, supplementary services

 Each Subscriber assigned IMSI to identify home user

3. Visitor Location Registers (VLR)

 Temporary database which stores IMSI & customer information for each roaming subscriber visiting the coverage area of particular MSC.

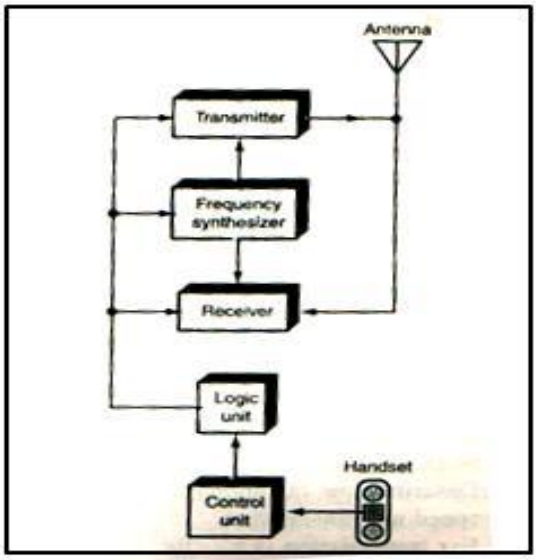
 It updates whenever new MS enters its area, by HLR database. It controls the mobiles roaming in its area.

4. **MSC performs the following major functions:**

- Call setup, supervision, and release

		•Digit collection and translation •Call routing •Billing information collection • Mobility management: Registration, locationupdating ,inter-BSS and inter-MSC call handoffs • Paging and alerting • Management of radio resources during a call • Echo cancellation • Manage connections toBSS, other MSCs, and PSTN/ISDN • Interrogation ofappropriate registers (V/HLRs) 5.**Authentication Center AC).** • **AC** associated **with the HLR**, the authentication center contains authentication parameters that are used on initial location registration, subsequent location updates, and on each call setup request from the MS. • **Equipment Identity Register(EIR)** • EIR maintainsinformation to authenticate terminal equipment so that fraudulent, stolen, or nontype-approved terminals can be identified and denied service.	
Q.5		**Attempt any FOUR :**	**16 Marks**
	a)	**Describe attenuation in optical fiber.**	**4 Marks**
	Ans:	Attenuation Definition: a loss of signal strength in a light wave, related to the distance the signal must travel. Determines the maximum transmission distance between transmitter and receiver. Attenuation is caused by: Absorption Scattering Radiative losses (bending losses) **or** ▪ Attenuation is defined as the ratio of optical output power to the input power in the fiber of length L. ▪ $\alpha = 10\log_{10} Pi/Po$ [in db/km] where, Pi= Input Power Po= Output Power, α is attenuation constant ***Marks to be credited if any of the loss like radiation, absorption ,coupling is explained.***	**Exp-4m**
	b)	**Draw the block diagram of mobile unit. State the function of logic unit and control unit in mobile Handset.**	**4 Marks**

Ans:



BLOCK DIAGRAM OF CELLULAR RADIO

Dig -2m Function of each=1m

function of logic unit in mobile Handset.

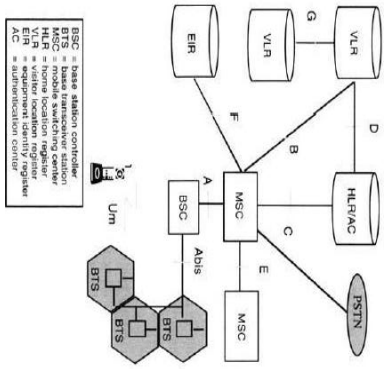
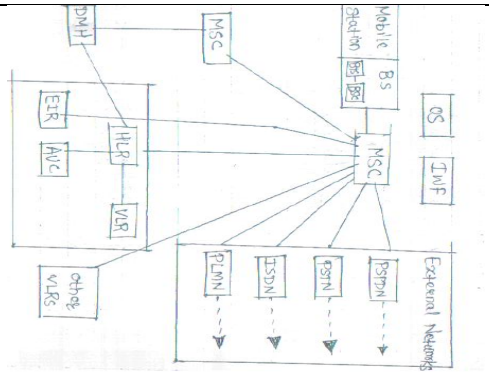
- The logic unit contains the master control circuitry

function of control unit in mobile Handset.

- The control unitc ontains the handset with speaker and microphone

c) Compare GSM with IS — 95. **4 Marks**

Ans:

SrN	GSM	IS-95
1	Developed by European	North America
2		
3	modulation technique -GMSK	modulation technique- like DQPSK or GMSK (used in GSM).
4	CDMA not used	Uses CDMA

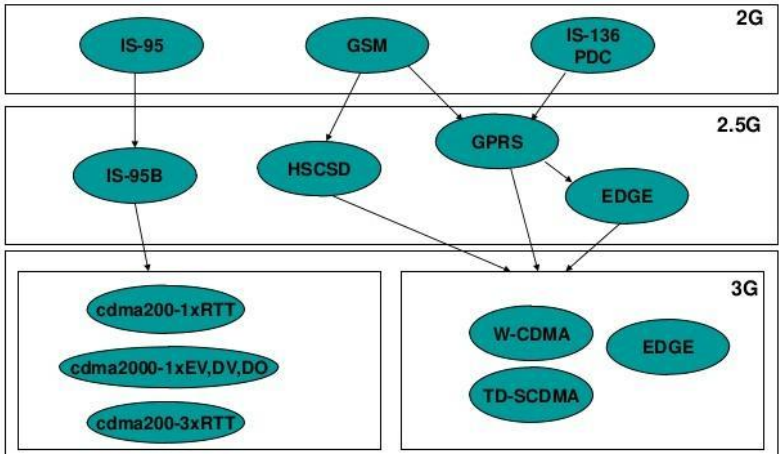
Mark to be credited for any other relevant comparative parameter

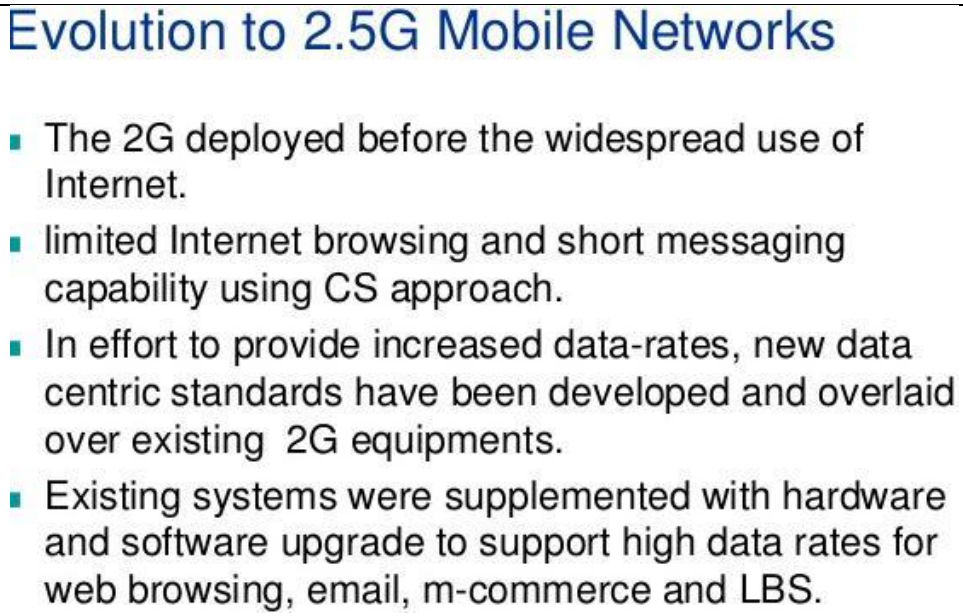
Any 4points-1m each

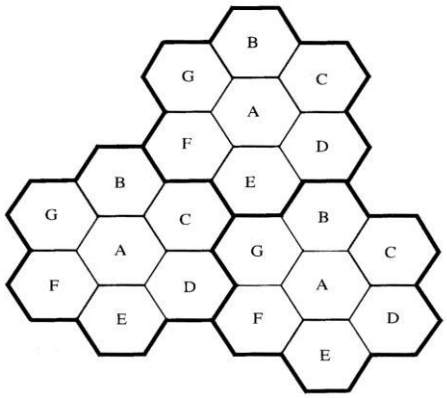
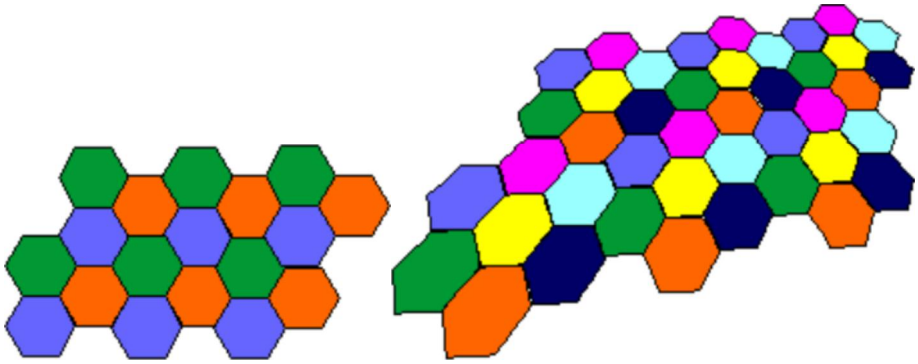
d) List GSM air interface specifications. **4 Marks**

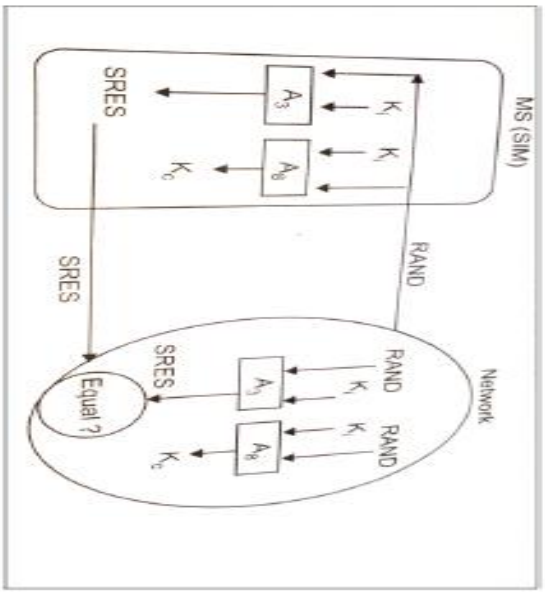
	Ans:		**Any 4- 1m each**

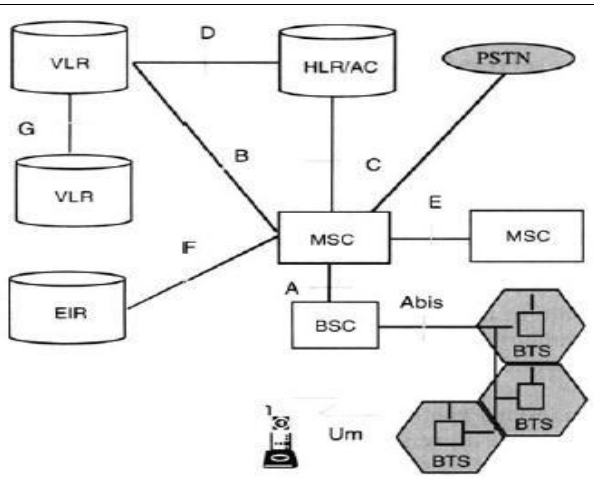
System Parameter	Value (GSM)
Multiple access	TDMA/FDMA/FDD
Uplink frequency (mobile-to-base)	890–915 MHz
Downlink frequency (base-to-mobile)	935–960 MHz
Channel bandwidth	200 kHz
Number of channels	124
Channels/carrier	8 (full rate), 16 (half rate)
Frame duration	4.6 ms
Interleaving duration	40 ms
Modulation	GMSK
Speech coding method	RPE-LTE convolutional
Speech coder bit rate	13 kb/s (full rate)
Associated control channel	Extra frame
Handoff scheme	Mobile-assisted
Mobile station power levels	0.8, 2, 5, 8 W

	e)	**Explain evaluation for 2.5 G TDMA standards.**	**4 Marks**
	Ans:		**Dig-2m Exp-2m**

		 **Marks can be credited if any other diagram of evolution is given**	
	f)	**Describe the important feature of 3G-CDMA-2000.**	**4 Marks**
	Ans:	1.It is evolved under European telecommunication standard institute (ETSI) in 1996. 2. It assures backward compatibility with 2G GSM, IS-136 and PDC TDMA technologies as well as all 2.5 G technologies. 4. UMTS network structure and bit level packaging of GSM data is retained by **3GWCDMA** 5. Additional capacity and bandwidth is provided by a new CDMA air interface. 6. The 3G W-CDMA air interface std has been assigned for "always-on" packet based wireless n/w and connected to the internet, anytime, anywhere. 7. **3GWCDMA** supports packet data rates upto 2.048 Mbps per user (if user is stationary) 8. W-CDMA supports:-Public and private network feature, As well as video conferencing and Virtual name entertainment. (VHE) 9. W-CDMA Requires:-Minimum spectrum allocation of 5MHz. 10. Complete change out of the RF equipment at each station to provide backward compatibility and interoperability for all GSM, IS-136/PDC, GPRS and EDGE equipment	**Any 4 relevant point - 1m each**
Q.6		**Attempt any FOUR :**	**16 Marks**
	a)	**Describe the concept of frequency reuse. Draw two frequency reuse patterns.**	**4 Marks**

	Ans:	 • **Frequency reuse** in mobile cellular systems **means** that **frequencies** allocated to the service are **reused** in a regular pattern of cells, each covered by one base station. The repeating regular pattern of cells is called cluster. • Each cellular base station is allocated a group of radio channels within a small geographic area called a *cell*.  **For cluster of 3cells** **For cluster of 7cells**	**Dig -2m** **Exp-2m**
	b)	**Explain Authentication process in GSM.**	**4 Marks**

	Ans:	 **Fig. GSM authentication process in GSM** **OR** **Explanation:** 2M • Authentication refers to process by which station confirms the identity of mobile station. • It protects GSM network against unauthorized access. • The Authentication Center is responsible for all security aspects. • The AUC generates the RI's associates them with IMSI and provides for each IMSI a set of triplets consisting of RAND (Random Number), SRES (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 responses matches then mobile phone authenticated.	
	c)	**Draw and explain GSM system Architecture.**	**4 Marks**

	Ans:	 • GSM is global system mobile developed by Europeans • It consists of MSC,MS,BSC,VLR,HLR ,EIR and authentication centre • It consists of protocol likeUm,Abis,A,B,C,D,E nad F to communicate between the different blocks. • It has different values of uplink and down link frequencies	**Dig-2m Exp-2m**
	d)	**Describe 3G-TD-SCDMA with respect to spectrum utilization, bandwidth, data rate and antenna.**	**4 Marks**
	Ans:	**3G -TD-SCDMA:** **spectrum utilization:** 25Erl./MHz **Bandwidth:** 1.6 MHz **data rate:** 1.971Mbps **antenna**: Smart antennas	**(Each features - 1M,Any Four)**
	e)	**Describe the advantage of 3G wireless network system.**	**4 Marks**
	Ans:	a.Overcrowding is relieved in existing systems with radio spectrum b. Bandwidth, security and reliability are more c. Provides interoperability among service providers d. Availability of fixed and variable rates e. Support to devices with backward compatibility with existing networks f. Always online devices – 3G uses IP connectivity which is packet based g. Rich multi media services are available	**1m each**