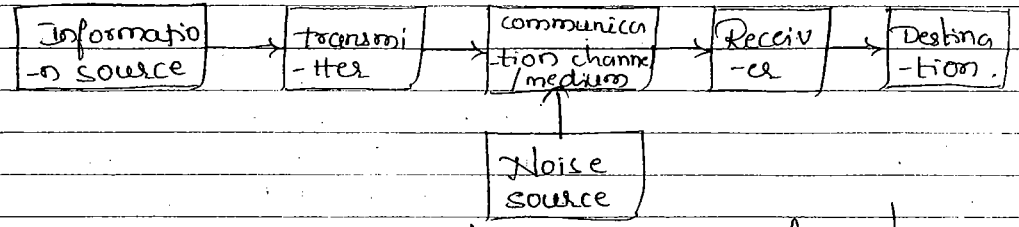
① Draw & explain the block diagram of communication s/m.



The basic components of communication s/ms are : information channel, transmitter, communication channel, receiver & destination.

The communication s/m communicate msgs. The messages comes from the information source. such as : human voice, pictures, data, music, & their combinations.
The amount of information contained in any given msg is measured in bits.

The transmitter is a collection of electronic ckt designe -d to convert the information into a signal suitable for transmission over a given communication medium. The msgs that comes from information source is non - electrical. Therefore such msgs needs to be processed before transmission & also required suitable transducers to convert them into electrical signals. The most of the transmitters have built-in amplifier ckts to amplify the incoming signals.

The common channel is the medium by which electronic signal is transmitted from one place to another. The communication medium can be a pair of connecting wire, co-axial cable, optical fibre cable or free space.

Noise is undesirable electric energy that enters the communication s/m via the medium & interfeares with a transmitate msg. Noise can be either natural or man made. Natural noise includes noise produced in nature. eg: lightning during rainy season. or noise due to radiations produced by the sun. man made noise is the noise produced by electric ignition s/ms of cars, electric motors. fluorescent lights etc.

A receiver is a collection of electronic ckts designed to convert the signal backs to original information. it consists of amplifier, detector, mixer, oscillator, transducers, & so on.

② Communication : Communication is the process of exchanging information. It consists of text, numbers, pictures, sound, video, or any combination of these.

② List the forms or types of electronic communication.

-> The following are the types of electronic communicat
1. One-way & 2-way communication.
2. Analog & digital communication.
3. Base band & broad broad band communication
4. Point to point & broad cast communication.
5. Wired & Wireless communication.

One-way communication :

One-way communication is referred as simplex. In simplex communication the information travels in one direction only

Ex: Communication through radio & t-v broad casting

2-way communication

2-way communication is referred to as duplex. The bulk of electronic communication is 2-way Duplex communication can be further classified as
a. half-duplex
b. full-duplex.

a. Half-duplex : Information can be sent in both direction, but not at the same time. In this s/m transmit mode there receiver is disablec & vice-versa.

Ex: Radio communications used in military, fire police & other services

b. Full-duplex : Information can be sent in both direction at the same time without interference.

Ex: Communication through telephone.

Analog communication

It deals with transmission of continuous signal over a given channel. An analog signal is a continuously varying voltage or current. Analog signal is a sine wave tone voice & video voltages are analog signals.

Digital communication:

Digital communication consist of information in the form of a sequence of symbols or letters.

corresponding to each symbol a particular electrical wave form is transmitted over the channel.

Data used in computers is digital where binary codes representing numbers, letters & special symbols are transmitted by wire or radio. The most commonly used digital code in communication is ASCII (American Standard code for Information Interchange).

Based band communication

Communication s/m in which signal transmission takes place without modulation are called base band s/ms. In base band s/ms the msg signal is applied directly to the medium. In base band communication the transmitter & receiver amplifies signal & perform appropriate filtering operation. No modulation or demodulation operations are performed in the s/m.

Broad band communication:

In this communication s/m the transmission frequency band is much greater than the msg frequency band. In this s/m the frequency modulation techniques are used - Analog methods are used to transmit digital data in broad band s/m. Transmission over longer distance can be achieved by using broad band communication but this s/m is more complex & expensive compared to base band communication.

Point to point communication

In this communication s/m the exchange information exchange takes place b/w 1 transmitter & 1 receiver.

Ex: Telephone.

Broad cast communication:

In broad cast communication information exchange takes place between 1 transmitter & a number of receivers.

Ex: Radio & T-V broad cast.

Wired communication:

It makes use of guided media such as transmission lines for carrying electrical signals from transmitter to receiver.

Ex: Cable T-V distribution s/m, Intercom in offices.

Wireless communication:

It makes use of electromagnetic spectrum. signals are communicated from transmitter to receiver by converting them into electric & magnetic fields.

Ex: Radio & T-V broad cast.

(4) Define modulation:

The process of changing some characteristics (Amplitudes, frequency or phase) of a carrier wave in accordance with the intensity of the signal is known as modulation.

(5) Need for modulation

Modulation is necessary in communication s/m

because of the following reasons:

1. Modulation for long distance communication:
Voice signals cannot be transmitted directly by radio waves or electromagnetic waves therefore to transmit the base band signals by electromagnetic waves therefore to transmit the base band modulation of signal is necessary to reach the long distance.

2. Wireless communication:
By using modulation techniques we can transmit the information from to transmitting end to receiving end without using wires. We can radiate the information into the space in the form of electromagnetic waves.

3. Practical antena length.
Antenas are needed to radiate & receive signals in wireless communication s/m. The height of the antenas is usually calculated as half of the wave length or equal to wavelength of the signal being radiated. many base band signals have low frequency to transmit these type of signals it is impossible or almost difficult to design a practical atena.
To achieve a practical antena we use modulation techniques for the radiations of the signals.

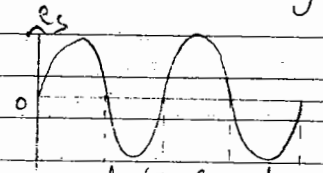
4. Modulation to reduce noise & interference.
By using modulation technique we can reduce the noise level present in the signal because frequency modulation technique is ineffected by noise & interference.

5. modulation for multiplexing
If a no of signal utilize a signal channel modulation may be used to translate different signals to different freq. bands.

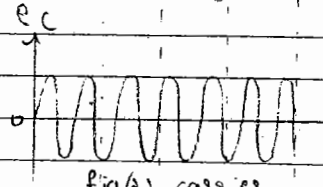
6. Modulation for freq. assignment.
Different communication services have been alloted different segments of frequency. for ex: mobile communication across at different frequencies than that of radio or T-V broadcast.

⑥ Types of modulation
There are 3 types of modulation
1. Amplitude modulation.
2. Frequency modulation
3. Phase modulation.

④
Define & explain Amplitude modulation.
→ When the amplitude of high frequency carrier wave is changed in accordance with the intensity of the signal it is called amplitude modulation.



fig(1) signal



fig(2) carrier

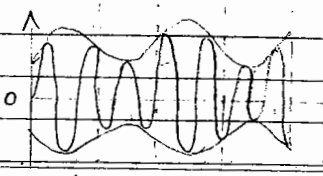
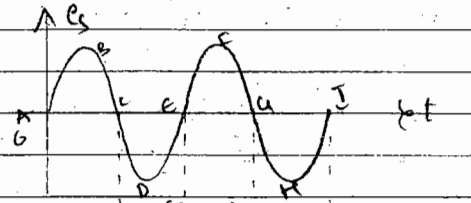


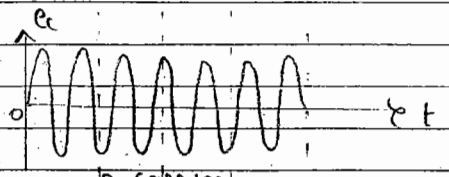
fig (3) AM wave

→ In amplitude modulation only the amplitude of the carrier wave is changed in accordance with the intensity of the signal. fig (1) shows the audio electrical signal, fig(2) shows a carrier wave of constant amplitude, fig(3) shows amplitude modulated wave.
it is clear that the amplitudes of both +'ve & -'ve half cycles of carrier wave are changed in accordance with the signal. When the signal is increasing in the +'ve sense the amplitude of the carrier wave also increases & vise versa.
Amplitude modulation is done by an electric ckt called as "Modulator"

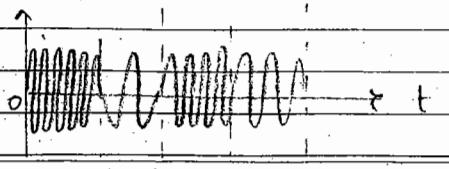
⑧ Define & expl° frequency modulation.
→ When the frequency of the carrier wave is changed in accordance with the intensity of signal it is reffered as frequency modulation.



1. Signal



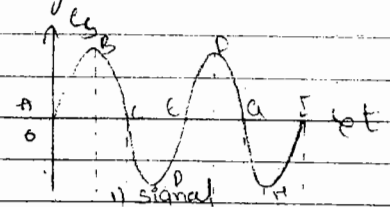
2. carrier



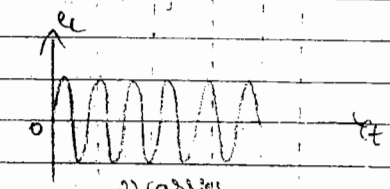
3. fm wave.

In freq Modulation only the freq of the carrier wave is changed in accordance with the intensity of the signal. The frequency variations of carrier wave depends upon the intensity of the signal. When the signal voltage is zero at A, C, E, G & I the carrier frequency is unchanged. When the signal reaches its +'ve peaks as at B & F the carrier frequency is increased to its maximum, however during the -'ve peaks of the signal as at D & H the carrier freq is reduced to minimum.

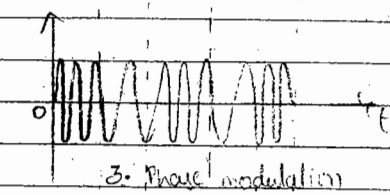
⑨ Define phase modulation & explain it.
→ Phase modulation is a process in which the amount of phase shift of a carrier is varied in accordance with the amplitude & rate of change of modulating signal.



1) signal



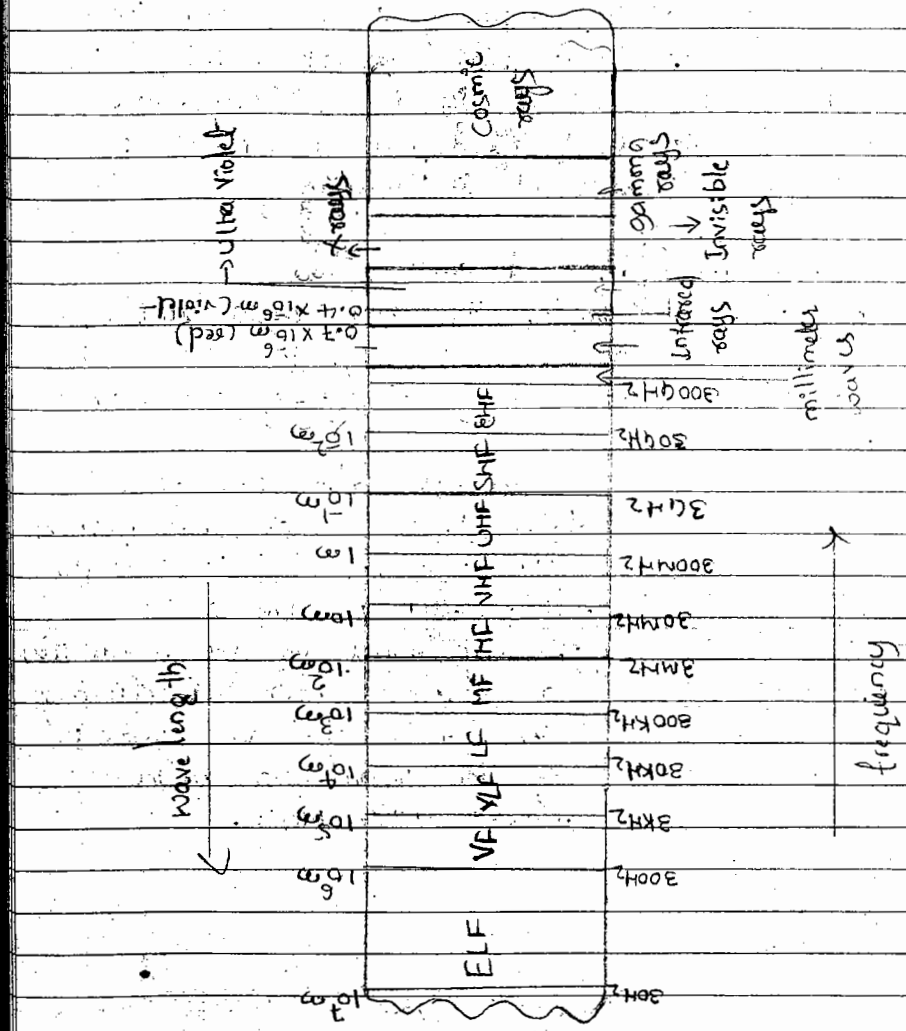
2) carrier



3. Phase modulation

from the above fig it is clear their maximum frequency changes occurs corresponding sign to the zero crossing point of the modulating signal. However during the +'ve & -'ve peaks of the signal no frequency change takes place.

Write a brief note on electromagnetic expect spectrum



Segment name	freq. range	Applications.
Extremely low freq (ELF)	30Hz – 300Hz	for marine time & naval time.
Voice frequency (VF)	300Hz – 3KHz	Human speech, most intelligible sound.
Very low freq (VLF)	3KHz – 30KHz	Musical instruments makes sound in this range & human hearing sense
Low freq (LF)	30KHz – 300KHz	Aeronautical & marine navigation
Medium freq (MF)	300KHz – 3MHz	AM radio broadcasting, marine & aeronautical communication.
High freq (HF)	3MHz – 30MHz	All kinds of 2-way radio communication. govt & military services use these frequencies for 2-way communication.
Very high freq (VHF)	30MHz – 300MHz	Mobile radio, marine & aeronautical comm^n, FM radio broadcasting & Television channels
Ultra high freq (UHF)	300MHz – 3GHz	UHF Television channels, land mobile communication, military services, radar & navigation services.
Super HF	3GHz – 30GHz	Radar, satellite comm^n
Extremely HF	30GHz – 300GHz	Research, radio astronomy
Infrared	>300GHz	It is used in astronomy to detect stars & physical bodies in space, TV remote control, heat radiated from airoplanes or missiles.
The visible spectrum (light)	>600GHz	Fibre Optics, X-rays, gamma rays, & cosmic rays figured in the band but these are not used for communication.

(11) Compare AM & FM

AM	FM
1. Modulating signal changes the amplitude of the carrie -r wave.	1. Modulating signal changes the freq of the carrier wave.
2. Lower freq	Higher freq.
3. Band width is small	Band width is large.
4. Simple & less expensive ckt.	Complex & more expensive ckt.

(12) Define the following:

(1) Frequency: It is defined as the no of cycles per second. It is measured in Hertz.

$f = 1/T$ Hz.

where T = time period in sec.

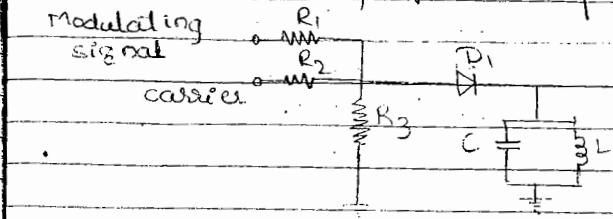
(2) Wavelength: It is defined as the distance travelled by an electromagnetic wave in one cycle. It is measured in mtrs. & it is denoted as 'λ'.

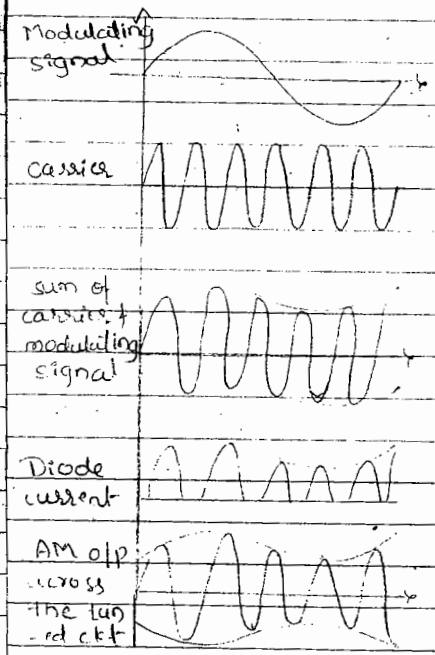
$\lambda = \frac{\text{Velocity mtrs}}{\text{freq}}$

(3) Noise: It is a random undesirable electrical energy that enters the comm^n sys through the comm^n media with the transmitted messages. It may be due to lightning, radiation emitted by the sun & stars.

(4) Messages: It may be a word or group of words, symbols or any other pre-arranged unit which is originated by the source of information.

Write a sketch & explain amplitude modulator.

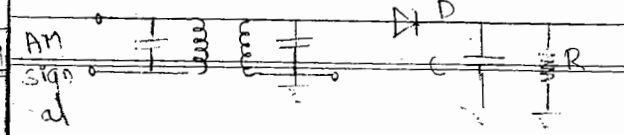


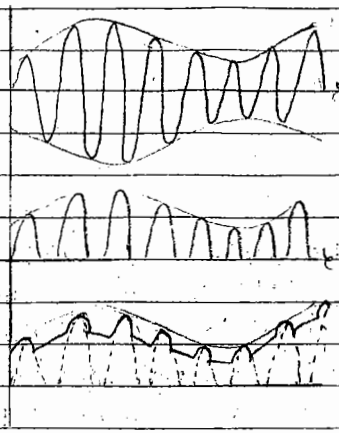


The above ckt shows AM with diode the carrier signal is applied to one of the i/p resistor R_2. The algebraic sum of this signals appears across R_3. The carrier & modulating signal linearly mixed. this is applied to the diode. The diode conducts during the +'ve waves & it remains OFF during the -'ve waves. When current flows through the diode energy stored in the capacitor. When the diode does not conduct its capacitor discharges & its stored energy in the inductor. Thus amplitude modulation occurs as both +'ve & -'ve half cycles of the waves appear at the o/p.

(14) Define demodulation: The process of recovering the audio signal from the modulated wave is known as demodulation.

(15) With a neat sketch explain diode demodulator.





Above fig shows diode demodulator (Diode detector) ckt & waveforms. The Amplitude modulated signal is applied to the basic half wave rectifier ckt consisting of diode & resistor the diode conducts when the +'ve half cycles of the AM signal. During the -'ve half cycles the diode is reverse biased & no current flows through it. As a result the voltage across R is a series of +'ve pulses.

To recover the original signal capacitor is connected across R. It's value is selected in such a way that in 2 separate or filter the carrier wave from the modulating wave. In this way a demodulator gives o/p across R. a modulating signal or audio signal.

16 Radio transmitter & receiver

Define transmitter.

Transmitter is electronic unit that accepts information signal to be transmitted & converts it into RF signal (Radio freq signal) capable of being transmitted over long distance.

17 What are the functions of freq transmitter?

Following are the functions of transmitter

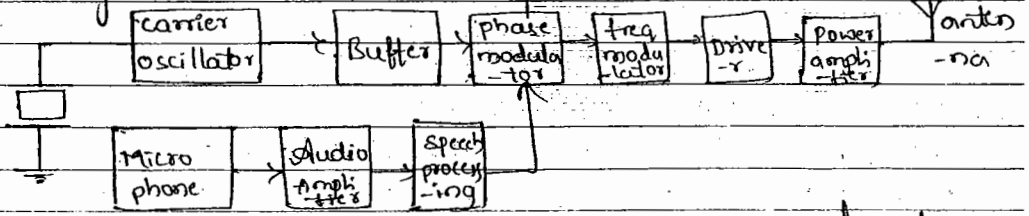
(1) Transmitter generates or signal desired correct transmitting frequency

(2) Transmitter generates form of modulation to modulate the carrier.

(3) Transmitter has to provide sufficient power amplification.

(4) Transmitter Antenna provides matched impedence of power amplifier for maximum transfer of power.

18 Explain with block dia freq modulated transmitter (FM) using indirect FM with phase modulator.

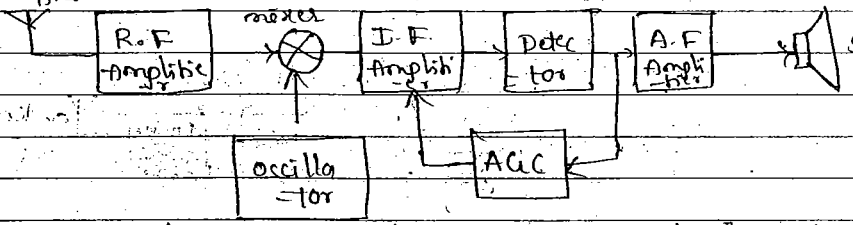


Above fig shows FM transmitter indirect method of FM generation is used. A crystal oscillator is used to generated the carrier signal. And a buffer amplifier is used to isolate it from the other part of the ckt. The carrier signal is then applied to phase modulator. The voice i/p is amplified & processed to limit the freq range & prevent over modulation. The o/p of the modulator is the desired freq modulated signal. A freq

multiplier is used to increase the freq of the modulated signal to some integer multiple of the i/p freq. After the freq multipliers a driver amplifier is used to increase the power level sufficiently to operate the final power amplifier. The final power amplifier increases the energy of the signal. This high energy, freq signal is transmitted into air by using antenna.

(19) Define receiver: It is a collection of electronic ckt that accept the transmitted message from channel & converts back to original information.

(20) Explain with blocked diagram the working of super heterodyne receiver.



Above fig shows the blocks dia of super heterodyne receiver. The radio waves from various broad casting stations are intercepted by the receiving antenna & are coupled to R.F amplifier. Here this signal is amplified before giving it to mixer circuit.

(The o/p of) The amplified o/p of R.F amplifier is fed to the mixer stage where it is combined with the o/p of a oscillator. The 2 freqs beat together & produced as intermediate freq (IF).

The o/p of the mixer is fed to IF amplifier for amplification of the signal.

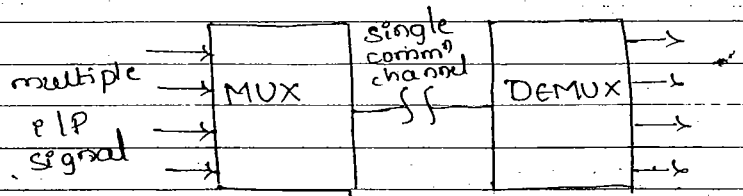
The o/p of the IF amplifier is fed to detector ckt (demodulator ckt). Here the audio signal is taken out from the I.F o/p.

The audio signal o/p of the detector stage is fed to audio amplifier. Here the signal is amplified & fed to the speaker. The speaker converts the audio signal into sound waves.

The o/p of the detector ckt is fed back to the I.F. amplifier through a ckt AGC. The purpose of connecting AGC ckt is to help maintainance of constant o/p voltage level over a wide range of R.F i/p signal levels.

(21) Multiplexing

Multiplexing is the process of simultaneously transmitting two or more individual signals over a single communication channel.

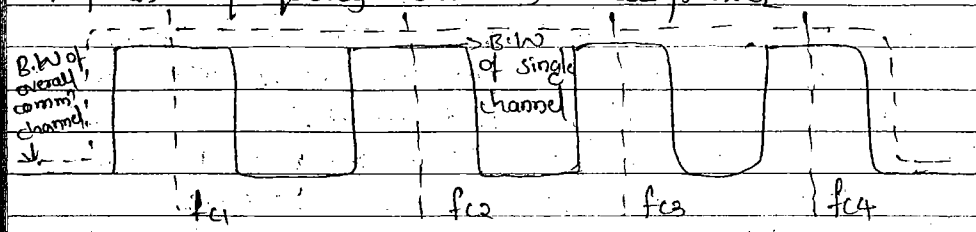


Multiple i/p signals are combined by the multiplexer into single signal, it is transmitted over the communication media on the otherhand communication links demultiplexer is used to separate the signals into the its original forms.

List the different types of multiplexing

There are 2 types of multiplexing
(i) frequency division multiplexing (FDM)
(ii) time division multiplexing (TDM)

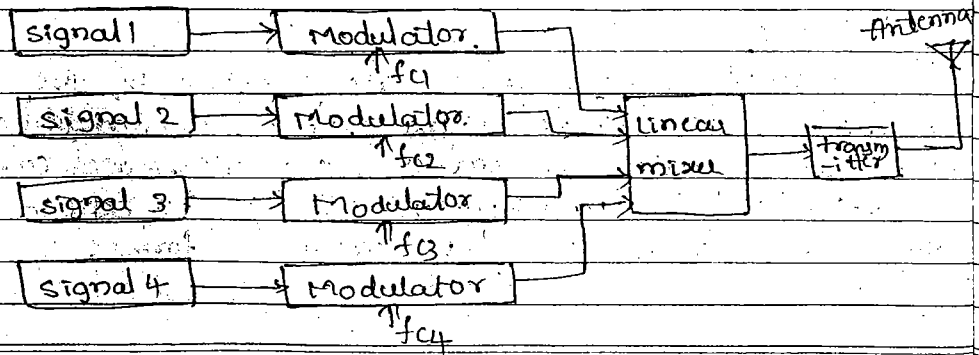
(23) Explain frequency division multiplexer



Above fig shows the frequency division multiplexing. In this sln number of signals share the bandwidth of a common communication channel. Each signal to transmitted over a channel with a separate carrier frequency.

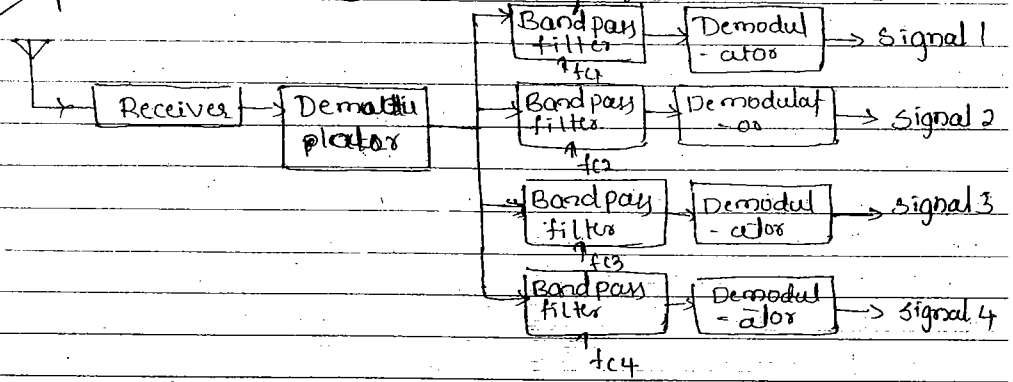
The modulated carrier frequencies are added together to form a single complex signal which is transmitted by the single channel.

(24) Explain with blocks dia frequency division multiplexing transmitter.



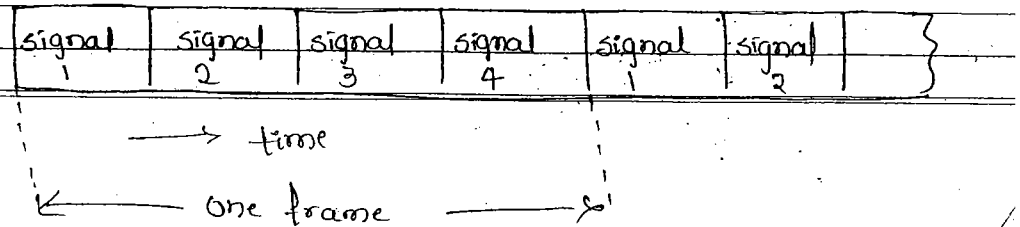
Above fig shows the block diagram of FDM transmitter. Each signal to be transmitted fed to a modulator circuit, the carrier of each modulator is on different frequency. The modulators outputs are added together in a mixer. The resulting o/p signal is a complex signal of all carriers. This signal is then used to modulate a radio transmitter through this transmitter the signal is transmitted into the air.

(25) Explain with the blocks dia of FDM receiver



Above fig shows the FDM receiver. Reciever picks up the signal & demodulate into complex signal. This is sent to a group of bandpass filters. Each center is on 1 carrier frequency, each filter passes only its channel & rejects others. The original signals are recovered by the demodulators of respective channels.

(26) Explain the concept of TDM.



In FDM each signal occupy the entire band width of the channel. Each signal is transmitted for only brief period of time. Here 4 signals are transmitted over a single channel. Each signal is allowed to use the channel. For fix period of time, once all the signals have been transmitted the cycle repeats again & again. Each cycle is called frame.

(22) Compare FDM & TDM

FDM	TDM
* This s/m is used for analog information	This s/m is used for digital information.
* Individual signal to be transmitted for different frequency with common Bandwidth.	Multiple signals are transmitted in different time slots.

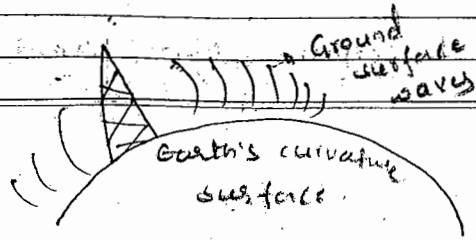
Radio wave propogation.

(23) List the different types of radio wave propogation.

⇒ The following are the 3 types of radio wave propogation.

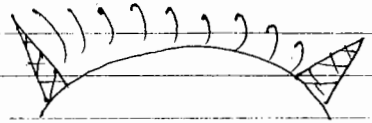
1. Ground wave propogation.
2. sky wave propogation.
3. space wave propogation.

(24) Explain the concept of ground wave propogation.



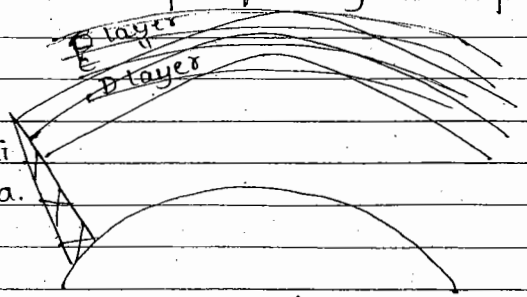
The ground waves are also called as surface waves. Ground waves propogates along the curvature of the earth. The ground wave propogation is strong at low & medium freq range. AM broad cast signal propogates through ground waves. The waves can travel beyond the horizon

(25) Explain the concept of space wave propogation.



Signal propogation by space waves is also called as line of sight propogation or direct wave propogation. The space wave travels in a straight line or directly to the receiver. The height of the transmitter & receiver are selected in such a way that they are in line. This type of wave propogation is used for frequencies above 30MHz.

(26) Explain the concept of sky wave propogation.



Sky wave propogation is due to reflection or bending of signals from upper atmospheric region called ionosphere. Ultra violet rays from sun causes ionization of upper atmospheric layer resulting in thick invisible layer.

The ionosphere is divided into 3 basic layers called 'D' layer, 'E' layer, & 'F' layer. These layers are ranging from 30 miles to 250 miles above earth surface. The atmospheric density increases from D layer to F layer. The pattern of layer changes in the night.

Transmittion line & radio wave propagation.

(32) Define transmission line.

→ Transmission line is a two wire cable that connects the transmitter to the antenna or antenna to the receiver.

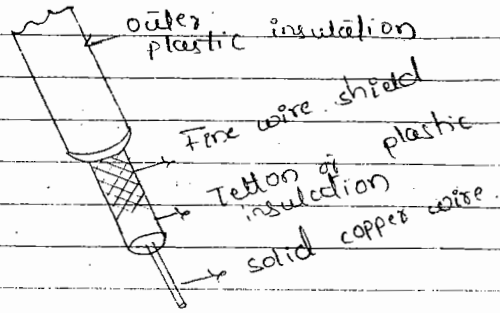
(33) List the types of transmission lines.

There are 2 types of transmission lines
1) balanced line
2) Un balanced line [co-axial wire/cable].

Balanced line: Balance line is made up of two parallel conductors spaced from one another by distance of half inches upto several inches. Insulating medium may be used to keep the wires separated.

Unbalanced line: The same current flows in each wire with respect to ground. There is a direction of current in one wire is 180°, out of phase with the current in the other wire, neither wire is connected to the ground. In an unbalanced line one conductor is connected to ground.

Write the construction of co-axial cable with a neat sketch.



Above fig shows the construction of co-axial cable. It consist of a solid center conductor surrounded by a plastic insulator. Over the insulator there is a second conductor made up of fine wire is called shield. An outer plastic protection is provided made up of plastic insulation.

Co-axial cable is also called as co-ax is an unbalanced line since the current in the center conductor is referenced to the shield which is connected to ground. Co-ax comes in a variety of sizes.

(35) Define characteristics impedence of co-axial cable:

When the length of a transmission line is longer than serval wave lengths at the singnal frequency the wires have a series of inductance, capacitance & resistance uniformly distributed along the entire length of the transmission line. Due to these the transmission line have an impedence in the circuit. This impedence of the line is known as the characteristic impedence of the line.

$$Z_0 = \sqrt{\frac{L}{C}}$$

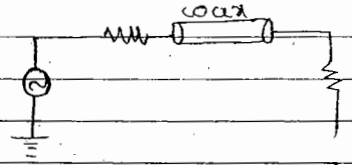
where Z_0 - char impedence of transmission line in Ω.
L - inductance of transmission line for given line
C - capacitance for the given

(36) Characteristics of coaxial cable:

Co-axial cable has the following characteristics

1. Flexible & easy to use.
2. Less expensive than fibre optics cable.
3. Ten MBPS [Mega Byte Per second] is the transmission range.
4. Good resistance to electrical interference.
5. Maximum cable length for thin neck is 185 meters & for thick neck is 500 metres.

(37) Explain the production of standing waves in a transmission line.



When a signal is applied to a transmission line it appears at other end of the line, sometimes later because of the propagation delay. If a sensitive load equal to the characteristic impedance of a line is connected at the end of the line, the signal is absorbed by the load & the power is dissipated as heat. If the load is an antenna the signal is converted to electromagnetic energy & radiated into space.

If the load at the end of a line is an open circuit or a short circuit or has an impedence other than the characteristic impedence of the line, the signal is not fully absorbed by the load.

When a line is not terminated properly, some of the energy is reflected from the end of the line & moves back up to the line towards the signal generated.

This reflected voltage adds to the forward generator voltage & forms a composite voltage that is distributed along the line. This pattern of voltage & its related current constitute what is called as standing waves.

(38) Explain the importance of standing wave ratio (SWR)

→ Standing wave ratio is defined as the ratio of maximum current to the minimum current along the line or the ratio of maximum voltage to the minimum voltage.

$$SWR = \frac{I_{max}}{I_{min}} = \frac{V_{max}}{V_{min}}$$

Under the shorted or open condition the current or voltage minimum value is zero. This produces an SWR of infinite. It means that no power is dissipated in the load. all the power is reflected backs to the source. In the ideal condition there are no standing waves, the voltage & current are constant along the line, so there is no minimum or maximum values of voltage & current. Therefore the SWR is almost equal to one.

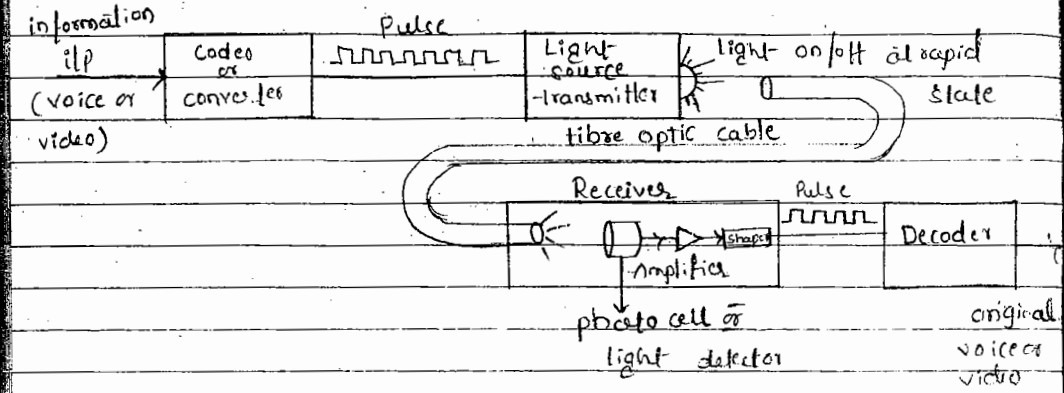
The SWR is also calculated by using characteristic impedence & load impedence as

$$SWR = \frac{Z_L}{Z_0} \quad \text{if } Z_L > Z_0$$

$$SWR = \frac{Z_0}{Z_L} \quad \text{if } Z_0 > Z_L.$$

2. Fibre Optics Communication.

(1) Explain with dia the basic elements of fibre optic communication s/m.



Above fig shows the basic elements of fibre optic communication s/m. The information signal to be transmitted may be voice, video or computer data. The first step is to convert the information of continuous analog signals into digital form. This can be done by using Analog to digital converter.

These digital pulses are then used to flash a powerful light source OFF & ON very rapidly This light source may be a light emmitting diode, of any colour or light source is the solid state lasers.

The light beam pulses are then fed into a fibre optic cable where they are transmitted over a long distance. At the receiving end a light suitable device known as a photocell is used to detect the light pulses. This photo cell converts the light pulses into the electrical signals. The electrical pulses are amplified & reshaped back into digital form. They are fed to a decoder such as a digital to analog converter, where the signal voice video is recovered.

(2) List the applications of fibre optic cables.

→ The following are the applications of fibre optic cables:

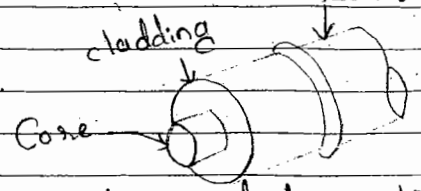
1. Local & long distance telephone s/ms.
2. TV studio to transmitter inter connection.
3. Closed ckt TV s/m.
4. Secure communication s/m at military bases.
5. Computer networks.
6. Ship board, air craft communication.
7. Air craft controls.
8. Inter connection of measuring & monitoring instruments.
9. Nuclear plant instrumentation.
10. College campus communication.
11. In industries process control s/m.

(3) List the benefits of fibre optic comm over conventional electric cables.

→ Following are the benefits of fibre optic comm

1. Wider bandwidth
2. Lower losses
3. Light weight
4. Small size
5. Higher strength compared to electrical cables.
6. Longer life
7. They are Interferance of the signal carried by optical signal is less.
8. Greater safety
9. The s/m is secured.

1. Explain construction of fibre optic cable.

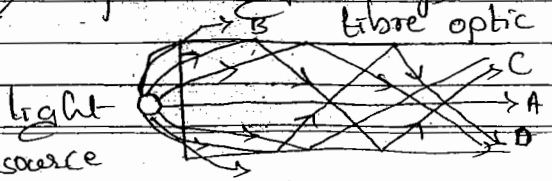


A fibre optic cable that carries the light is made from either glass or plastic. The core is developed to create nearly perfect optical glass or plastic which is transparent to light. Such materials can carry light over a long distance. The glass or plastic is melted & pulled through a form to produce a fibre thread like fiber.

The fibre which is called the core is made up of glass or plastic is surrounded by a protective cladding, which is also made up of glass or plastic but has a lower index of refraction, the idea is to keep the light waves within the core. In addition to protecting the fibre from scratches, the cladding adds strength to the cable. If the core is made up of plastic then cladding is also made up of plastic & these 2 layers are surrounded by a insulating medium known as jacket.

Common arrangement is a glass core with a fibre plastic cladding these type of fibre optic cable are known as plastic clad silica cables.

2. Explain light rays in a fibre optic cable.



Fibre optic cable.

Above fig shows a thin fibre optic cable. A beam of light is focused on the end of the cable. This beam of light can be position-ed in a number of different ways so that the light enters the fibre at different angles.

Light ray A enters the cable ⊥r to the end surface therefore the light beam simply travels straight down the fibre & exists at the other end.

The angle of light beam B is such that its angle of incidence is less than the critical angle therefore refraction takes place. The light wave passes through the fibre & exists.

The angle of incidence of light beam C & D is greater than the critical angle therefore the total internal reflection takes place and the light becomes are simply reflected off the surface of the fibre cable. The light beam bounces back & forth b/w the surfaces until it exists at the other end of the cable.

When the light beam reflects off the inner surface the angle of incidence is equal to the angle of reflection. Because of this light rays entering at different angles will take different paths through the cable. Some paths will longer than other paths, some light rays exists sooner & some later.

(5) Define mode.

Mode is defined as the various paths that the light ray can take in passing through the fibre.

Classify the fibre optic cables based on modes.

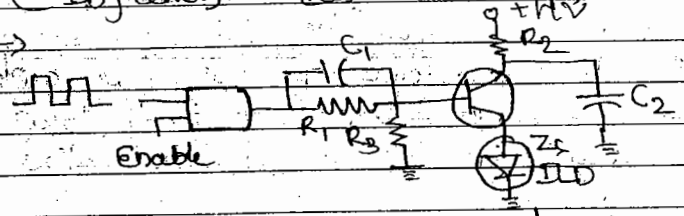
→ The fibre optic cable are classified as

1. Single mode cable.
2. Multi mode cable.

Single mode cable: In single mode the light follows a single path through the core.

Multi mode cable: In multi mode the light takes many paths through the core.

Explain with dia ILD optical transmitter (Injection Laser Diode).

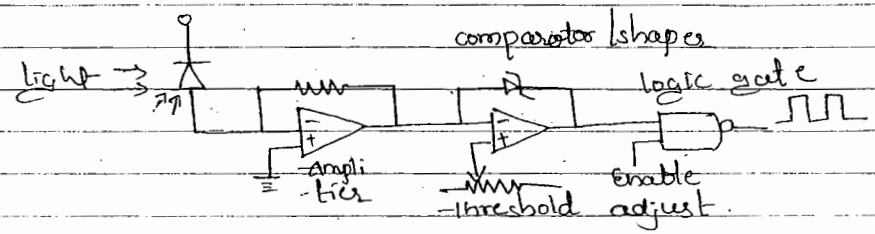


A transmitter consist of modulator & a circuit that generates the carrier. In this case the carrier is light beam that is modulated by digital pulses which turn it ON & OFF.

Above fig shows ILD transmitter. When the input zero the AND gate output is zero, therefore the transistor Q_1 is in the OFF condition & so is the ILD.

Then C_2 discharges a very high current pulse into the laser turning it ON & creating an intense light pulse.

Explain with dig the working of photodiode / optical receiver.



The receiver consist of a detector that will sense the light pulses & converts them into an electrical signal. This signal is then amplified & shaped into the original digital data.

Above fig shows the basic circuit of photo-diode optical receiver. The current through the photodiode generated when light is sensed produces a current that is then amplified in an op-amp. Following the amplifier is an op amp comparator used as a shaping ckt that squares the pulses to ensure fast rise & fall times. The o/p is passed through a logic gate so that the correct binary voltage levels are produced.

Data Communication.

1. Explain the concept of data comm?.

→ Digital signals are binary pulses that have 2 distinct state. Each represented by a voltage level. The binary zero level might be zero volt or ground & binary 1 level may be +5V. Any other 2 voltages can also be used.

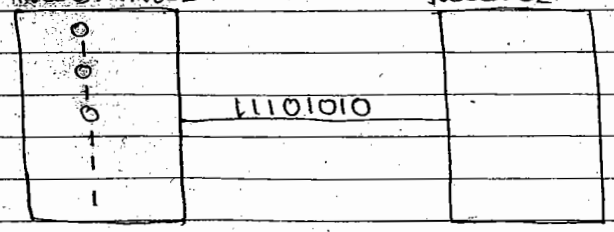
Binary signals are easy to generate & process with electronic ckt. The binary signals represent data or information. The binary signals are coded made up of groups or patterns of zeros & one's. Each pattern represents a numerical value, a letter of alphabet, or some special symbols, meanings, or messages.

2. Explain the modes of transmission or list the different types of transmission of digital data.

→ The following are the modes of transmission of digital data.

1. Serial communication.
2. Parallel "
3. Synchronous "
4. Asynchronous "

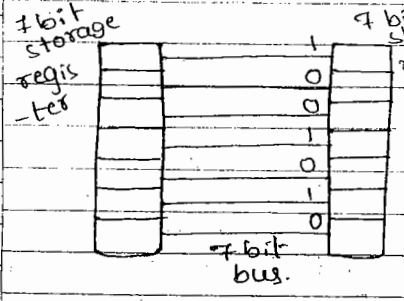
1. Serial comm?:



Above fig shows the concept of serial data comm?. Each bit of the word is transmitted one after the another. The LSB is transmitted first & MSB is transmitted last. Each bit is transmitted for fix interval of time. The voltage level representing each bit appear on single data line one after another. Entire word has being transmitted.

Serial data transfer takes longer time & it is inexpensive.

2. Parallel - transmission.

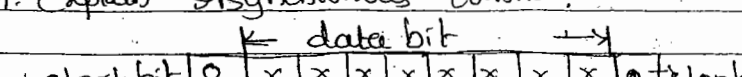


Beside fig shows the concept of parallel data comm?. The binary word to be transmitted is usually loaded into a register containing flip flop for each bit. The flip flop o/ps are connected to the wire to carry bits to the receiving ckt. This is the fast comm? compared to serial comm?. This type of comm? s/m is used for short distance transmission.

3. Compare serial & parallel data type comm?.

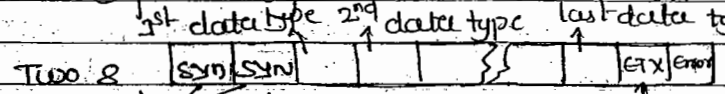
Serial comm?	Parallel comm?.
1. It sends data bit by bit.	It sends data simultaneously
2 Used for long distance transm	Used for short distance transm
3. Transmission cost is less	Transmission cost is more.
4. Speed of data transm is slow.	Speed of data transm is fast.
5. It requires single comm? channel.	It requires 8 comm? channels.
6. Synchronous & Asynchronous transmissions are the modes of serial comm?.	No modes in parallel comm?.

4. Explain Asynchronous comm.



In a asynchronous s/m, transmit & receive clocks are different. Framing is used so that the receiver is able to identify the 1st bit of the character. Each data word is attached by start & stop bits that identify the beginning & the end of the word. A start bit is transmitted at the beginning of each character, at least one stop bit at the end, start & stop bits are represented by binary 0 & binary 1 respectively. In asynchronous comm there is no fixed length of time interval b/w characters.

5. Expl synchronous transmission.



The technique of transmitting each word one after the another without start & stop bit is known as synchronous data comm.

In these s/m transmitter & receiver has synchronized to the same clock freq. Data is sent in blocks that are much longer than characters. Transmitter & receiver a group of synchronization are placed at the beginning & end of the blocks. At the beginning of blocks two 8 bit synchronization codes are placed to indicate start of transmission. The receiving equipment looks for these codes & then begin to receive the data.

Receives can keep track of the remaining data without start & stop bit. Synchronous comm is faster & more efficient than asynchronous comm.

6. List the comparision b/w asynchronous & synchronous data transmission.

Asynchronous	Synchronous
1. Data is grouped into bytes	Bytes are transmitted as blo
2. Start & stop bits are attached to each byte.	Start & stop bits are not required.
3. Synchronous character is not transmitted	synchronous character is transmitted along with bit stop
4. Separate clocks i/ps are required for sender & receiver.	Same clock is used both transmitter & receiver.

7. Define channel capacity $C = BW \log_2 (1 + \frac{S}{N})$

→ To send the information from one place to another, transmitted signal must travel through the media to reach the receiver. This medium refers as channel.

Channel capacity is concerned with the rate of transmission of data over the comm channel.

8. Define bit rate, baud rate & band width.

→ Bit rate means bits transmitted per second. Commonly used units are Kbps, Mbps.

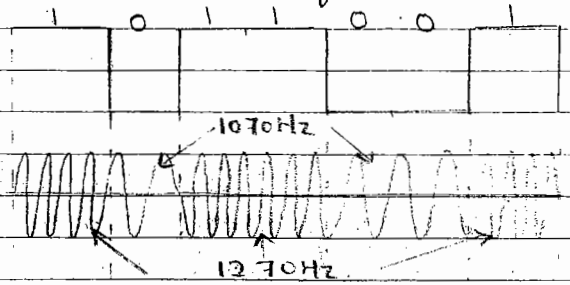
Baud rate is the no of symbols transmitted per second. Each symbol may stand for more than one bit information.

9. Define modem & need of modem.

→ A modem is a device containing both a modulator & a demodulator.

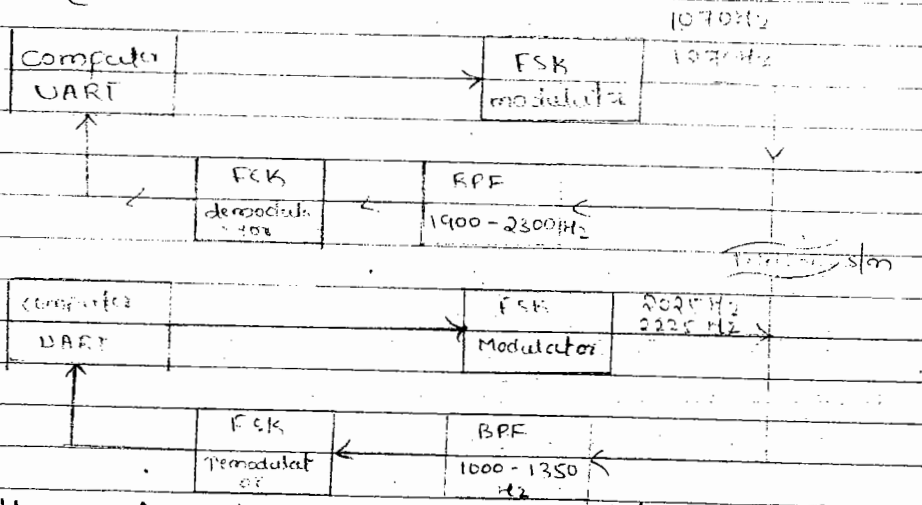
A modem is used to convert binary signals into analog signals capable of being transmitted over the telephone lines and to demodulate such analog signals & reconstruct the equivalent binary output.

10. Explain the concept of frequency shift keying modem



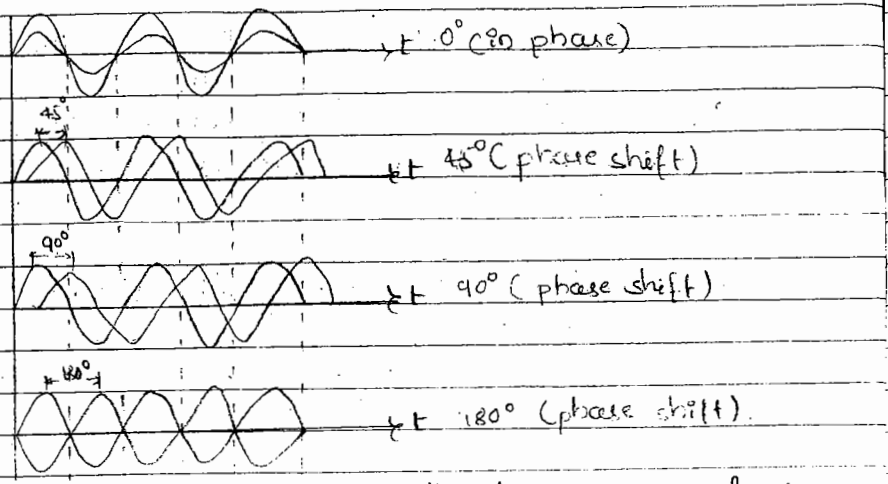
→ In frequency shift keying modem 2 sinewave frequencies are used to represent binary 0s & 1s. The binary 0 is usually known as space & binary 1 is refered as mark in data communication. The binary 0 has a freq of 1070Hz where as a mark has a frequency of 1270Hz. These 2 frequencies are alternately transmitted to create the serial binary data. This band of freq signals are well within the 300 to 3kHz bandwidth normally associated with the telephone sln. To permit simultaneous transmit & receive operations with a modem known as full duplex operation Another set of frequencies has to be defined. A binary zero or a space is 2025Hz & a binary 1 is 2225Hz. These signals frequencies are also within the telephone bandwidth but are spaced far enough from the other frequencies. Therefore selective filters can be used to distinguish b/w the 2 signal frequencies. The 1070 & 1270Hz signal frequencies are used for transmitting & the 2025 & 2225 Hz signal frequencies are used for receiving the data.

11. Explain with dia the working of frequency shift keying modulator.



Above fig shows frequency shift keying modem, each modem contains an FSK modulator & an FSK demodulator. So both send & receive operation can be possible. Bandpass filter at the i/ps to each modem separate the 2 signal frequencies. In the upper modem a bandpass filters allowes frequencies b/w 1950 & 2300 Hz to pass. This means that 2025 & 2225 Hz signal freq will be passed but the 1070 & 1270Hz signal frequencies generated by the internal FSK modulator will be rejected. The lower modem has bandpass filter that accepts the lower freq signals while rejecting the upper freq signals generated by FSK modulator.

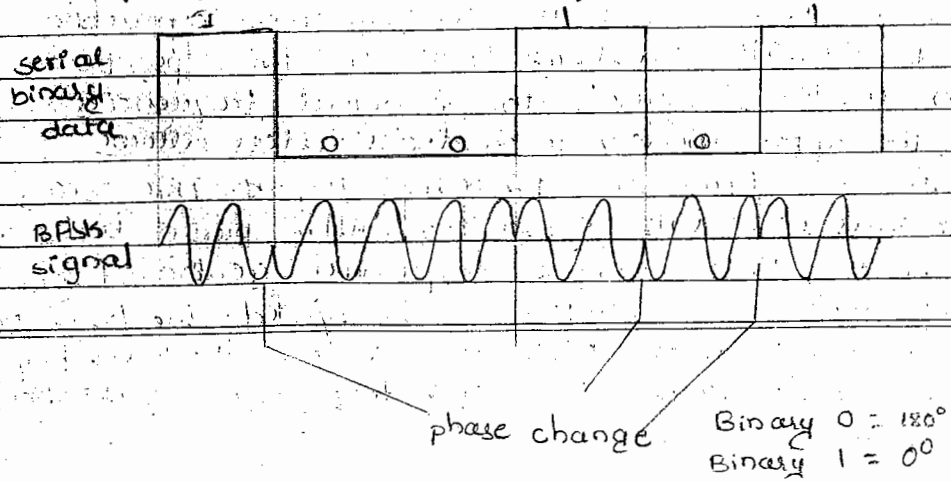
12 Explain the concept of PSK modem (pulse shift keying)



In phase shift keying, the binary signal to be transmitted changes the phase shift of a signal wave depending upon whether a binary 0 or binary 1 is to be transmitted.

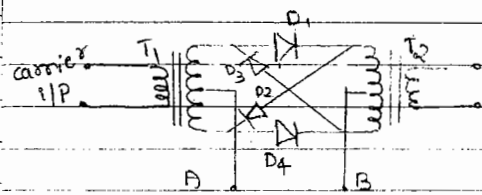
Phase shift is a time difference b/w 2 sinewaves of a same frequency, as shown in the above fig. A phase shift of 180° represents the maximum difference & is also known as as phase reversal.

13. Explain the concept of BPSK modem (Binary PSK)



The above fig shows the simplest form of PSK known as Binary Phase shift keying (BPSK). During the time that a binary 0 occurs the carrier signal is transmitted with one phase. But when a binary 1 occurs the carrier is transmitted with a 180° phase shift.

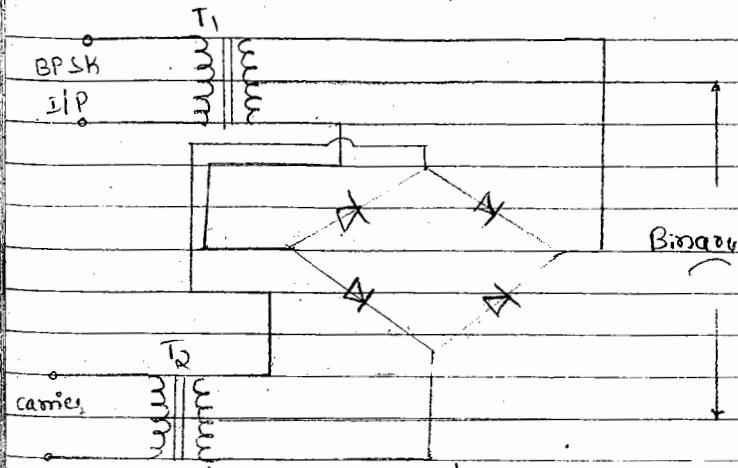
14. Explain with ckt dia BPSK modulator.



The fig shows a BPSK modulator. Consist of 2 transformers T_1 & T_2, & bridge of 4 diodes D_1, D_2, D_3 & D_4, & a 2 center tapped points A & B connected to the modulator to give binary i/p information. The carrier sinewave is applied to the i/p transformer T_1 & the binary signal is applied to the x'mer center taps. The binary signal provides a switching signals for the diode. When a binary 0 appears at the i/p, A is +ve w.r.t B. Therefore diode D_1 & D_4 conducts. Thereby connecting the secondary of T_1 to the primary of T_2. The windgs are phased so that BPSK o/p is in phase with a carrier i/p.

When a binary 1 appears at the i/p A is negative w.r.t B. Therefore diode D_2 & D_3 conducts. Thereby connecting x'mer. This wdg to the primary of T_2 but with the interconnection or reversal. This introduces a 180° phase shift carrier at the o/p.

15. Explain with dia the working of BPSK demodulator.



Above fig shows the ckt dia of BPSK demodulator. It consist of 4 diodes forming a bridge, 2 x'mers T_1 & T_2. BPSK i/p is applied to the primary of x'mer T_1. Carrier signal is applied to the primary of x'mer T_2. & o/p is taken from the centre taps of T_1 & T_2.

The BPSK & carrier signals are applied to the x'mers for proper demodulation. BPSK signal is that a carrier with correct freq & phase relationship must be applied to the balance modulator along with the BPSK signal is passed. The i/p is the recovered binary data stream.

Satellite Communication.

1. Explain the concept of satellite comm.

→ Satellite is a physical object that orbits or revolves around some celestial body. Ex: Moon is a satellite of the Earth.

Artificial satellites can also be launched into the orbit. A major application of artificial satellite is in communication.

The location & performance of satellite is determined by the factors such as weight of satellite, gravitational forces on the satellite from moon & sun & the gravitational force of the earth.

To escape Earth gravitational pull an object should travel at a speed of the greater than the escape velocity which is 25,000 miles/hr.

A satellite revolves round the Earth in circular or elliptical path. In an elliptical orbit the speed of the satellite changes depending upon the height of the satellite above the Earth.

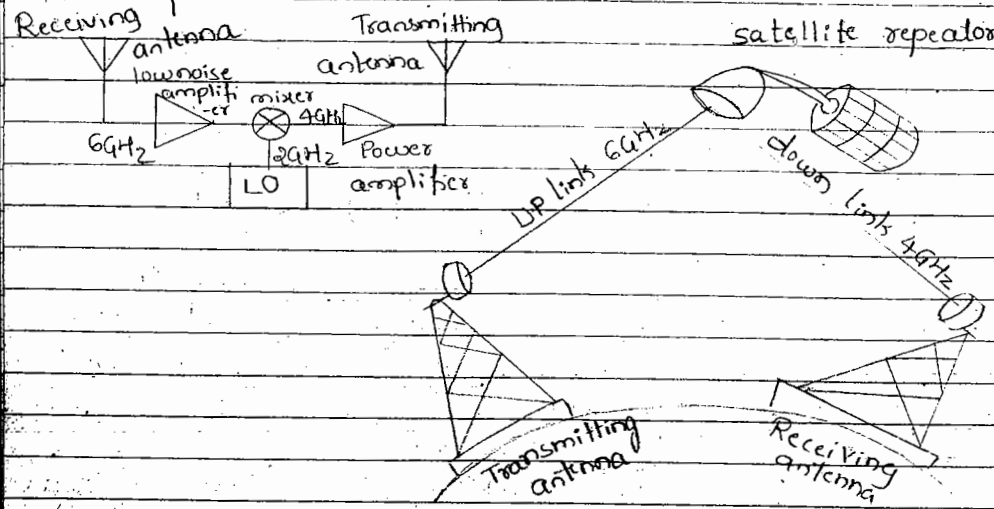
When the satellite is in an elliptical orbit the centre of the earth is one of the focal point. The highest distance of the satellite above the earth is called apogee & the lowest distance above the earth is called perigee.

2. Explain geo synchronous orbit.

→ The orbit around the earth equator at a distance of 35,860 Km is called geo stationary or geo synchronous orbit.

A satellite placed in this orbit revolves round the earth in 24 hrs. Since the satellite remains there fixed no special earth station tracking antenna are required. Satellites placed in geo synchronous are called geo synchronous satellite. Most of the comm satellites are of geo synchronous type.

3. Explain with block dia the working of transponders.



The transmitter receiver combination in the satellite is known as transponder. Its basic function is amplification & frequency translation. A typical comm satellite will have 12, 24, or more transponders. Each transponder represents an individual comm channel.

The receiver picks up the transmitted signal from the earth station. This signal is called the uplink. The transponder amplifies the signal, translate it into another freq & retransmits it to the receiving station on the earth. The retransmitted signal to the receiving station is called downlink.

The reason for freq translation is that the transponder cannot transmit & receive the signal at the same freq.

4. List the application of satellite comm.

→ * The main application of satellite is in the field of comm. It permits reliable long distance comm world wide.

* Observation: Weather satellite are used for predicting the weather condition.

* Navigation: It is used in global positioning s/m (GPS). In the field of navigation.

* Observation: Satellite monitor the states of earth's resources such as land & oceans. They can spot mineral resources of sources of pollution.

5. Explain with block dia satellite sub s/m.

→ The major sub s/ms are:

1. Comm sub s/m.
2. Telemetry tracking & control sub s/m
3. Propulsion sub s/m.
4. Attitude control sub s/m
5. Power sub s/m.

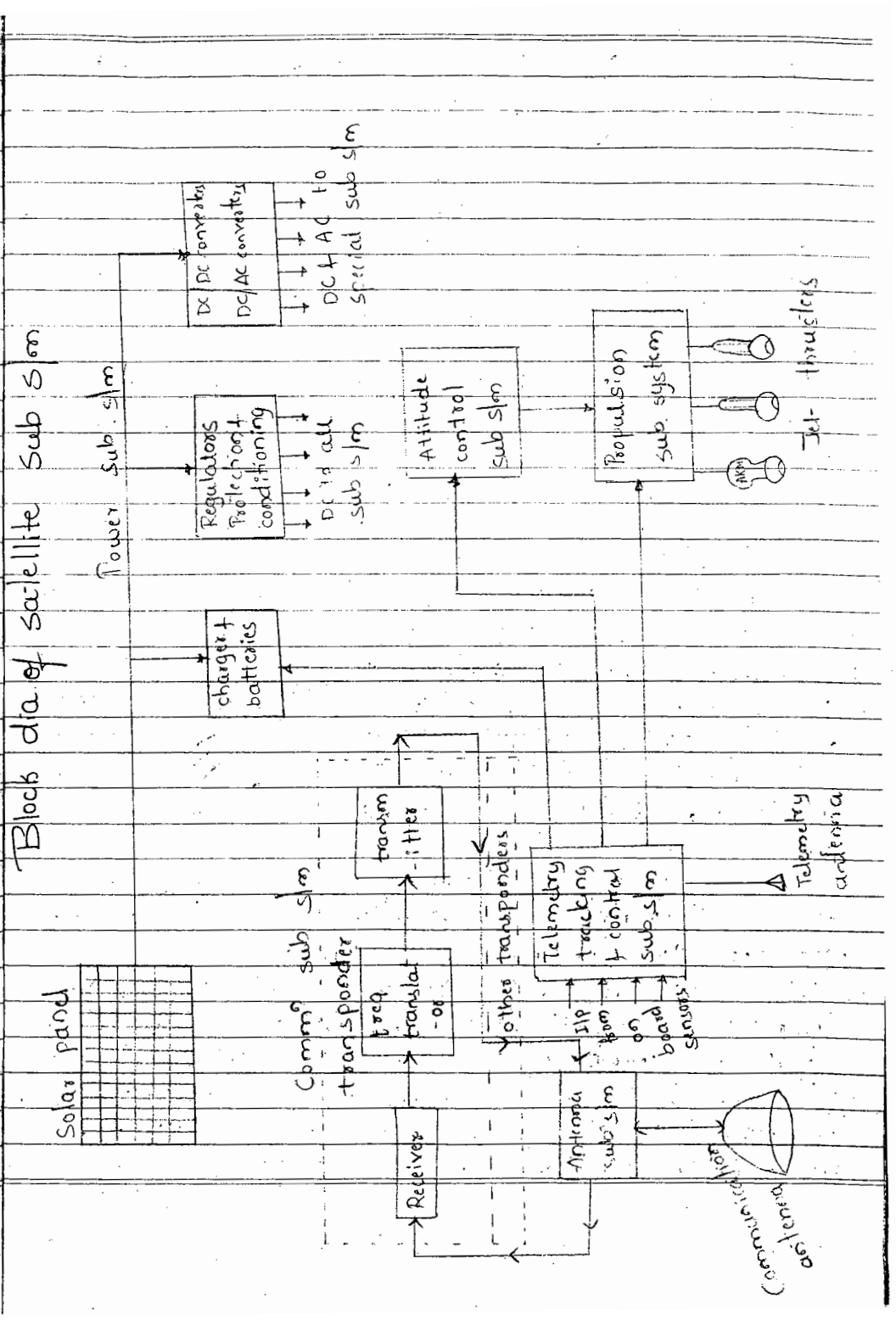
1. Comm sub s/m: It consist of multiple transponders, shares a common antenna for both transmission & reception. They receive them as uplink signals, amplify them & retransmit as downlink signals.

2. Telemetry tracking & control sub s/m:
It monitors on board condition such as temp, battery voltage & transmits this data to a ground station for analysis. The ground station may then issue orders to the satellite by transmitting a signal to the control sub s/m which is used to control many space craft function such as firing of jet thrusters.

3. Propulsion sub s/m: It contains apogee kick motors (AKM) & jet thrusters. The AKM & jet thrusters are controlled by the ground station.

4. Attitude control sub s/m: It provides stabelizat-on in the orbit & sensors changes in orientations. It gives the jet thrusters to perform attitude adjustments to keep the satellite in its assigned orbital position.

5. Power sub s/ms: They supply electrical power to sub s/ms. They charge the batteries to operate the satellite during eclipse periods. DC to DC converters & DC to AC converters are used to supply special voltages to some sub s/ms.



Explain the (concept) blocks dia of satellite earth station.

→ It consist of 5 major sub sys
1. Antenna sub sys
2. Receiver sub sys
3. Transmitter sub sys
4. Ground comm^{n} equipment (GCE)
5. Power sub sys

1. Antenna Sub sys: It consist of a possible parabolic reflector, horn antenna, wave guide & related devices.

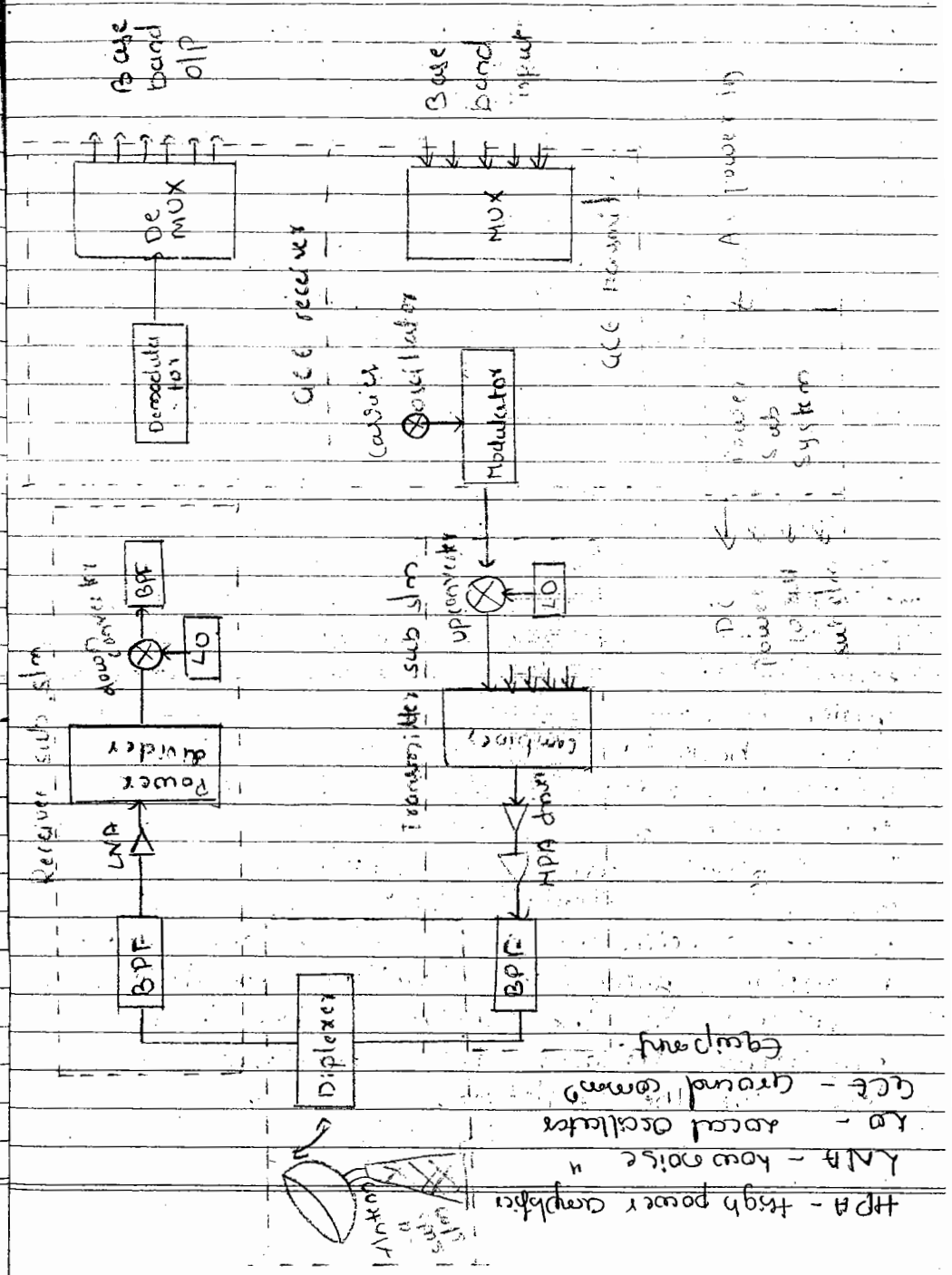
The antenna sub sys includes a diplexer, a wave guide assembly that permits both transmitter & the receiver to use the same antenna. The diplexer feeds a band pass filter in the receiver section that ensures only the received frequencies passed through the receiving ckt & blocks. high power transmitter signal which can occur simultaneously with reception.

2) Receiver sub sys: It consist of low noise amplifiers, filters, power dividers & related circuteries.

Many earth stations have multiple circuits for reliability & switched on automatically if the main unit fails.

3) Transmitter sub sys: It consist of high power amplifiers, multiplexers, modulators, up-converters & combiners in its circuteries.

4) Ground comm^{n} equipment (GCE): It consist of both receiving & transmitting ckts the transmitter portion of the GCE consist of



multiplexers, modulators, up-converters & related filters. Connections to the telephone s/m, microwave relay links are made through GCE. The receiving portion consist of down-converters filters, demodulators & demultiplexing equipment.

5. Power sub s/m: It provides power to the equipments. The primary source of power is the AC power lines. It also consist of emergency power sources such as diesel generators, inverts & batteries to ensure continuous operation during power failure.

Explain the concept of GPS (Global Positioning S/m)

→ Global Positioning s/m is the newest & most useful satellite s/m. Its primary application is navigation. The s/m is a networks of 24 low earth orbit satellite spaced equally around the world in over lapping pattern. Each satellite transmits a unique signal back to the earth on low microwave frequencies. Receivers on the earth picks up transmission from 4 satellites simultaneously the receiver uses the signals in a micro processor to calculate the exact position of the receiver on earth. The receiver o/p is a display giving the latitude, longitude & attitude of the receiver. GPS was primarily designed as a navigation s/m for the military.

Applications of GPS s/m.

1. To pinpoint locate the destination
2. To guide emergency vehicle through electronic map.
3. To monitor continuously the moment of cargo or any vehicle.
4. A GPS assisted navigation s/m air-lines can fly more direct routes, saving time for passangers & fuels.

Explain the concept of GIS.

→ Geographic Information s/m is a computer s/m to capture, store, manipulate analyze, manage & display all kinds of geographical data.

Imp features of GIS is the capability to combine different layers to show new information for ex: You can combine elevation data, receiver data, land use data, & many more to show information about the landscape of the area. From map you can tell where high lands or where is the best place to built house which has river view. GIS can be used to solve the location based question such as what is located here? or where to find particular features.

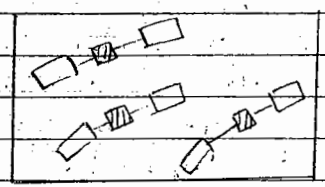
For ex: Forest area on the land by use of map.

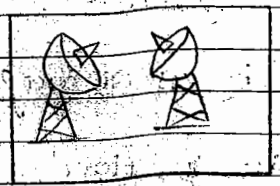
App of GIS.

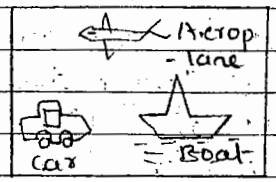
1. Disaster management: In case of flood, earth quakes, Tsunami, etc. location emergency transportation, finding safe & shortest route & place.

2. Town & country management: Transportation management, land use planning, waste management, pollution control can be planned & executed easily
3. Agriculture & crop management: Depending on the season water availability & metrological conditions crops are suggested.
4. Natural resource management.
5. Development plans, maps, of areas can be prepared as required to any scale.
6. Impact or feature effect of certain developm-ent & decisions can be accessed in advance.
7. Overall resources utilization & management planning done through GIS helps natrong economy & reducing un-employment.

Explain the GPS architecture with dia.





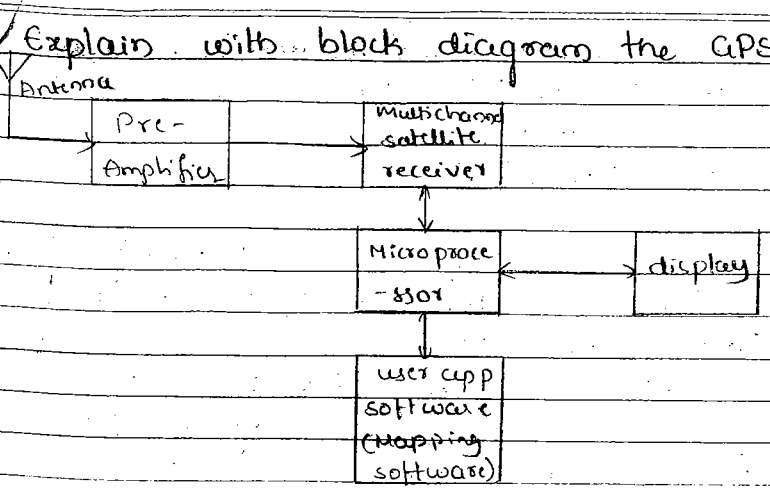


control segment

The GPS consist of 3 segments.
1. Space segments
2. Control segments
3. User segment.

(1) Space segment: The space segment of GPS consist of 24 satellites. These satellites orbit at 20,200 km above the surface of the earth in six circular orbital planes with a 12 hour orbital period each. These planes are such that from any location on the earth atleast 5 satellite can be veiwed. These satellites continously broad cast navigational signals. These navigational data can be receive by any one any where on the earth free of cost for decoding & finding navigational parameters such as location, velocity & time.
(2) Control segment: The control segment of GPS consist of master control station (MCS) & a no. of smaller earth stations located at different places around the world. The monitering stations track GPS satellite & pass the major data to the MCS. The computers the satellite parameters & sends them backs to the satellite. The satellite broad cast these parameters to all the GPS receivers.
(3) User segments: The user segment of the GPS consist of receivers which calculate the location information using the signals received from the satellite.

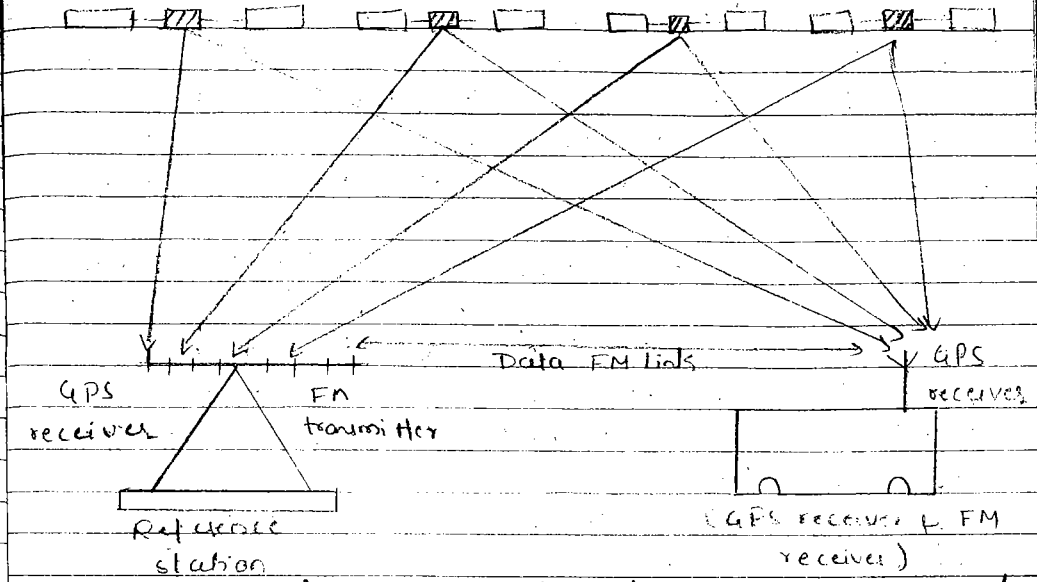
Explain with block diagram the GPS receiver.



The GPS receiver is a microprocessor based system along with a multichannel satellite receiver which receives the signal from the satellite at that location. The data send by each satellite consist of coded time & location of the satellite. The GPS receiver calculates its own location parameters from a minimum of 4 such signals. These parameters are calculated once per second & send to display unit. The location data can be integrated with an application software package such as mapping software.

3. Explain with diagram of the differential GPS system.

In differential GPS system there is a reference station, this reference station has a GPS receiver as well as an FM transmitter. This station receives the



GPS signals & computes its location parameters. These parameters are compared with its own location parameters to calculate the error of the GPS receiver. The error correction to be applied to the results of the GPS signals is. Thus calculated & this information is broadcast to all the GPS receivers around the the reference station using the FM transmitter. The differential GPS receivers of all user are fitted with FM receivers in addition to the GPS receive -rs. The differential GPS receiver obtains the location parameters from the GPS data & then applies the correction based on the information received on the FM channel. This results in obtaining more accurate location parameters.

Explain the concept of GPS

In the past sailors used to look at the stars in the sky to navigate their ships. There are a no. of electromagnetic & electronic navigational its where develop to determine the location of moving as well as stationary objects. Now-a-days the greatest innovation in navigational aides is the GPS in which electronic gadgets look at artificial satellites to determine the location & speed of an object. The most attractive features of the GPS is that it is a reliable navigational anywhere on the earth operating in all weather conditions 24hrs a day and can be used by the marine time & land users.

Microwave Techniques

Signals with freq. greater than 1GHz are called microwaves. It extends from 1-30GHz with the wavelength varying from 30cm to 1cm.

Importance of microwaves in comm?.

⇒ The wave spectrum space of 0 to 300MHz is full with the use of higher frequency the B.W available for the transmission of information is greater.

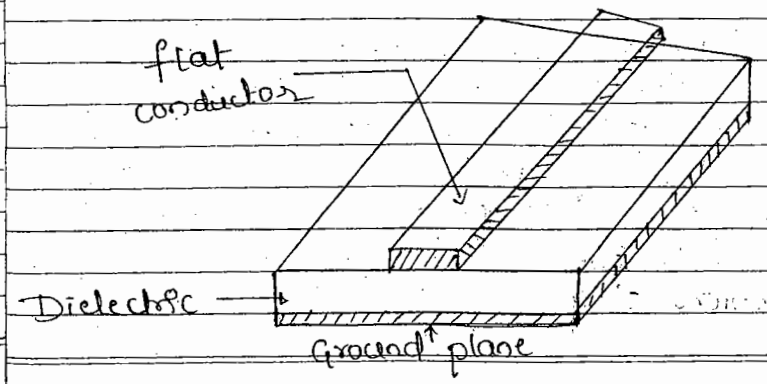
Microwaves having a freq range of 1-30GHz offers larger B.W for comm? & has temporarily solve the problem of spectrum crowding.

Digital transmission requires wide B.W which is easily transmitted using micro-waves.

Television transmission is also done by using microwaves as it is better to transmit video signals in higher frequencies.

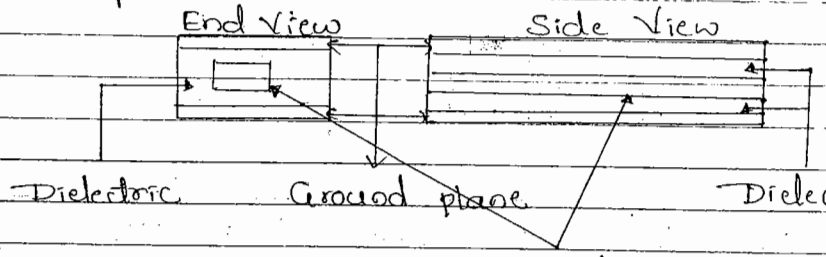
Explain the constn and working of micro strip, strip line, & wave guides.

⇒ micro-strips:



Micro strip is a flat conductor separated from a large conducting ground plane by an insulating dielectric medium as shown in the fig above. The PCB (Printed Circuit Board) techniques can be used to create ~~separ~~ special microwave transmission lines. The length of the micro strip is usually one quarter or one half wavelength. The ground plane is the Comm Circuit common.

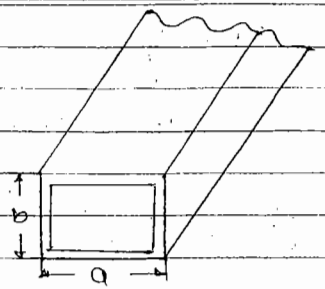
Strip Line:



Strip line is a flat conductor sandwitch b/w 2 ground planes as shown in fig above. It is more difficult to make but it will not radiate as micro strip does. The length is one quarter or one half wave length.

Both strip line & micro strip are widely used to form the tuned ckts used in micro wave receiver front ends & in the amplifier sections of transmitters. Diodes transistors & other components are mounted right on the PCB & are connected directly to form micro strip or strip line.

Waveguide:



A waveguide is a hollow metal tube designed to carry microwave energy from one place to another. Waveguides may be used to carry energy b/w pieces of equipments or over long distances to carry transmitter to an antenna or micro wave signals from an antenna to a receiver.

Waveguides made from copper, aluminium or brass. These materials are either in rectangular form or circular cross section. They are coated with silver on the inner side to reduce resistance to a low value. A microwave signal is injected at one end of the waveguide & it propagates through the waveguides.

Most

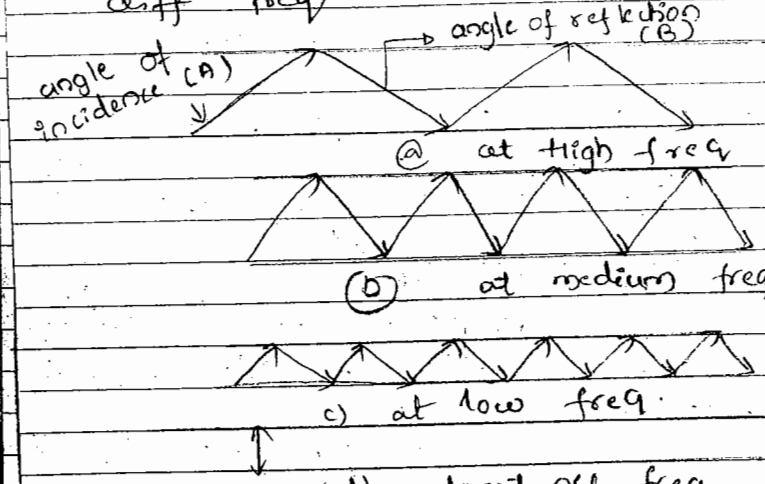
Explain cutoff freq.

Most waveguides are made of rectangular variety. It is the size of the waveguide that determines its operating frequency range. The width of the wave guide is labled as 'a' & the height is labled as 'b'. The freq of operation is found by the 'a' dimension. This dimension is usually

made equal to 1 half the wavelength at the lowest freq of operation. This freq is known as the waveguide cutoff freq.

At the cut-off freq & below the waveguide will not transmit energy. At frequencies above the cut off freq the waveguide will propogate electromagnetic energy.

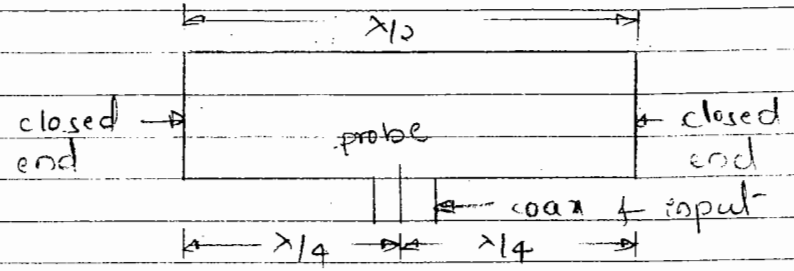
Draw wave paths in a waveguide at diff freq



When the energy into the wave guide is launched the electromagnetic fields will bounce of the sight walls of the waveguides. The angle of incident & reflection depends upon the operating freq. At high frequencies the angles are large & therefore the paths b/w the opposite walls is relatively long. As the operating freq gets lower the angles decrease & the

the operating freq reaches the cutoff freq of the waveguide, the signals simply bounces back & forth directly b/w the sight walls of the waveguide & has no forward motion. If the cutoff freq & below no energy is propogated.

Explain - the constn & working of cavity resonators.



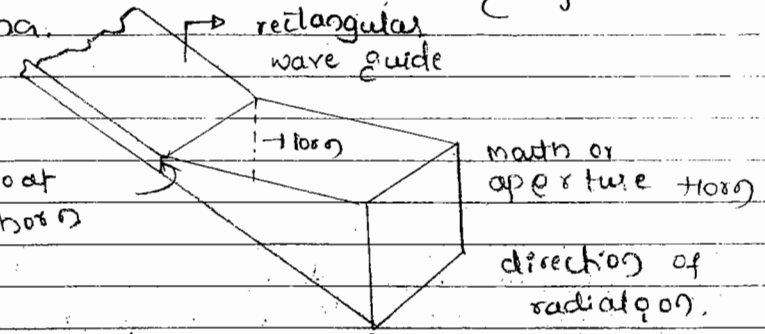
A cavity resonater is a short segment of waveguide that acts as a high Q tuned resonant circuit. A simple cavity resonater can be formed with a short piece of waveguide one half wavelength long. A small probe at the center injects micro wave energy. The short piece of wave guide is closed at each end the result is that when microwave energy is injected into the cavity the signal will bounce of the shorted ends of the waveguide & reflect back towards the probe. Because the probe is located at quarter wavelength from each shorted end, the reflected signal will reinforce the signal at the probe the result is that the signal will bounce backs & forth off the shorted ends if the signal is removed, the wave will continue to bounce back & forth for a continuous

length of time until losses cause it to die down.

Cavity resonators are in □ shape, ○ shape etc. The app of cavity resonator are for amplification & to generate oscillation.

Microwave antennas.

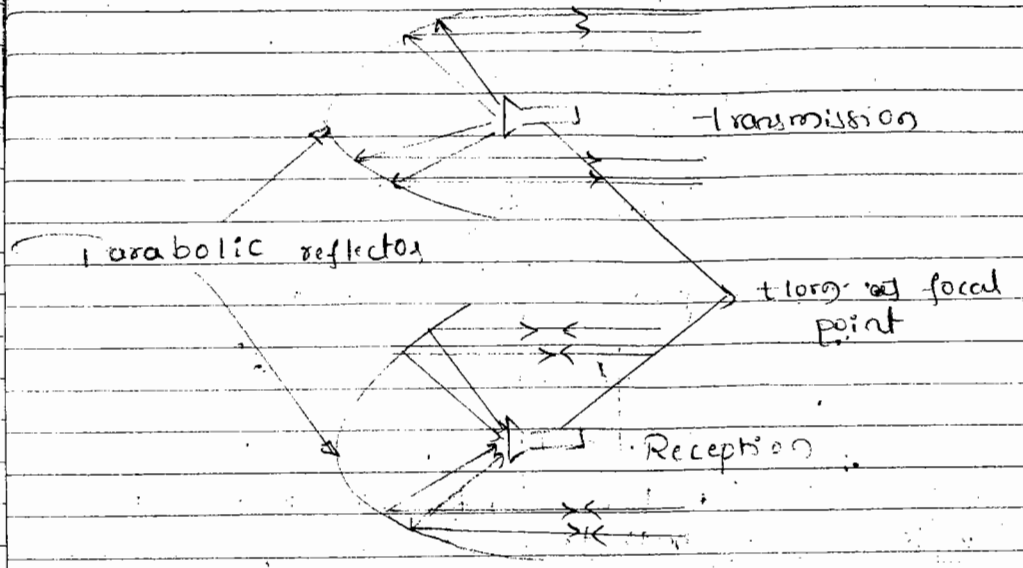
Explain with dia the working of horn antenna.



It is a rectangular waveguide with one end flared to create a horn. The longer & more gradual the flare lower is the losses. It has excellent gain & directivity. Different types of horn antennas are available such conical, sectoral horn antennas etc.

The gain & the directivity is the fun^{ct} of its dimension namely horn length flared angle, aperture area or mouth area.

Explain with dia, the working of parabolic antenna.



A parabolic reflector is a large dish shaped structure made of metal or screen mesh. The energy radiated by the horn is pointed at the reflector which focuses the radiated energy into a narrow beam & reflects it towards its destination. Because of the unique parabolic shape the electro magnetic waves are narrowed into an extremely small beam.

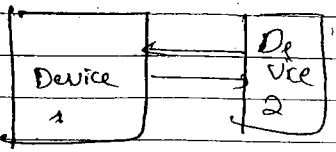
Above fig shows the parabolic reflector is used in combination with a horn antenna for both transmission & reception. The horn antenna is placed at the focal point in transmitting, the horn radiates the signal towards the reflector where as

In reception, the reflector picks up the electromagnetic signal & bounces the wave towards the antenna at the focal point. The gain of a parabolic antenna is directly proportional to the mouth of the parabolic.

//

Part - A

(1) Half duplex

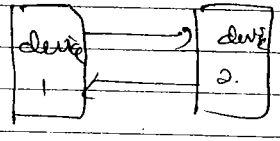


Information can be sent in both the direction but not the same time.

In half duplex s/m transmitter mode receiver is made off & vice versa.

Ex. Radio comm used in military, fire polices & other services

Full duplex

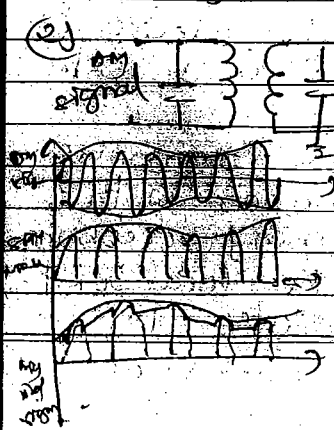


Information can be sent in both the direction at the same time

In full duplex s/m both are set on mode itself.

Comm - through telephone.

(2)

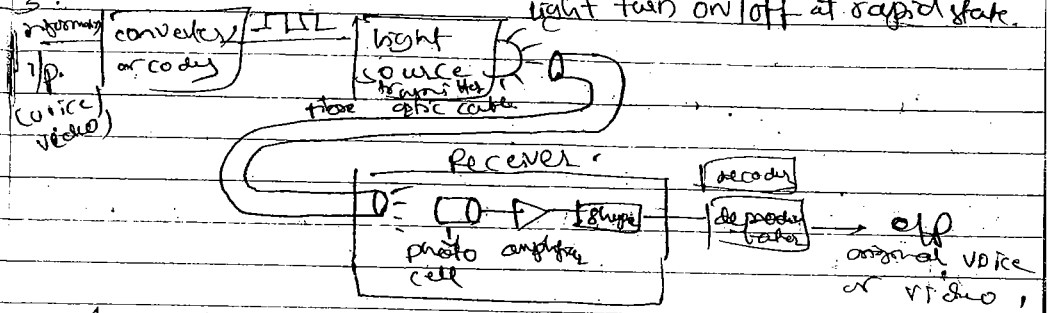


The fig shows the diode demodulator ckt & its waveforms. It consists of a half rectifier circuit with a diode.

I/p signal is applied to the half wave rectifier ckt consisting of diode & resistor. The diode conducts for +ve half cycle.

During +ve half cycles the diode, therefore diode doesnot conducts. As a result the voltage across R is the series of +ve pulses. To recover the original signals capacitor is connected across R.

3.



light turn on/off at rapid rate.

Above fig shows the basic elements of fibre optic cable comm s/m. The information signal to be transmitted may be voice i/p, or video signal. The primary step is to convert these electrical signals (analog signals) to digital signals using DC LDC converters. The o/p of the coder is sent to the light transmitting device. That may be either laser or light emitting diode, to flash the power full light source OFF/ON very rapidly.

These light beam pulses are then fed to the fibre optic cable where they are transmitted over a long distance. At the receiving end a photo sensor or photocell is used to detect the light pulses. The photocell converts the light pulses into electric signals & are applied to the amplifier for amplification & are reshaped back into digital form using shapers. They are fed to decoder where the signal voice or video is recovered.

Computer Networking.

Data comm^{n} s/m is used for sending binary msgs over long distances. In the data comm^{n} s/m the communicating entities are known as source & destination. Computer networks is a collection of autonomous computers which are interconnected. If 2 computers are said to be interconnected if they are able to exchange the information. The practise of connecting these computers together is called networking. A network may contain two or more computers that are linked to share the resources, files & to communicate. To achieve communi-cating, computers on a network must have a common protocol.

Protocol: A set of formal rules describ-ing how to transmit or exchange data especi-ally according to a networks.

Advantages of networking:

1. It reduces the cost through sharing of the data & peripherals.
2. It allows the sharing of resources.
3. It enables efficient comm^{n} & scheduling.

Disadvantages:

1. Fault in a network can cause loose of user data
2. The larger the network more difficulty to control.
3. Security a network from hakers is difficult.

The 3 categories of computer networks are LAN, MAN & WAN.

Local Area Network (LAN)

A LAN is generally a privately owned network within a single office, building or campus, spaning a distance of few kms. LANs are designed to share data both hardware & software resources. LANs have data rates of the orders of several Giga bytes per second (Gbps) LANs use star, ring, or bus topologies.

Measure characteristics of LAN

1. Every computer has the potential to communicate with any other computer of the network.
2. High degree of interconnection b/w the computers.
3. High data transmission rate.
4. Easy physical connection of computers in a network.

Advantages of LAN

1. The reliability of the network is high. because the failure of 1 computer in the network does not effect the functioning of other computers.
2. Addition of new computer to network is easy.
3. High rate of data comm^n is possible.
4. Peripheral devices like magnetic disks & printers can be shared by other computers.

Disadvantages

If the comm^n line fails, the entire network s/m breaks down.

Uses of LANs

1. Personal computing
2. Word & text processing
3. Electronic message handling
4. File transfers & access.

Metro Politan Area Network (MAN)

A MAN is designed to cover an entire city, the comm^n is over moderetly inexpensive media. MANs are usually owned by cable television companies, MANs permit users to have access to hardware & software resources.

Wide Area Network (WAN)

A WAN is a huge compared to a LAN or a MAN. A WAN spans according to cities, states, countries, For instance, a WAN could be made up of a LAN in India & another LAN in US & a 3rd LAN in Japan is connected to form a big networks of network. The technical specification of a WAN differs from that of a LAN, although in the principle of a WAN looks like a big LAN.

List the types of wireless LAN. 3m

1. Wireless Personal Area Networks (WPAN)
2. Wireless Metropolitan Area Network (WMAN)
3. Wireless Wide Area Network (WWAN)
4. Wireless Local Area Networks (WLAN)

Define computer networks. Mention the advantages of networking. 6m

→ A set of computers connected by media links or interconnection of computers for the purpose of communication is known as computer networks.

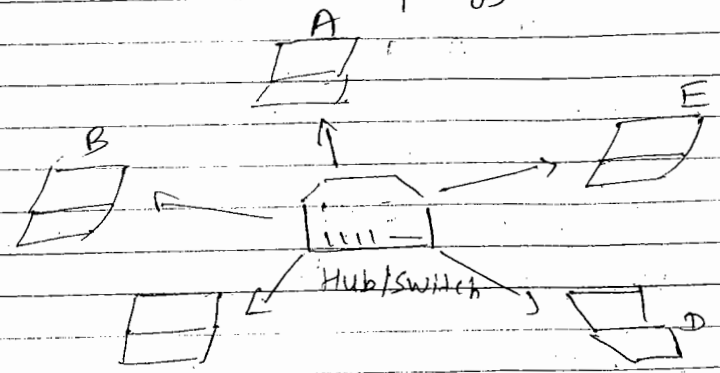
Advantages of "networking":

1. Resource sharing i.e., sharing of a printer or sharing of a file or sharing of a memory etc.
2. Saving money: Since expensive resources such as high quality printers, disk storage s/m, central files & data bases are used on shared buses. There is a saving of money.
3. High speed & reliable interconnection b/w localized computing elements.
4. Remote work stations can be easily accessed
5. Due to networking marketing has become effective & easier.

Define topology. Explain star topology 3+3=5

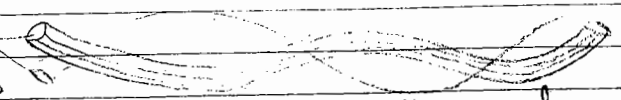
Topology is the term is used to describe the way in which the computers are connected in a network. Physical topology describes the actual layout of the network hardware. Logical topology describes the scheme used by the networks operating s/m to manage the flow of information b/w the nodes.

In star topology



In star topology, there is a central node (switch or hub) to which all the nodes connected as shown in the fig. The star configuration is also commonly called hub & spoke because it resembles a wagon wheel. The comm b/w any 2 stations can take place only through the central node. System reliability is dependent on the central node. Failure of the central node results in total breakdown of network.

Describe the characteristics of twisted pair cable in LAN. -4m.



* Twisted pair cable may be used to transmit both analog & digital cables. Compared to other guided transmission media, twisted pair is limited in distance, B.W & data rate.
* Twisted pair is susceptible to interference & noise shielding the wire with metallic

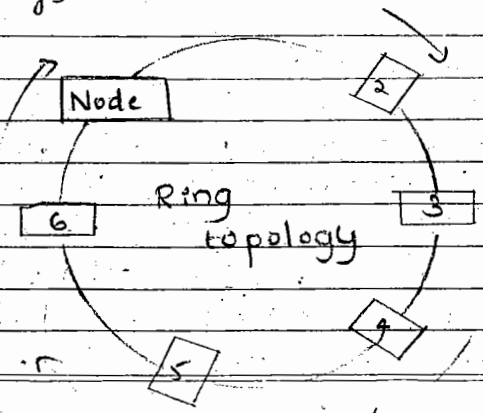
brid or sheeting reduces interference. The twisting of the wire reduces low freq interference & cross talk.

* For point to point analog signaling, a B.W of about 250 KHz is possible. This accomodates a no. of voice chanels.
* For long distance digital point to point signaling data rates are upto few Megha bits (Mbps) are possible
For every short distance data rates upto 100Mbps have been achieved in commercial available products

Merits
* Easy to install.
* Fault identification is easy, links failure has no effect on the rest.
* Cheaper compare to mesh topology.

Demerits
* Failure of the hub results in total break down of the networks.

Ring topology.

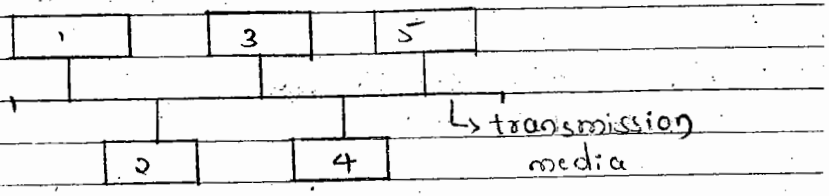


In this each node is connected to 2 neighbo-uring nodes. Data is taken from one of the neighbouring node & it is transmitted to another node. In this direction of data transmission / comm° is unidirectional. Data travels from node to node around the ring in round fasion. To receive messages each work station must have its own address. The message is passed around the ring until the address station recognizes & receive the messages only one path is possible. Failure of any one station on the ring results in total breakdown of the network.

Merits
* It is easy to add or delete work station on ring network.
* S/w modification cost is low.
* Performance is faster.

Demerits
* Ring requires complex hardware to implement.
* Failure in chanel can cause network feilure.
* Fault identification is difficult.

Bus topology



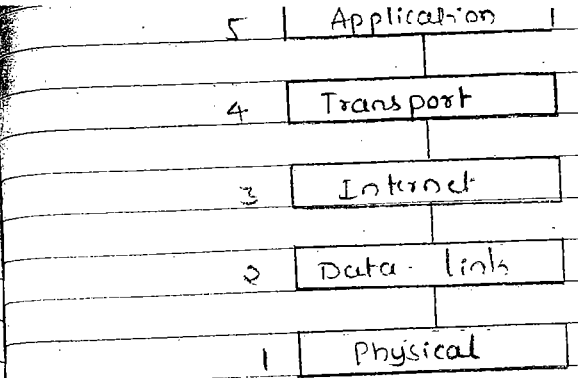
It consist of single line of the transmission media. It is used for data comm^n networks. This is also called as multi-drop line. This type of topology is used in Ethernet LAN. Messages are broad casted along the whole bus. To receive a transmission, work station must be able to recognize its own address. Signal strength problems commonly are handled by limiting the length of the cable network & the no. of attached work station.

Comm^n is bidirectional on the bus. Any station can transmit to any other station. Comm^n b|w 2 stations takes place directly without interference from any other station.

Merits
* Excellent under light loads.
* Expansion is easy
* Failure of any node does not effect on the network operation.
* On the existing length additional nodes can be connected.

Demerits
* Fault identification is difficult.
* A single cable is dedicated to all the information traffic performance can be slow.

Explain the functionality of each layer TCP/IP model 7m.



TCP/IP (Transmission Control Protocol/Internet Protocol) is the basic comm^n protocol of the internet. The fig shows the TCP/IP model. It is organized in 5 layer as shown.

1. Application layer handles high level protocols representation, encoding & dialogue control. It ensures that the data is properly packed before it is passed to the next layer.
2. The transport layer sends data packets from a source to a destination through cloud. The primary duty of this layer is to provide end to end control & reliability.
3. The purpose of internet layer is to select the best path for packets to travel through the network. Best path determination & packet switching occur at this layer.
4. The data-link layer is responsible for delivery of the packets b|w 2 sites on the same link.
5. The physical layer is the lowest layer it is concerned with transmitting raw bits over a chanel.

State the factors to be considered in choosing a networks topology.

-** Capabilities of the network access the device.
* Capability of the media or the time of transmission line.
* The level of the control or fault tolerance desired.
* The cost associated with cabling or telecommunication ckt.
* Logical flow of data.

Explain layers of OSI model 3+4=6.

layer 1	Application	operating s/m Internet.
2	Presentation	
3	Session	
4	Transport	
5	Net-work	
6	Data link	
7	physical	

(1) Physical layer: It is concerned with creating bit links b/w sender & receiver. Its functions are representing bits, data rate, bit synchronization, transmission medium & transmission mode determination.
(2) Data-link layer: It is responsible for hop to hop delivery. The other responsibilities are framing, addressing, medium access control, flow control & error control.
(3) Network layer: It is responsible for source to destination delivery of a packet, across various tinks which includes creating logical end to end connection, addressing & routing.
(4) Transport layer: It is responsible for end to end free delivery of the entire message which includes service point addressing, segmentation, service point addressing & reassembly, connection control, flow control & essos.
(5) Session layer: It is responsible for dialogue control. It establishes, maintains & synchronizes the interaction b/w communicating s/m. Its specific responsibilities are half & full duplex service, synchronization & atomization.
(6) Presentation layer: It is responsible for reforming the data to a format understood by the receiving app layer, specific responsibilities includes translation, encryption & compression.
(7) Application layer: It enables the user to access the networks. It provides services such as email, file transfer, data base management etc.

Compare TCP/IP model with OSI model

5	Application	layer 1	Application
		2	Presentation
4	Transport	3	Session
		4	Transport
3	Internet-	5	Network
		6	Data-link
2	Data-link	7	Physical
1	Physical		

* TCP/IP model combines OSI application, presentation, session layer into its app layer.
* TCP/IP combing OSI data link & physical layer to its network access layer.
* TCP/IP appears simpler because of its few layers.
* When the TCP/IP transport layer uses UDP, it does not provides reliable delivery of packets.
* Internet was developed based on the stds of TCP/IP model protocol. OSI model is used as guide to understand the comm? process.

Define ethernet: It is one of the most successful LAN. Ethernet shares media. Network which uses shared media as high probability of data collision. ethernet uses CSMA/CD (Carrier sense multi access / collision detection) on the occurance of collision in the ethernet all its hosts roll back, wait for some random amount of time and then re transmit the data.

ethernet has 10BASET specification. The number 10 indicates 10mbps, Base stands for baseband, & T stands for thick ethernet.

Standard Ethernet

Char	10Base5	10Base2	10BaseT	10BaseFL
Medium	50Ω coaxial	50Ω coaxial	UTP	Graded Index fibre-optic
Cable diameter	10mm	5mm	0.4 to 0.6 mm	62.5mm core 125 mm cladding
Topology	Bus	Bus	Physical-Y Logical bus	star
maximum segment length	500m	185m	100m	2km

Fast Ethernet: (100 Base-T)

100 Base-T ethernet std defines the use of 100 mbps, base indicates base band communication, T indicates the distance generally 100mtrs.

Fast ethernet can be classified into 2 pair or 4 pair implementation. 2 pair implementation is called 100Base-X. It may be either twisted pair cable, 100Base-TX, or 100 Base-FX fibre optic cable. 4 pair implementation is designed for twisted pair cable 100 Base-T4.

Giga ethernet: Giga ethernet can be characterised as either as 2 wire or 4 wire implementation. 2 wire implementation is called 1000 Base-X, which can use short wave optical fibre 1000 Base-SX, long wave optical fibre - 1000 Base-LX, short copper jumpers 1000 Base-CX.

4 wire version uses twisted pair cable 1000 • Base-T.

(IMP)

List & explain the physical media in a giga ethernet. -5m-

→ The physical media can be characterised into 2 types.

(1) 2 wire implementation.

(2) 4 wire implementation.

They are identified by 3 part, product-name, indicating the transmission rate, the transmission method & the media type.

They are as follows.

1000 Base-LX : 1000 Mbps, Base band, long wave length over optical fibre cable.

1000 Base-SX : 1000 Mbps, Baseband, short wave length over optical fibre cable.

1000 Base-CX : 1000 Mbps, base band, short wavelength shielded twisted pair cable.

1000 Base-T : 1000 Mbps, base band, long wavelength over four UTP copper cables.

Wireless LAN: (WLAN)

Wireless LAN is typically an extension wired LAN. WLAN components convert data packets into radio waves instead of copper wires or optical fibres for signal transmission. Wireless LAN provides greater flexibility to the users who are becoming mobile within their building environment.

Distance of coverage depends on the transmitter and the sensitivity of the receiver.

Infrastructure WLAN
Ad-hoc WLAN

There are 2 kinds of services in WLAN.

(1) Basic service set (BSS)

(2) Extended service set (ESS).

Basic Service Set (BSS)

Network configuration with one cell is called basic service set. Access point (AP) is the base station for a loop of users.

Extended Service set (ESS)

It is made up of 2 or more BSS with access point. BSS are connected through a distribution s/m.

Wireless Access Point (WAP)

In computer networking, a wireless access point is a device that allows wireless comms to connect wireless network using bluetooth or related standards. The WAP usually connects to a router data b/w the wireless devices & the wired devices on the network.

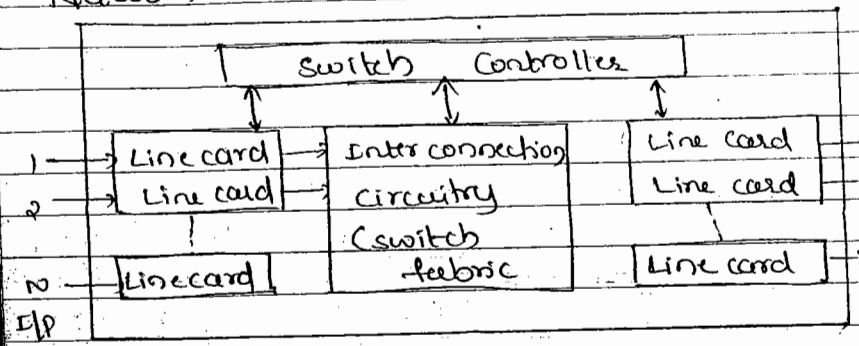
(IMP) state the applications of WLANs -5m.

WLANs are used in

1. Organization with dangerous & hazardous conditions that cannot be supported on wired networks.
2. Emergency situation where there is no time to lay wires.
3. Inventry control or product retrieval in warehouse.

4. Data transfer within work stations in large opened manufacturing areas.
5. Information exchanges between personal in office building where installing cable upgrades may be difficult.
6. Comm^n among medical staff members in a health care facility.
7. Voice & data transfer among computing & comm^n devices in a home.

Network



Switches are multi part bridges under considered layer 2 & layer 3 devices. Most switches have values of 12, 24 or more ports and can be handle several conversations at the same time in full duplex mode.

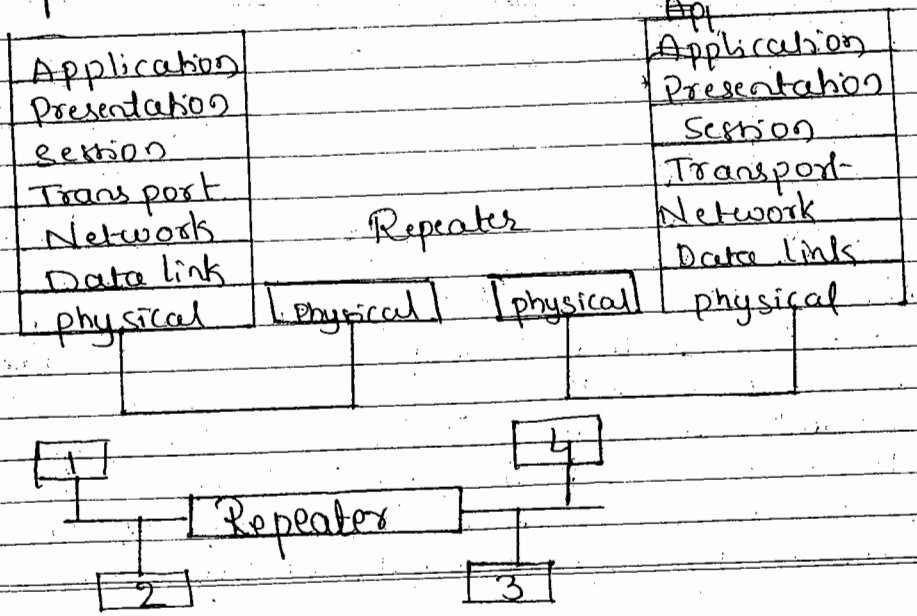
Switches consist of the following components

1) I/P O/P ports
2) Line card
3) Interconnection circuitry
4) A switch controller.

Explain the importance of switches as a networking device. — 4m.

→ Switches are networking devices that perform switching.
→ They are considered as layer 2 & layer 3 devices.
→ They have ports & can handle several conversation at the same time in full duplex mode.
→ They establish & appropriate links for network traffic b/w source & destination nodes.
→ Switches employ buffers to store frames on a temporary bases. When the link is busy the frame would wait in buffer till the link becomes free.

Repeater

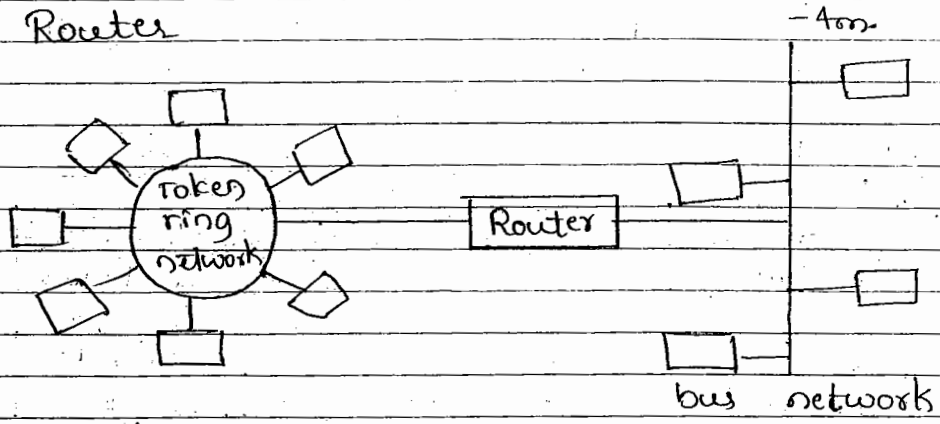


Repeater is a special device similar to hub. Its function is to amplify and relay the electrical signals from one cable to another. Repeaters are also called physical relay or Level 1 relay

functions of repeaters.

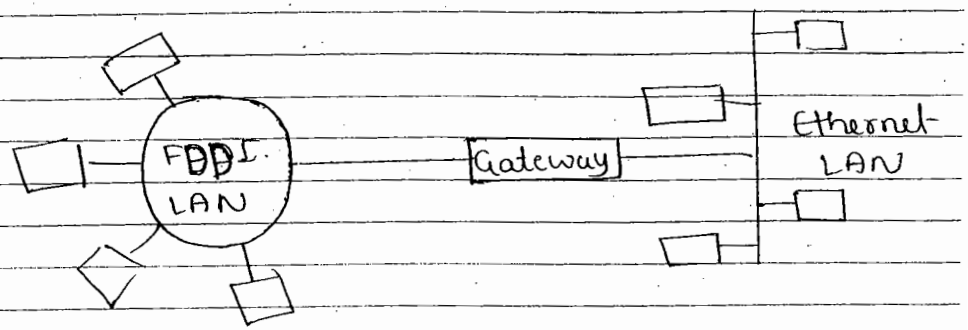
→ Amplify electrical signals.
→ Connect two identical physical links
→ act upon bits transfered blw the physical layer of 2 stations.
→ Perform -lining correction and waveform regeneration.

Router



A router is a 3 layer device that routes packets based on logical networks address (host to host). A router normally connects LANs and WANs in the network internet and has a routing table i.e, making decision about the route using a protocol. Routing protocols are used to continuously update the routing table that are consulted for forwarding & routing that works in netwo -rk layer.

Explain with sketch the functions performed by gate ways. - 5m.



FDDI - Fibre Distribute Data Interface

To connect 2 networks that use differen protocol families, a complete translation blw the protocol families are required. It is also called Level-7 relay or inter-working units. It is the interface blw 2 dissimilar nlw.

For ex: Ethernet LAN with FDDI LAN.

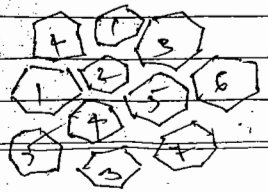
A gateway can connect any nlw to any other nlw & provides the following fun
→ Bit handling
→ Framing
→ Errors detection
→ Routing
→ Flow Control
→ Message byte field interpretion & so on.

Explain multi cell system.

→ In a multicell system the service area is divided into cells as shown in fig. Each cell is represented by a hexagon. Each cell has a base station with a low-power transmitter. The size of the cell may vary, depending upon the terrian. Each cell is allocated some channels, and all the mobiles, when they are in that cell, use these channels for communication.

In a multicell system, two adjacent cells cannot use the same channel because there will be interference. When a mobile subscriber moves from one cell to another cell while the call is in progress.

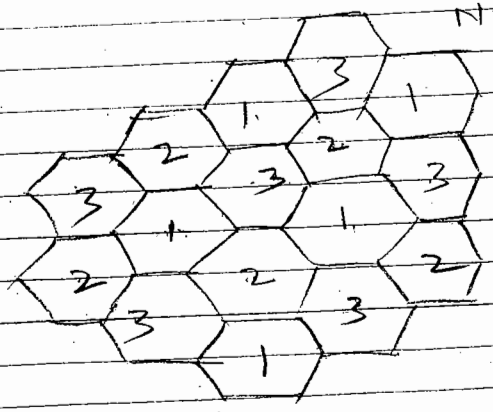
When the mobile terminal is at the edge of one cell, the signal strength goes down, & the mobile terminal monitors the signal strength, goes down, and the mob. stn of the channels in the adjacent cells and switches to the channel for which signal strength is high. The call will not be dropped, and conversation will continue using the new channel. This process is called handoff or handover.



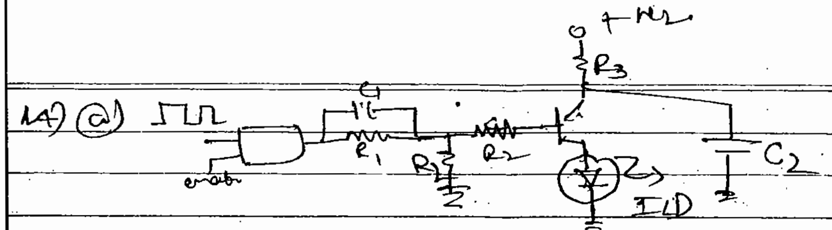
Frequency reuse:

Every cellular service provider will be allocated a fixed number of channels for use in a service area. The service provider has to make best use of the channels - to provide the maximum number of simultaneous calls. Though adjacent cells cannot use the same channels, the same channels can be reused in other cells, provided there is a minimum separation distance b/w the cells using the same channels. The concept of clusters is of importance here. A cluster is a group of cells, and no channels are reused within a cluster.

In multicell systems, each cell is assigned a group of radio channels. The same radio channels can be reused in another cell, provided a minimum distance is maintained between the two cells using the same radio channels.



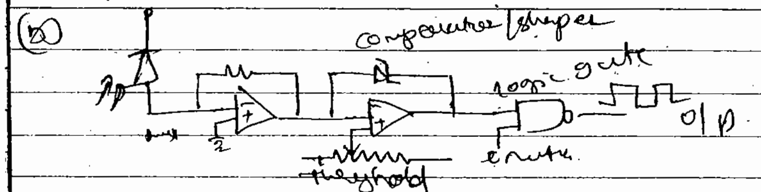
14) (a) ⊓⊔⊓



A transmitter consist of modulator & a circuit that generates carrier. In this case the carrier is a light beam that is modulated by a digital pulse which turn it ON & OFF.

Above fig shows ILD transmitter. When the I/P of AND gate is zero, O/P of AND gate is also zero. Therefore transistor Q_1 is in OFF condition so as the ILD. Then C2 discharges a very high current pulse into the laser turning it ON & creating an intense light pulse.

(b)



The receiver consist of a detector that will sense the light pulses & converts them into electrical signal. This signal is then amplified & reshaped to its original digital form.

Above fig shows the basic ckt dig of photo... The current through the optical receiver photo diode generated when light is sensed produces a current that is then amplified in an op-amp. Following the op-amp there is an comparator / shaper ckt used as a shaper ckt so that squares the pulse to ensure fast rise & falls times. The o/p is then passed through the logic gate to get a correct binary voltage at the o/p side.

Category 5: Used in local area network. It support upto 100 Mbps data transmission speed.

Category 4: It supports transmission speed of 16 Mbps. & three twist per foot.

Category 3: It support data transmission speed upto 10 Mbps. At least three twist per feet & used in telephone s/m.

Category 2: It support data transmission speed upto 4 Mbps & suitable for voice data transmission.

Category 1: Mostly used in telephone s/m. Cat 1 is suitable for voice & low speed data communication.

Mobile Communication :-

Single-Cell Systems :-

In single-cell systems, the entire service area is covered by one base station. The drawbacks of the this approach are high-power transmitters are required, power consumption of the mobile phone will be high, and expansion of the system is difficult.

Disadvantages :-

1) :- Very powerful transmitters are required at the base station.

2) :- The capacity of the system will be very low. because

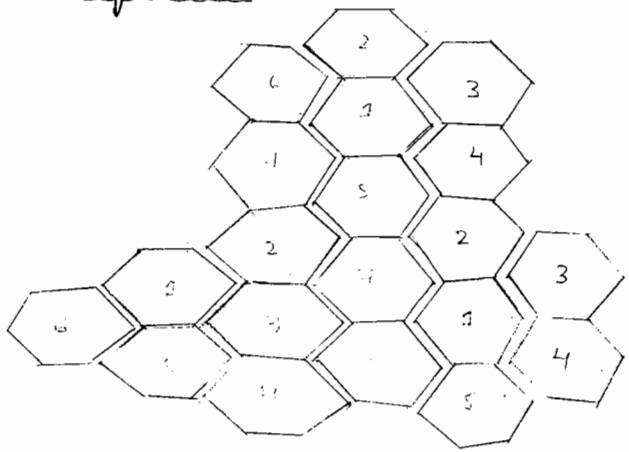
3) :- The number of subscribers who can make calls simultaneously also will be limited.

4) :- The size of the mobile terminals will be large.

5) :- The power consumption will be very high.

6) :- Expansion of the system to cater to a higher number of subscribers will be very difficult.

Multicell Systems :-



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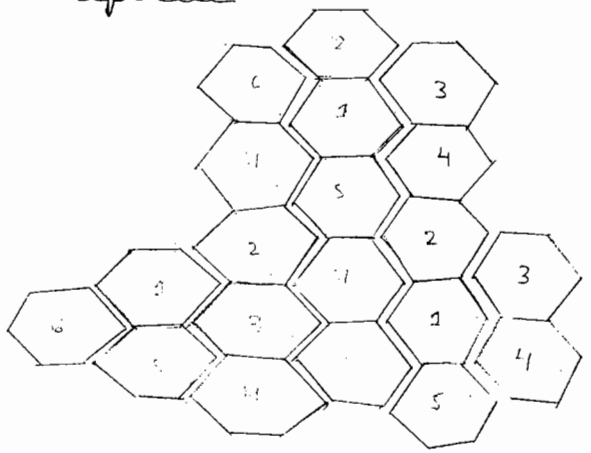

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Salient Features of GSM :-

The salient features of GSM are :-

1) It is based on digital technology, so security can be built into the system easily
2) Since the interfaces are standardized, hence the network operator & the subscriber will be benefited
3) A higher calling capacity per cell
4) Support for international roaming
5) In addition to voice services, data services are also supported.

GSM Services :-

GSM services are divided into telephony services and data services. In additional to the normal telephony services, the following services are also supported:

1) Group 3 facsimile transmission through a Special interface.
2) Short messaging service to transmit a maximum of 160 Alphanumiric character

3) The service can be used to transmit information regarding traffic congestion, accident information and so on

4) Voice mail

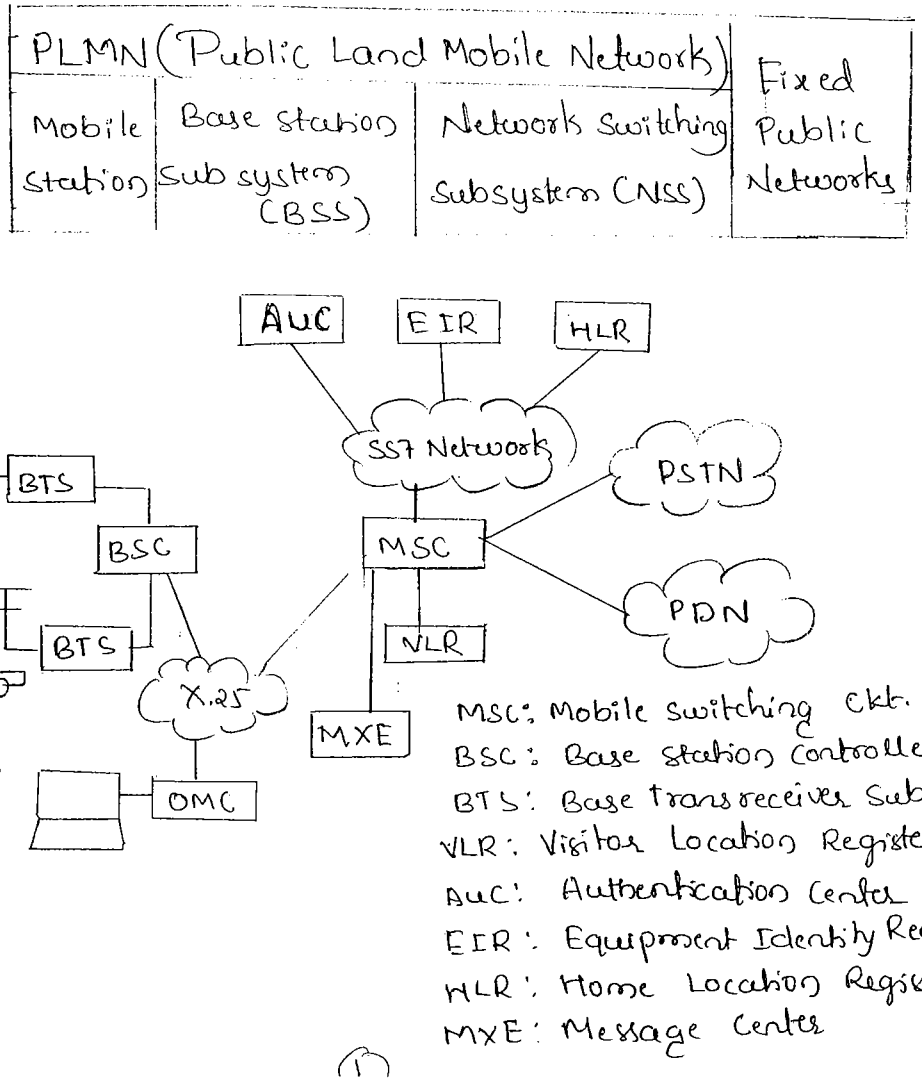
5) Fax mail

GSM system also supports the following services

1) Call forwarding
2) Barring outgoing calls
3) Barring incoming calls
4) Advice of charge
5) Call hold, to interupt a call and then reestablish it again.
6) Call waiting
7) To provide conferencing facility
8) Calling line Indentification Presentation, (CLIP) to display the telephone number of the calling party

In closed user group service, a number of mobile subscribers can communicate among themselves at reduced charge

Explain the GSM system Architechture.



The mobile network of the entire region is known as a public land mobile network (PLMN). The PLMN will be in the administrative control of one operator. The PLMN consist of mobile stations (MS), base station subsystems (BSS), and network switching subsystem (NSS).

The GSM system consists of mobile stations, base transreceiver subsystem (BTS), base station controller (BSC), and mobile switching center (MSC). Public networks such as PSTN and ISDN are ~~connected to~~ connected to the MSC.

The PLMN is connected to the Public Switch Telephone Network (PSTN) or Public Data Network (PDN) or Integrated Services Digital Network (ISDN) at the MSC.

Mobile station (MS): Also known as mobile handset or hand phone, this is the subscriber terminal.

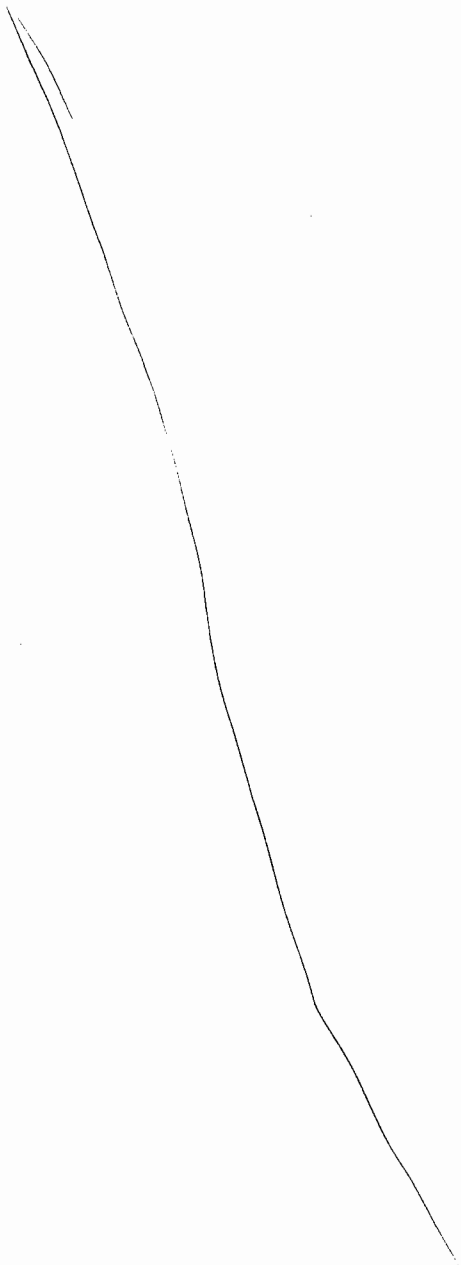
The MS is identified by a number known as MS-ISDN (the mobile phone number). Each MS is also uniquely identified by IMSI (international mobile subscriber identity). The MS contains a SIM (subscriber Identity module). SIM is smart card inserted in the handset. It is protected by a personal identity number (PIN). PIN is ch-ked locally and not transmitted over the radio

BTS :- BTS is the radio interface between the MS & the BSC. Communications between the MS & the BTS is through one channel consisting of a pair of frequencies one for uplink & one for down link. ~~The frequency allocation to GSM in 900MHz band is~~

(HLR) Home location register :-

HLR is a centralized data base to manage the subscribes data It is a stand alone system connected to GSM network sub systems with ~~signalling~~ signaling system NO-7. This data base contains

1) Subscribes information
2) Subscribes rights & privileg
3) Location information.



SIM contains IMSI. To identify a handset hardware uniquely, IMEI (International mobile equipment Identity) is used, which is a number given by the manufacturer to the handset.

2) BSS: The BSS acts as a relay between the NSS and the mobile stations. The BSS consists of B and BTSs. The service area is arranged into cells, and each cell will have a BTS. Each cell can vary from 350 meters to 35 kilometers.

> BSC: BSC contains the transcoders that conve the PCM-coded speech into 13kbps data for sending it to the BTS. In the reverse dire -on, the 13kbps-coded speech is converted in 64kbps PCM data to send it to the MSC.

> Authentication Center (AuC): AuC provides the data to verify the identity of each user and to provide confidentiality of the conversa -n / data. HLR / AuC are administered by man-machine interface (MMI) commands from the OMC.

> Visitor Location Register (VLR): VLR is responsible for the current location of the user. VLR contain information about all the mobile subscribers currently located in the MSC service area. VLR is generally integrated into MSC. When a mobile station roams into a new MSC service are

(10) the VLR connected to that MSC gets the data about the mobile station from the HLR and stores it.

7) Equipment identity register (EIR): EIR contains information about the mobile equipment. Each MS is uniquely identified by IMEI (International mobile equipment identity). When a mobile handset is lost, the subscriber informs the customer support center, and this information is stored in the EIR. When the lost mobile is used for making a call, the EIR will not permit the call. Because EIR also provides the security, EIR and AuC can be combined into one computer.

8) Mobile switching center (MSC): MSC provides complete switching functionality for the entire network, so all call control functions are built in the MSC. It also provides the interface to the rest of the world - PSTN, PDN, ISDN, and so on. MSC is also connected to the OMC.

9) Operation and maintainance center (OMC):

The OMC is used to carry out network management activities such as fault diagnosis of various network elements, traffic analysis, billing, performance management, configuration management (such as adding a new BSC and cell splitting), as well as managing subscriber information.

The communication between the MSC and the databases (HLR, EIR, AuC) is through an SS7 network, because only signaling information is exchanged between these entities. The communication between the OMC and the MSC/BSC is through a packet switching network based on X.25 standards.

10) Message center: Message center is a node that provides voice, data, and fax messaging. It handles the SMS, cell broadcast, voice mail, and e-mail messaging. Separate servers are required to handle these messaging systems, which are connected to the MSC.

11) Gateway MSC: When a PLMN contains more than one MSC, one of the MSCs is designated as a gateway MSC to interconnect with other networks such as PSTN and ISDN. If the PLMN contains only one MSC, that MSC itself can act as a gateway MSC.

Explain GSM Network Areas.

⇒ In a GSM network, the following areas are defined: cell, location area, service area, and PLMN.

Cell: Cell is the basic service area; one BTS covers one cell. Each cell is given a cell global identity (CGI), a number that uniquely identifies the cell.

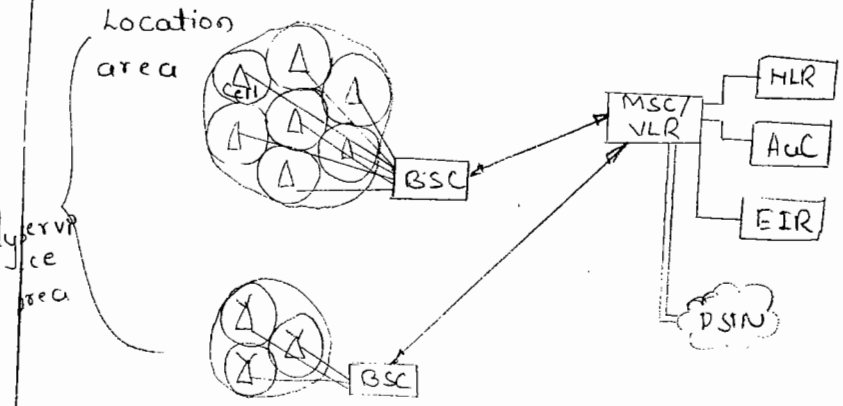
location area: A group of cells form a location area. This is the area that is paged when a subscriber gets an incoming call. Each location area is assigned a location area identity (LAI). Each location area is served by one or more BSCs.

MSC / VLR service area: The area covered by one MSC is called the MSC/VLR service area.

PLMN: The area covered by one network operator is called PLMN. A PLMN can contain one or more MSCs.

Figure shows a GSM PLMN serving two cities. Each city will have a number of BTSs and one BSC. The two BSCs are connected to the MSC. MSC also acts as the gateway to the PSTN. The number of BTSs in a city depends on the subscriber density and the terrain. Presently, each

Indian city is covered by about 100 to 200 BTS



GSM PLMN serving two cities

GSM Operation :

Call from Mobile Station:

When a mobile subscriber makes a call to a PSTN telephone subscriber, the following sequence of events takes place:

1. The MSC/VLR receives the message of a call request.
2. The MSC/VLR checks if the mobile station is authorized to access the network. If so, the mobile station is activated.

3. MSC/VLR analyzes the number and initiates a call setup with the PSTN.
4. MSC/VLR asks the corresponding BSC to allocate a traffic channel (a radio channel and a time slot).
5. BSC allocates the traffic channel ~~(a radio slot)~~ and passes the information to the mobile station.
6. Called party answers the call, and the conversation takes place.
7. The mobile station keeps on taking measurements of the radio channels in the present cell and neighboring cells and passes the information to the BSC. BSC decides if handover is required and, if so, a new traffic channel is allocated to the mobile station and the handover is performed.

Call to a Mobile Station:

When a PSTN subscriber calls a mobile station, the sequence of events is as follows:

1. The gateway MSC receives the call and queries the HLR for the information needed to route the call to the serving MSC/VLR.
2. The GMSC routes the call to the MSC/VLR
3. MSC checks the VLR for the location area of the MS.
4. MSC contacts the MS via the BSC by sending a pager request.
5. MS responds to the page request.
6. BSC allocates a traffic channel and sends a message to the MS to tune to the channel. The MS generates a ringing signal and, when the subscriber answers, the speech connection is established.
7. The mobile station keeps on taking measurements of the radio channels in the present cell and neighboring cells and passes the information to the BSC. BSC decides if handover is required and, if so, a new traffic channel is allocated to the mobile station and the handover is performed.

(16)

Compare 2G & 3G.

2G	3G.
1) The speed of data transmission is low	1) The speed of data transmission is high
2) Video calls can be made with less speed.	2) Video calls can be made with high speed.
3) Information transmission through voice signal.	3) Information transmission through video conferencing, MMS etc.
4) Less security.	4) High security.
5) Less features available	5) More features available (Mobile TV, GPS, video transfer).
6) Downloading & Uploading speed is less	6) Downloading & uploading speed is high.
7) Cost paid by consumer is less	7) Cost paid by consumer is ~~high~~ more.