DEPARTMENT OF ECE

EC 6651 COMMUNICATION ENGINEERING

CLASS/SEM - III EEE/VI SEM

UNIT I

ANALOG COMMUNICATION

PART-A

1. Define amplitude Modulation.

Amplitude Modulation is the process of changing the amplitude of a relatively high frequency carrier signal in proportion with the instantaneous value of the modulating signal.

2. Define Modulation index and percent modulation for an AM wave.

Modulation index is a term used to describe the amount of amplitude change present in an AM waveform .It is also called as coefficient of modulation. Mathematically

Modulation index is

$m = Em/ Ec$

Where m = Modulation coefficient

Em = Peak change in the amplitude of the output waveform voltage.

Ec = Peak amplitude of the unmodulated carrier voltage.

Percent modulation gives the percentage change in the amplitude of the output wave when the carrier is acted on by a modulating signal.

3. Define Low level Modulation.

In low level modulation, modulation takes place prior to the output element of the final stage of the transmitter. For low level AM modulator class A amplifier is used.

4. Define High level Modulation.

In high level modulators, the modulation takes place in the final element of the final stage where the carrier signal is at its maximum amplitude. For high level modulator class C amplifier is used.

5. What is the advantage of low level modulation?

An advantage of low level modulation is that less modulating signal power is required to achieve a high percentage of modulation.

6. Distinguish between low level and high level modulation.

In low level modulation, modulation takes place prior to the output element of the final stage of the transmitter. It requires less power to achieve a high percentage of modulation.

In high level modulators, the modulation takes place in the final element of the final stage where the carrier signal is at its maximum amplitude and thus requires a much higher amplitude modulating signal to achieve a reasonable percent modulation

7. Define image frequency.

An image frequency is any frequency other than the selected radio frequency carrier that if allowed to enter a receiver and mix with the local oscillator will produce a cross product frequency that is equal to the intermediate frequency.

8. Define Local Oscillator tracking.

Tracking is the ability of the local oscillator in a receiver to oscillate either above or below the selected radio frequency carrier by an amount equal to the intermediate frequency throughout the entire radio frequency band.

9. Define High side injection tracking.

In high side injection tracking, the local oscillator should track above the incoming RF carrier by a fixed frequency equal to fRF +fIF.

10. Define Low side injection tracking.

In low side injection tracking, the local oscillator should track below the RF carrier by a fixed frequency equal to fRF –fIF.

11. Define tracking error. How it is reduced.

The difference between the actual local oscillator frequency and the desired frequency is called tracking error. It is reduced by a technique called three point tracking.

12. Define image frequency rejection ratio.

The image frequency rejection ratio is the measure of the ability of preselector to reject the image frequency.

$$r = (fim/fRF)-(fRF/fim)$$

13. Define Heterodyning.

Heterodyne means to mix two frequencies together in a nonlinear device or to translate one frequency to another using nonlinear mixing.

14. What are the disadvantages of conventional (or) double side band full carrier system?

In conventional AM, carrier power constitutes two thirds or more of the total transmitted power. This is a major drawback because the carrier contains no information; the sidebands contain the information. Second, conventional AM systems utilize twice as much bandwidth as needed with single sideband systems.

15. Define Single sideband suppressed carrier AM.

AM Single sideband suppressed carrier is a form of amplitude modulation in which the carrier is totally suppressed and one of the sidebands removed.

16. Define AM Vestigial sideband.

AM vestigial sideband is a form of amplitude modulation in which the carrier and one complete sideband are transmitted, but only part of the second sideband is transmitted.

17. What are the advantages of single sideband transmission? The

advantages of SSBSC are

1. Power conservation: Normally, with single side band transmission, only one sideband is transmitted and the carrier is suppressed. So less power is required to produce essentially the same quality signal.
2. Bandwidth conservation: Single sideband transmission requires half as much bandwidth as conventional AM double side band transmission.
3. Noise reduction: Because a single side band system utilizes half as much bandwidth as conventional AM, the thermal noise power is reduced to half that of a double side band system.

18. What are the disadvantages of single side band transmission?

1. Complex receivers: Single side band systems require more complex and expensive receivers than conventional AM transmission.
2. Tuning Difficulties: Single side band receivers require more complex and precise tuning than conventional AM receivers.

19. Define direct frequency modulation.

In direct frequency modulation, frequency of a constant amplitude carrier signal is directly proportional to the amplitude of the modulating signal at a rate equal to the frequency of the modulating signal.

20. Define indirect frequency Modulation.

In indirect frequency modulation ,phase of a constant amplitude carrier directly proportional to the amplitude of the modulating signal at a rate equal to the frequency of the modulating signal.

21. Define instantaneous frequency deviation.

The instantaneous frequency deviation is the instantaneous change in the frequency of the carrier and is defined as the first derivative of the instantaneous phase deviation.

22. Define frequency deviation.

Frequency deviation is the change in frequency that occurs in the carrier when it is acted on by a modulating signal frequency. Frequency deviation is typically given as a peak frequency shift in Hertz (Do).The peak to peak frequency deviation (2Df) is sometimes called carrier swing. The peak frequency deviation is simply the product of the deviation sensitivity and the peak modulating signal voltage and is expressed mathematically as Df = K1 Vm Hz

23. State Carson rule.

Carson rule states that the bandwidth required to transmit an angle modulated wave as twice the sum of the peak frequency deviation and the highest modulating signal frequency. Mathematically carson's rule is B=2(Df +fm) Hz.

24. Define Deviation ratio.

Deviation ratio is the worst case modulation index and is equal to the maximum Peak frequency deviation divided by the maximum modulating signal frequency. Mathematically, the deviation ratio is
DR= Df (max) fm(max)

25. What is multiplexing?

Multiplexing is the transmission of information from one or more source to one or more destination over the same transmission mediam.

PART – B

1) Name the methods used for the suppression of unwanted side band in AM transmission? Discuss the working of any one of them. **(16)**

2) (i) Compare the features of FM with AM. Also write the merits and demerits of FM. **(6)**

(ii) Discuss the Armstrong method of FM generation **(10)**

3) Describe the working of direct and indirect method of generation of FM signal. **(16)**

4) Discuss in detail about the working of a SSB transmitter and receiver. **(16)**

5) (i) Explain the method of generating a single sideband signal using balance modulators **(8)**

(ii) Discuss the principle of AM based radio frequency receiver with block diagram **(8)**

6) Explain with neat circuit, generation of AM wave. For an AM DSBFC modulator with carrier frequency fc = 100 KHz and a maximum modulating signal fm = 5 KHz, determine bandwidth and sketch the output frequency spectrum. **(16)**

7) Solve the expression for the amplitude modulated wave and its power relation and give the time and frequency domain representation of AM wave. **(16)**

8) List out the relative merits of high level modulation and low level modulation in AM transmission? The anode dissipation of a class C power amplifier is 944 watts when modulation depth is 60%, the efficiency of a power amplifiers is 60%, while that the modulator is 25%.Find.

(i) Carrier power and modulator tube dissipation when modulation depth is 100%

(ii) AF output and rating of the modulation value to affect 100% modulation.

(iii) Overall efficiency at 60% modulation depth.

9) (i) Derive the equation for the spectrum of FM signal**.**

(ii) Explain the generation of FM Signal using reactance modulation scheme with neat diagram.

2. Define balanced transmission line.

I n bal anc ed tran smi ssio n line , bot h con duc tors

UNIT II

DIGITAL COMMUNICATION

PART-A

1. Define transmission line.

A transmission line is a metallic conductor system that is used to transfer electrical energy from one point to another. A transmission line is two or more conductors separated by an insulator, such as a pair of wires or a system of wire pairs.

carry current; one conductor carries the signal and the other is the return. This type of transmission is called differential or balanced signal transmission.

3. Define unbalanced transmission line.

In unbalanced transmission line, one wire is at ground potential where as the other wire is at signal potential. This type of transmission is called single ended or unbalanced signal transmission. **(16)**

4. Define Open wire transmission line. **(8)**

(8)

An open wire transmission line is a two wire parallel conductor. It consists simply of two parallel wires, closely spaced and separated by air. Nonconductive spacers are placed at periodic intervals for support and to keep the dielectric between the conductors constant. The dielectric is simply the air between and around the two conductors in which the TEM wave propagates.

5. What are the advantages of open wire transmission line?

a. Simple in construction
b. Radiation losses are high
c. It is susceptible to noise pickups.

6. Define twisted pair cable.

There are cabled into cores. The cores are covered with various types of sheaths neighboring pairs are twisted with different pitch to reduce interference between pairs due to mutual conduction.

7. Define shielded cable transmission line.

In shielded cable transmission line, parallel two wire transmission lines are enclosed in a metallic conductive metal braid to reduce the radiation losses and interference. The metal braid is connected to ground acts as shield. The braid also prevents signal radiation from reaching the conductors.

8. Define concentric transmission line.

Coaxial or concentric conductors are used for high frequency applications to reduce losses and to isolate transmission paths. The basic coaxial cable consists of a center conductor surrounded by a concentric conductor. At high frequencies, the coaxial outer conductor provides excellent shielding against external interference.

9. Describe the electrical and physical properties of a transmission line.

The electrical properties of a transmission line are wire conductivity and insulator dielectric constant. The physical properties are wire diameter and conductor spacing.

10. List and describe the four primary constants of a transmission line.

The primary constants of a transmission line are series dc resistance, series inductance, shunt capacitance, and shunt conductance. The primary constants are uniformly distributed throughout the length of the line and therefore are commonly called distributed parameters.

11. List the secondary constants of a transmission line.

Secondary constants of a transmission lines are

Characteristic impedance
Propagation constant

12. Define characteristic impedance for a transmission line.

Characteristic impedance is defined as the impedance seen looking into an infinitely long line or the impedance seen looking into a finite length of line that is terminated in a purely resistive load equal to the characteristic impedance of the line. It is also called as surge impedance.

13. Define propagation constant.

Propagation constant is used to express the attenuation (signal loss) and the phase shift per unit length of a transmission line. It is also called as propagation coefficient.

14. Define velocity factor for a transmission line.

Velocity factor (sometimes called velocity constant) is defined as the ratio of the actual velocity of propagation through free space. Mathematically the velocity factor is

Vf=vp/c
Where vf= velocity factor
Vp=actual velocity of propagation
C=velocity of propagation through free space(3X108 m/s)

15. List and describe five types of transmission line losses.

Transmission line losses are conductor loss, radiation loss, dielectric heating loss, coupling loss, and corona.

16. Describe an incident wave, reflected wave.

An ordinary transmission line is bidirectional; power can propagate equally well in both directions. Voltage that propagates from the source toward the load is called incident voltage, and the voltage that propagates from the load toward the source is called reflected voltage.

17. Define resonant line.

A transmission line with no reflected power is called a flat or resonant line.

18. Define non resonant transmission line.

A transmission line is non resonant if it is of finite length or if it is terminated with a resistive load equal in ohmic value to the characteristic impedance of the transmission line.

19. Define reflection coefficient.

The reflection coefficient (sometimes called the coefficient of reflection) is a vector quantity that represents the ratio of reflected voltage to incident voltage or reflected current to incident current.

20. Define matched line.

When $Z_0=Z_L$, all the incident power is absorbed by the load .This is called a matched line.
Where Z_0=characteristic impedance
Z_L= load impedance

21. Define unmatched line.

When $Z_0 \_ Z_L$, some of the incident power is absorbed by the load and some is returned to the source. This is called an unmatched or mismatched line.
Where Z_0=characteristic impedance
Z_L= load impedance

22. Define standing wave.

In unmatched line, some of the incident power is absorbed by the load and some is returned to the source. So there are two electromagnetic waves, traveling in opposite interference pattern known as standing wave.

23. Define standing wave ratio.

The standing wave ratio is defined as the ratio of the maximum voltage to the minimum voltage (or) the maximum current to the minimum current of a standing wave on a transmission line.SWR is often called the voltage standing wave ratio (VSWR).

24. Define ground wave propagation.

A ground wave is an electromagnetic wave that travels along the surface of earth. Therefore ground waves are sometimes called surface waves. Ground waves must be vertically polarized.

25. What are the disadvantages of ground wave propagation?

1. Ground waves require relatively high transmission power.
2. Ground waves are limited to very low, low, and medium frequencies, requiring large antennas.

26. What are the advantages of ground wave propagation?

1) Ground waves are relatively unaffected by changing atmospheric conditions.

2) If the transmitted power is large enough, then ground wave propagation can be used to communicate between any two points in the world.

27. Define space wave propagation.

Space wave propagation of electromagnetic energy includes radiated energy that travels in the lower few miles of earth's atmosphere. Space waves include both direct and ground reflected waves. Direct waves travel essentially in a straight line between the transmit and receive antennas. Space wave propagation with direct waves is commonly called line of sight transmission.

28. Define sky waves.

Electromagnetic waves that are directed above the horizon level are called sky

waves.

29. Define critical frequency.

The critical frequency is defined as the highest frequency that can be propagated directly upward and still be returned to earth by the ionosphere.

30. Define virtual height.

Virtual height is the height above earth's surface from which a refracted wave appears to have been reflected.

31. Define maximum usable frequency.

Maximum usable frequency is the highest frequency that can be used for sky wave propagation between two specific points on earth's surface.

PART – B

1. A PCM system has the following parameters: a maximum analog input frequency of 4 KHz a maximum decoded voltage at the receiver of ±2.55 V, and a minimum dynamic range of 46dB. Calculate the following:

(i)	Minimum sample rate	**(4)**
(ii)	Minimum number of bits used in the PCM code	**(4)**
(iii)	Resolution	**(4)**
(iv)	Quantization error	**(4)**

2. (i) Discuss on the process"Companding" and its characteristics. (6)
(ii) How does Flat top sampling differ from natural sampling? Illustrate and obtain the filtered output? (10)

3. Explain QPSK with a block diagram and spectrum and discuss the phasor diagram for sinusoids. Also Develop the expression for its bit error Probability. (16)

4. Describe in detail about the operation of a ASK and BSK with neat diagram. (16)

5. (i) Describe the working of a Delta modulation system. **(8)**

(ii) What is meant by quantization and develop an expression for quantization noise in PCM and DM systems **(8)**

6. (i) Discuss the generation method of PWM. Explain how you will convert PWM to PPM with diagram. **(6)**

(ii) Describe the working of pulse code modulation system with its block diagram **(10)**

7.(i) Explain Frequency shift keying method with equations**.** **(8)**

(ii) Discuss the method of modulation and demodulation in MSK with equations and block diagrams **(8)**

8. Discuss DPCM technique with neat block diagram. For minimum line speed with an 8 bit PCM for speech signal ranging upto 1 volt. Calculate the resolution and quantization error. Calculate the coding efficiency for a resolution of 0.01 volt with the 8 bit PCM**.** **(16)**

9. List the advantages of data communication and explain GMSK and QAM techniques with neat diagram. **(16)**

10. With a neat block diagram, explain BPSK transmitter. Also analyze the bandwidth considerations of BPSK. **(16)**

UNIT III

SOURCE CODES, LINE CODES & ERROR CONTROL (Qualitative only)

PART-A

1. What are the advantages of digital transmission?

The advantage of digital transmission over analog transmission is noise immunity. Digital pulses are less susceptible than analog signals to variations caused by noise.

Digital signals are better suited to processing and multiplexing than analog signals.

Digital transmission systems are more noise resistant than the analog transmission systems.

Digital systems are better suited to evaluate error performance.

2. What are the disadvantages of digital transmission?

The transmission of digitally encoded analog signals requires significantly more bandwidth than simply transmitting the original analog signal.

Analog signal must be converted to digital codes prior to transmission and converted back to analog form at the receiver, thus necessitating additional encoding and decoding circuitry.

3. Define pulse code modulation.

In pulse code modulation, analog signal is sampled and converted to fixed length, serial binary number for transmission. The binary number varies according to the amplitude of the analog signal.

4. What is the purpose of the sample and hold circuit?

The sample and hold circuit periodically samples the analog input signal and converts those samples to a multilevel PAM signal.

5. What is the Nyquist sampling rate?

Nyquist sampling rate states that, the minimum sampling rate is equal to twice the highest audio input frequency.

6. Define and state the causes of fold over distortion.

The minimum sampling rate (fs) is equal to twice the highest audio input frequency(fa).If fs is less than two times fa ,distortion will result. The distortion is Called aliasing or fold over distortion. The side frequencies from one harmonic fold over into the sideband of another harmonic.

The frequency that folds over is an alias of the input signal hence, the names “aliasing” or “fold over distortion”.

7. Define overload distortion.

If the magnitude of sample exceeds the highest quantization interval, overload distortion occurs.

Quantization is a process of approximation or rounding off. Assigning PCM codes to absolute magnitudes is called quantizing.

8. Define dynamic range.

Dynamic range is the ratio of the largest possible magnitude to the smallest possible magnitude.

9. Define coding efficiency.

Coding efficiency is the ratio of the minimum number of bits required to achieve a certain dynamic range to the actual number of PCM bits used. Mathematically, coding efficiency is

Coding efficiency= Minimum number of bits (including sign bit) X 100 Actual number of bits (including sign bit)

10. Define companding.

Companding is the process of compressing, then expanding. With companded systems, the higher amplitude analog signals are compressed prior to transmission, then expanded at the receiver.

11. Define slope overload. How it is reduced.

The slope of the analog signal is greater than the delta modulator can maintain, and is called slope overload. Slope overload is reduced by increasing the clock frequency and by increasing the magnitude of the minimum step size.

12. Define granular noise. How it is reduced.

When the original input signal has relatively constant amplitude, the reconstructed signal has variations that were not present in the original signal. This is called granular noise.
Granular noise can be reduced by decreasing the step size.

13. Define adaptive delta modulation.

Adaptive delta modulation is a delta modulation system where the step size of the AC is automatically varied depending on the amplitude characteristics of the analog input signal.

14. Define peak frequency deviation for FSK.

Peak frequency deviation is the difference between the carrier rest frequency and either the mark or space frequency and either the mark or space frequency.

15. Define Baud rate.

The rate of change at the output of the modulator is called baud.

16. Define QAM.

Quadrature amplitude modulation is a form of digital modulation where the digital information is contained in both the amplitude and phase of the transmitted carrier.

PART – B

1 For the given 8 bit stream 11010100, plot the NRZ, RZ, AMI, HDBP and Differential Manchester codes. **(16)**

2 Describe about the viterbi algorithm by showing the possible path through the trellis of a coder. Assume the state diagram of any coder. **(16)**

3 **(i)** Discuss the Bandwidth-SNR trade off of a communication system. **(4)**

(ii) Apply the following coding technique and obtain the output wave form for the

bit stream 10011100 on NRZ, RZ, AMI, HDBP, ABQ and MBnB. **(12)**

4 (i) Design a convolutional coder of constraint length 6 and rate efficiency ½. **(4)**

(ii) State and prove Shannon noiseless coding theorem. **(12)**

5 (i) Given states S={S_0,S_1,S_2,S_3,S_4} and their probabilities P={0.4,0.2,0.2,0.1,0.1}. Find coding efficiency and entropy for Huffman coding. **(8)**

(ii) Give the procedure for Shannon Fano coding and use the procedure to obtain the code for the source symbols S_0, S_1, S_2, S_3, S_4, S_5 with their respective probabilities ½, 1/3, 1/12, 1/15, 1/120, 1/120. **(8)**

UNIT IV

MULTIPLE ACCESS TECHNIQUES

PART A

1. Define data communication codes.

Data communication codes are prescribed bit sequences used for encoding characters and symbols.

2. Define error detection.

Error detection is simply the process of monitoring the received data and determining when a transmission has occurred.

3. Define Echoplex.

Echoplex is a relatively simple type of error detection scheme that is used almost exclusively in data communications systems where human operators are used to enter the data manually from a keyboard.

4. Define parallel interface.

Parallel interfaces transfer data between two devices eight or more bits a time. That is one entire data word is transmitted at a time .Parallel transmission is sometimes referred to as serial by word transmission.

5. What are the advantages of parallel transmission?

The advantage of parallel transmission is data are transmitted much faster than with serial transmission because there is a transmission path for each bit of the word. In parallel interface there is no need to convert data from parallel to serial or vice versa.

6. What is the purpose of data modem?

The primary purpose of data modem is to interface computers, computer networks, and other digital terminal equipment to analog communication lines and radio terminals.

7. Classify data modems.

Data modems are generally classified in to synchronous and asynchronous data modems.

8. Define OSI.

The term open system interconnection is the name for a set of standards for communications among computers. The primary purpose of OSI standards is to serve as a structural guideline for exchanging information between computers, terminals and networks.

9. What are the advantages of bus topology?

a. The bus topology is easy to understand, install, and use for small networks.
b. The cabling cost is less as the bus topology requires the least amount of cable to connect the computers.
c. The bus topology is easy to expand by joining two cables with a BNC barrel connector.
d. In the expansion of bus topology repeaters are used to boost the signal and increase the distance.

10. What are the disadvantages of star topology?

One disadvantage of a star topology is that the network is only as reliable as the central node. When the central node fails, the entire system fails.

11. Describe LAN.

A local area network is usually a privately owned and links the devices in a single office, building or campus of up to a few kilometers in size.

12. Define LAN topology.

The topology or physical architecture of a LAN identifies how the stations are interconnected.

13. What are the seven layers of open system interconnection?

The seven layers of open system interconnection are
_ Physical layer
_ Data link layer
_ Network layer
_ Transport layer
_ Session layer
_ Presentation layer
_ Application layer

PART – B

1 500 users employ FDMA to transmit 1000-bit packets of data. The channel band width is 100MHz and QPSK is used at each of the 5000 carrier frequencies employed

(i) What is the maximum bandwidth allocated to each user? **(5)**

(ii) What is the bit rate employed by each user? **(6)**

(iii) How long does it take to transmit a packet? **(6)**

2 Describe briefly about the operation of a typical TDMA system with the time pattern. **(16)**

3 Explain the principle of FDMA with diagram. **(16)**

4 Describe CDMA technique in detail. **(16)**

5 Discuss TDMA technique in detail and compare it with FDMA. **(16)**

6 Compare various multiple access techniques used in wireless communication with their merits and demerits. **(16)**

7 Explain with a neat block diagram the SDMA technique. **(16)**

8 Illustrate how interference is avoided by using code division multiplexing. **(16)**

9 Describe briefly about wired and wireless communication systems. **(16)**

10 Discuss the BSC and BEC with their channel diagram and transition matrix. **(16)**

UNIT V

SATELLITE, OPTICAL FIBER – POWERLINE, SCADA

PART A

1. Define satellite.

Satellite is a celestial body that orbits around a planet.In aerospace terms, a satellite is a space vehicle launched by humans and orbits earth or another celestial body.

2. State Kepler's first law.

Kepler's first law states that a satellite will orbit a primary body following an elliptical path.

3. State Kepler's second law.

Kepler's second law states that for equal time intervals of time a satellite will sweep out equal areas in the orbital plane, focused at the bary center.

4. State Kepler's third law.

The third law states that the square of the periodic time of orbit is proportional to the cube of the mean distance between the primary and the satellite.

5. Define orbital satellite.

Orbital satellites are also called as nonsynchronous satellite.Nonsynchronous satellites rotate around earth in an elliptical or circular pattern. In a circular orbit, the speed or rotation is constant however in elliptical orbits the speed depends on the height the satellite is above the earth.

6. Define prograde orbit.

If the satellite is orbiting in the same direction as earth's rotation and at an angular velocity greater than that of earth, the orbit is called a prograde (or) posigrade orbit.

If the satellite is orbiting in the opposite direction as the earth's rotation or in the same direction with an angular velocity less than that of earth, the orbit is called a retrograde orbit.

7. Define Geo synchronous satellite.

Geo synchronous or geo stationary satellites are those that orbit in a circular pattern with an angular velocity equal to that of Erath. Geosynchronous satellites have an orbital time of approximately 24 hours, the same as earth; thus geosynchronous satellites appear to be stationary as they remain in a fixed position in respect to a given point on earth.

8. Define apogee and perigee.

The point in an orbit which is located farthest from the earth is called apogee.
The point in an orbit which is located closest to earth is called perigee.

9. Define angle of inclination.

The angle of inclination is the angle between the earth's equatorial plane and the orbital plane of a satellite measured counterclockwise at the point in the orbit where it crosses the equatorial plane traveling from south to north.

10. Define Decending node.

The point where a polar or inclined orbit crosses the equatorial plane traveling from south to north. This point is called descending node.

11. Define ascending node.

The point where a polar or inclined orbit crosses the equatorial plane traveling from north to south is called ascending node.

12. Define line of nodes.

The line joining the ascending and descending nodes through the center of earth is called line of nodes.

13. Define angle of elevation.

Angle of elevation is the vertical angle formed between the direction of travel of an

electromagnetic wave radiated from an earth station antenna pointing directly toward a satellite and the horizontal plane.

14. Define Azimuth angle.

Azimuth is the horizontal angular distance from a reference direction, either the southern or northern most point of the horizon.

15. What are the advantages of optical fiber communication?

- Greater information capacity
- Immunity to crosstalk
- Immunity to static interference
- Environmental immunity
- Safety
- Security

16. Define a fiber optic system.

An optical communications system is an electronic communication system that uses light as the carrier of information. Optical fiber communication systems use glass or plastic fibers to contain light waves and guide them in a manner similar to the way electromagnetic waves are guided through a waveguide.

17. Define refractive index.

The refractive index is defined as the as the ratio of the velocity of propagation of Light ray in free space to the velocity of propagation of a light ray in a given material.

18. Define critical angle.

Critical angle is defined as the minimum angle of incidence at which a light ray may strike the interface of two media and result in an angle of refraction of 90°or greater.

19. Define single mode and multi mode propagation.

If there is only one path for light to take down the cable, it is called single mode.

If there is more than one path ,it is called multimode.

20. Define acceptance angle.

It defines the maximum angle in which external light rays may strike the air/fiber interface and still propagate down the fiber with a response that is no greater than 10 dB below the maximum value.

21. Define numerical aperture.

Numerical aperture is mathematically defined as the sine of the maximum angle a light ray entering the fiber can have in respect to the axis of the fiber and still propagate down the cable by internal reflection.

22. Define modal dispersion.

Modal dispersion or pulse spreading is caused by the difference in the propagation times of light rays that take different paths down a fiber. Modal dispersion can occur only in multimode fibers.It can be reduced by using single mode step index fibers and graded index fibers.

a. The increase in current density generates a more brilliant light spot. b. The smaller emitting area makes it easier to couple its emitted light into fiber.

c. The small effective area has a smaller capacitance, which allows the planar heterojunction LED to be used at higher speeds.

23. What are the disadvantages of injection laser diode?

ILDs are typically on the order of 10 times more expensive than LEDs

Because ILDs operate at higher powers, they typically have a much shorter life time than LEDs.

ILDs are more temperature dependent than LEDs.

PART – B

1 Describe briefly and compare the three types of optical fiber configurations. **(16)**

2 Discuss in detail about the frequency reuse concept of cellular network. Support your answer with the required diagram. **(16)**

3 Discuss broadly on the multiple access techniques used in satellite communication. **(16)**

4 Describe the following.

(i) Optical detectors and their types.

(ii) Satellite types.

(iii) Digital filters used in satellite systems.

(iv) Optical link **(16)**

5 **(i)** An X band transponder of a geo synchronous satellite at a height of 35760 km from the surface of the earth and operating at 7.6 GHz has its antenna oriented towards earth station antenna. The input power and directive gain of the transponder antenna are 18 W and 36dB respectively. Assuming no losses occurring in the down link determine

(1) Power received by earth station antenna of aperture diameter and efficiency given as 3 meters and 62% respectively.

(2) EIRP of the transponder antenna **(6)**

(ii) Write notes on SCADA and Intelsat. **(10)**

6 **(i)** What are the modes of operation suggested in optical fibres? How are optical fibres classified according to this? Discuss elaborately. **(10)**

(ii) State the advantages of Fiber optic communication. **(6)**

7 **(i)** Explain with the block diagram of an earth station. **(8)**

(ii) Explain in detail about the aperture actuators used in satellites. **(8)**

8 **(i)** Illustrate Kepler's law and how they relate to satellite communication. **(8)**

(ii) Illustrate the significance of satellite link budgets s and how they are calculated. **(8)**

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9 (i) Draw the block diagram of a satellite uplink model and explain its operation. **(8)**

(ii) Discuss power line carrier communication with suitable example and diagram. **(8)**

10 (i) Explain the concept of satellite communication system and its application. **(8)**

(ii) Explain in detail about the operation of any one fiber optic source and detector. **(8)**