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UNIT – 10 COMMUNICATION SYSTEMS

+2 PHYSICS
STUDY MATERIAL

It includes

- **Book Back Answers**
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Unit – 10 COMMUNICATION SYSTEMS

I Multiple Choice Questions

1.The output transducer of the communication system converts the radio signal into ----------

(a) Sound (b) Mechanical energy

(c) Kinetic energy (d) None of the above

2.The signal is affected by noise in a communication system

(a) At the transmitter (b) At the modulator

(c) In the channel (d) At the receiver

3.The variation of frequency of carrier wave with respect to the amplitude of the modulating signal is called ---------

(a) Amplitude modulation **(b) Frequency modulation**

(c) Phase modulation (d) Pulse width modulation

4.The internationally accepted frequency deviation for the purpose of FM broadcasts

(a) 75 kHz (b) 68 kHz (c) 80 kHz (d) 70 kHz

5.The frequency range of 3 MHz to 30 MHz is used for

(a) Ground wave propagation (b) Space wave propagation

(c) Sky wave propagation (d) Satellite communication

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Book inside

1. T.V. tower has a height of 300m. What is the maximum distance up to which the T.V transmission can be received

a) 62Km b) 32 Km c) 42 Km d) 52 Km

Hint : $d = \sqrt{2Rh} = \sqrt{2 \times 6400 \times 1000 \times 300} = 62Km$

2. Digital signals

(i) Do not provide a continuous set of values,

(ii) Represent values as discrete steps,

(iii) Can utilize binary system, and

(iv) Can utilize decimal as well as binary systems.

Which of the above statements are true?

(a) (i) and (ii) only

(b) (ii) and (iii) only

(c) (i), (ii) and (iii) but not (iv)

(d) All of (i), (ii), (iii) and (iv).

Ans. (c) A digital signal uses the binary (0 and 1) system for transferring message signals. Such a system cannot utilise the decimal system (which corresponds to analogue signals). Digital signals represent discontinuous values.

3. If the sum of the heights of transmitting and receiving antenna is line of sight communication is fixed at h, show that the range is maximum when the two antenna have a height each

a) h/4 b)h/6 c)h/8 **d)h/2**

Hint :

Now $d_1 = \sqrt{2Rh_1}$

$d_2 = \sqrt{2Rh_2}$

For maximum range

$d_m = \sqrt{2Rh_1} + \sqrt{2Rh_2}$

$d_m = d_1 + d_2 = d$

Given $h_1 + h_2 = h$

Let $h_1 = x$ then $h_2 = h - x$

$d_m = \sqrt{2Rx} + \sqrt{2R(h-x)}$

Differentiating wr.t x

$$\frac{dd_m}{d_x} - \sqrt{\frac{R}{2x}} = \sqrt{\frac{R}{2(h-x)}} = 0 i.e. \frac{1}{2x} = \frac{1}{2(h-x)}$$

$$\Rightarrow x = \frac{h}{2} \Rightarrow h_1 = h_2 = \frac{h}{2}$$

4. Frequencies in the UHF range normally propagate by means of:

(a) Ground waves. (b) Sky waves. (c) Surface waves. **(d) Space waves.**

Owing to its high frequency, an ultra high frequency (UHF) wave can neither travel along the trajectory of the ground nor can it get reflected by the ionosphere. The signals having UHF are propagated through line-of-sight communication, which is nothing but space wave propagation.

5. What should be the minimum length of the antenna capable of emitting audio signal of wave length λ?

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a) λ/8 b) λ/3 c) λ/6 **d) λ/4**

6.____is used as a medium an space communication

a)Two wire line **b) Space** c) Amplifier d) Optical fibre

7. Intensity of electric field of ground waves is in_____of the distance travelled by it.

a)Square b)inverse of root c) proportion **d) inverse**

8. Though which mode of communication can radiowaves be sent from one Place to another?

a)Ground wave Propagation c) sky wave Propagation

c)Space wave Propagation **d) All of the above**

9. Which of the following is not a component of communication System ?

a)Transmitter b) Transmission channel

c) Noise d) Receiver

10. Device which transform one form of energy in to another form of energy is called a

a)Transducer b) Transformer c) Transponder d) Transistor

11. The electromagnetic waves of frequency 2 MHz to 30 MHz are

a)in ground wave propagation **b) in sky wave propagation**

c) in micro wave propagation d) in satellite communication

12. An antenna can transmit___radiation with more efficiency.

a)low frequency **b) high frequency**

c) long wave length d) None of these

13. AM is used for broadcasting because

a)it is more noise innumerable than other modulation system

b)it requires less transmitting power compared with other system

c)it's are avoids receiver complexity

d)No other modulation system can provide the neccessary band width faithful transmission

14. The area to be covered for T.V telecast is doubled. Then the height to transmitting antenna will have to be

a)doubled b) halved c) quadrupled d) kept unchanged

15. The process of superimposing signal frequency on the carrier wave is known as

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a)transmission b) reception **c) modulation** d) detection

16. The refractive index of the ionosphere

a)increase as we go from the lower to upper layer of the ionosphere

b)decrease as we go from the lower to upper layer of the ionosphere

c)remain the same through out the ionosphere

d)is equal to unity

17.A receiving station on the ground is receiving a signal of frequency 10 MHz, then the mode of transmission is

a)ground wave propagation b) sky wave propagation

c)both ground wave and sky wave propagation

d)neither ground wave nor sky wave propagation

18. In satellite communication 6 GHz frequency is used for___and 4 GHz frequency is used for

a)uplink, down link b) down link, up link

c)modulation, demodulation d) demodulation, modulation

19. In frequency modulation

a)the amplitude of modulated wave varies as frequency of carrier wave.

b)the frequency of carrier wave varies as amplitude of modulating wave.

c)The amplitude of modulated wave varies as amplitude of carrier wave.

d) The frequency of modulated wave varies as frequency of modulating wave.

20. What is the working principal of optical fibre ?

a)Refraction **b)Total internal reflection**

c)Dispersion d)Scattering

21. In modulation process radio signal is called

a)modulating wave **b) Carrier wave**

c)modulated wave d) transmitting wave

22. Refractive index of the ionosphere is

a)one b)more than one c) less than one d) Zero

23. In amplitude modulation, the bandwidth is

a) equal to the signal frequency **b) twice the signal frequency**

c) thrice the signal frequency d) four times the signal frequency

24. Skip distance is the shortest distance between

a) the point of transmission and the point of reception

b) the uplink station and the downlink station

c) the transmitter and the target d) the receiver and the target

25. In amplitude modulation

a) the amplitude of the carrier wave varies in accordance with the amplitude of the modulating signal

b) the amplitude of the carrier wave remains constant

c) the amplitude of the carrier wave in accordance with the frequency of the modulating signal

d) modulating frequency lies in the audio range.

26. In Phase modulation

a) Only the phase of the carrier wave varies

b) only the frequency of the carrier wave varies

c) both phase and frequency of the carrier wave varies

d) there is no change in frequency and phase of the carrier wave.

27. …….. is a link between the transmitter and receiver

a)Microphone **b) Transmission Channel** c) transducer d) telephone

II Short answers

1. Give the factors that are responsible for transmission impairments.

Noise

- It is the undesirable electrical signal that interfaces with the transmitted signal.
- Noise attenuates or reduces the quality of the transmitted signal.

Attenuation

The loss of strength of a signal while propagating through a medium is known as attenuation

2. Distinguish between wireline and wireless communication? Specify the range of electromagnetic waves in which it is used.

Wireline communication	Wireless communication
It uses mediums like wires, cables and optical fibers	It uses free space as a communication medium
It cannot be used for long distance transmission as they are connected physically.	It is used for long distance transmission
Examples : Telephone, intercom and cable TV.	**Example :** Mobile, radio or TV broadcasting, and satellite communication
Range of electromagnetic waves in which it is used. 49 MHz TO 150 MHz	Range of electromagnetic waves in which it is used IS 300MHz to 300GHz

3. Explain centre frequency or resting frequency in frequency modulation.

When the frequency of the baseband signal is zero (no input signal), there is no change in the frequency of the carrier wave. It is at its normal frequency and is called as **centre frequency or resting frequency**

4. What does RADAR stand for?

It stands for Radio Detection and Ranging System.

5. What do you mean by Internet of Things?

Using Internet of Things (IoT), it is made possible to control various devices from a single device. Example: home automation using a mobile phone.

Book inside

1.Define Bandwidth

The frequency range over which the baseband signals or the information signals such as voice, music, picture, etc. is transmitted is known as bandwidth

2. Define Bandwidth of transmission system

The range of frequencies required to transmit a piece of specified information in a particular channel is called channel bandwidth or the bandwidth of the transmission system.

3. **Comparison between FM and PM**

- PM wave is similar to FM wave. PM generally uses a smaller bandwidth than FM.
- In PM, more information can be sent in a given bandwidth.
- Hence, phase modulation provides high transmission speed on a given bandwidth

4.Give the applications of ICT in Fisheries

a) Satellite vessel monitoring system helps to identify fishing zones.
b) Use of barcodes helps to identify time and date of catch, species name, quality of fish.

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5. What is the purpose of modulating a signal in transmission?

Modulation is done because low frequency signal cannot be transmitted to a longer distance so in order to increase the range of transmission modulation is done.

6.Why ground wave propagation is not suitable for high frequencies?

Ground waves are not suitable for propagation high frequencies because signals having frequency more than 1500 KHz are greatly absorbed by the surface of the earth and cannot be transmitted.

7. Sky has no limit but sky wave propagation has its limit. Explain why?

Sky wave propagation is due to the reflection of radio waves by the ionosphere but high frequency waves gets absorbed by the ionosphere and cannot be reflected by the ionosphere.

8. Is it necessary for a transmitting antenna to be at the same height as that of the receiving antenna for line-of-sight communication?

Line-of-sight communication means that there is no physical obstruction between the transmitter and the receiver. In such communications it is not necessary for the transmitting and receiving antennas to be at the same height.

9.Two waves A and B of frequencies 2 MHz and 3 MHz, respectively are beamed in the same direction for communication via sky wave. Which one of these is likely to travel longer distance in the ionosphere before suffering total internal reflection?

- As the frequency of wave B is more than wave A , it means refractive index of wave B is more than that of B
- For higher refraction the angle of refraction is less , i.e bending is less.
- So wave B travel long distance

10. Why is a AM signal likely to be more noisy than a FM signal upon transmission through a channel?

- In AM , carrier wave instantaneous voltage is varied by modulating waves voltage .
- On transmission , noise signal can be also added and receiver assumes noise as a part of the modulating signal.

III Long Answers

1. What is modulation? Explain the types of modulation with necessary diagrams.

Modulation

For long distance transmission, the low frequency baseband signal (input signal) is superimposed onto a high frequency radio signal by a process called modulation.

There are three types of modulation

(i)Amplitude modulation

(ii)Frequency modulation

(iii)Phase modulation

(i)Amplitude modulation (AM)

If the amplitude of the carrier signal is modified according to the instantaneous amplitude of the base band signal, then it is called amplitude modulation

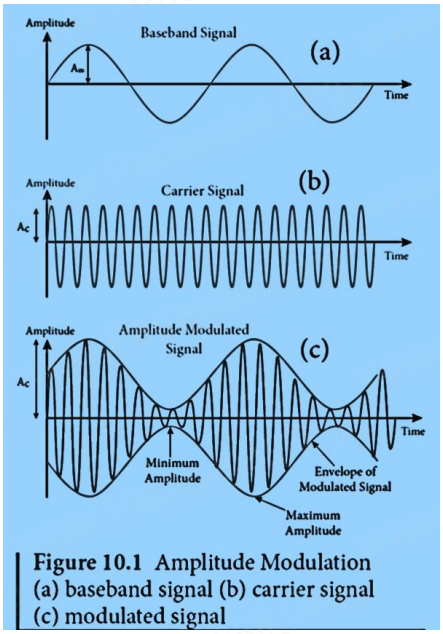


Figure 10.1 Amplitude Modulation
(a) baseband signal (b) carrier signal
(c) modulated signal

Characteristics

Frequency and the phase of the carrier signal remain constant.

Uses

It is used in radio and TV broadcasting.

How it is done

The signal shown in Figure is the message signal or baseband signal that carries information.
The carrier wave which is high frequency wave is modified in proportion to the amplitude of the baseband signal.

(ii)Frequency modulation (FM)

The frequency of the carrier signal is modified according to the instantaneous amplitude of the baseband signal in frequency modulation.

Characteristics

Amplitude and the phase of the carrier signal remain constant.

How it is done

- Increase in the amplitude of the baseband signal increases the frequency of the carrier signal and vice versa.
- This leads to compressions and rarefactions in the frequency spectrum of the modulated wave
- Louder signal leads to compressions and relatively weaker signals to rarefactions.
- When the amplitude of the baseband signal is zero ,the frequency of the modulated signal is the same as the carrier signal.
- The frequency of the modulated wave increases when the amplitude of the baseband signal increases in the positive direction (A, C).
- The increase in amplitude in the negative half cycle (B, D) reduces the frequency of the modulated wave .

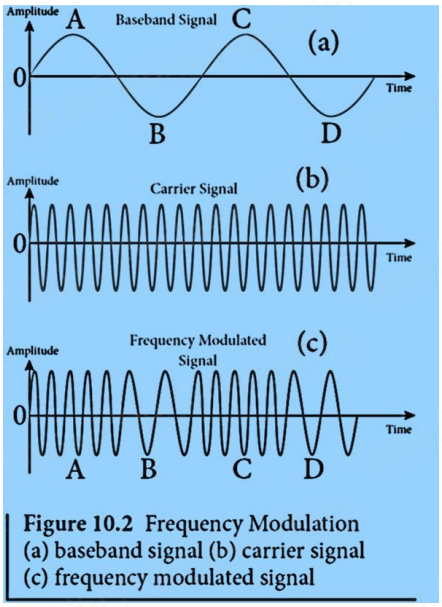


Figure 10.2 Frequency Modulation
(a) baseband signal (b) carrier signal
(c) frequency modulated signal

- When the frequency of the baseband signal is zero (no input signal), there is no change in the frequency of the carrier wave. It is at its normal frequency and is called as **centre frequency or resting frequency.** Practically this is the allotted frequency of the FM transmitter.

(iii) Phase modulation (PM)

- The instantaneous amplitude of the baseband signal modifies the phase of the carrier signal keeping the amplitude and frequency constant is called phase modulation
- This modulation is used to generate frequency modulated signals. It is similar to frequency modulation except that the phase of the carrier is varied instead of varying frequency.
- carrier phase changes according to increase or decrease in the amplitude of the base band signal. When the modulating signal goes postive, the amount of phase lead increases with the amplitude of the modulating signal.

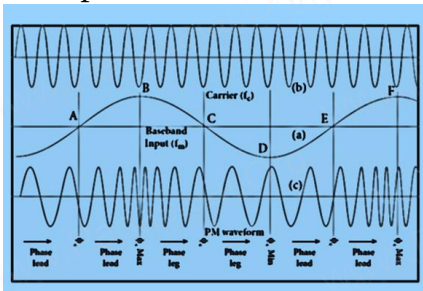


Figure 10.3 Phase Modulation
(a) carrier signal (b) baseband signal
(c) phase modulated signal

- Due to this , the carrier signal is compressed or its frequency is increased.
- On the other hand , the negative half cycle of the base band signal produces a phase lag in the
- carrier signal.
- This appears to have stretched the frequency of the carrier wave .
- Hence similar to frequency modulated wave , phase modulated wave also comprises of
- compressions and rarefactions.
- When the signal voltage is zero (A, C a d E) the carrier frequency is changed .
- The frequency shift in carrier wave frequency exists in phase modulation as well .
- The frequency shift depends on
  i)amplitude of the modulating signal
  ii)the frequency of the signal.

2. Elaborate on the basic elements of communication system with the necessary block diagram.

1.Information source

Information can be in the form of a sound signal like speech , music , pictures or computer data which is given as input to the input transducer

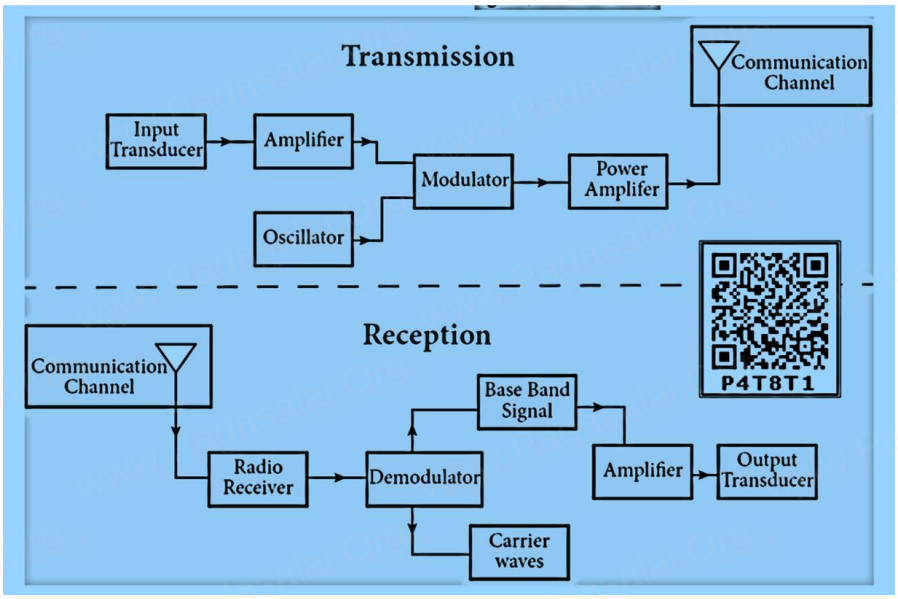
2. Input transducer

- A transducer is a device that converts variations in a physical quantity (pressure, temperature, sound) into an equivalent electrical signal or vice versa.
- In communication system, the transducer converts the information which is in the form of sound, music, pictures or computer data into corresponding electrical signals.
- The electrical equivalent of the original information is called the baseband signal.

Example for the transducer : Microphone that converts sound energy into electrical energy.

3. Transmitter

- It feeds the electrical signal from the transducer to the communication channel.
- It consists of circuits such as amplifier oscillator, modulator, and power amplifier. The transmitter is located at the broadcasting station.



Amplifier

The transducer output is very weak and is amplified by the amplifier.

Oscillator

- It generates high-frequency carrier wave (a sinusoidal wave) for long distance transmission into space.
- As the energy of a wave is proportional to its frequency, the carrier wave has very high energy.

Modulator

It superimposes the baseband signal onto the carrier signal and generates the modulated signal.

Power amplifier

It increases the power level of the electrical signal in order to cover a large distance.

4. Transmitting antenna

- It radiates the radio signal into space in all directions.
- It travels in the form of electromagnetic waves with the velocity of light (3×10^8 m s^{-1}).

5. Communication channel

- Communication channel is used to carry the electrical signal from transmitter to receiver with less noise or distortion.

- The communication medium is basically of two types: wireline communication and wireless communication.

6. Noise

- It is the undesirable electrical signal that interfaces with the transmitted signal. Noise attenuates or reduces the quality of the transmitted signal.
- It may be man-made (automobiles, welding machines, electric motors etc.) or natural (lightning, radiation from sun and stars and environmental effects).
- Noise cannot be completely eliminated.

7. Receiver

- The signals that are transmitted through the communication medium are received with the help of a receiving antenna and are fed into the receiver.
- The receiver consists of electronic circuits like demodulator, amplifier, detector etc.
- The demodulator extracts the baseband signal from the carrier signal. Then the baseband signal is detected and amplified using amplifiers. Finally, it is fed to the output transducer.

8. Repeaters

- Repeaters are used to increase the range or distance through which the signals are sent.
- It is a combination of transmitter and receiver.
- The signals are received, amplified, and retransmitted with a carrier signal of different frequency to the destination. The best example is the communication satellite in space.

9. Output transducer

It converts the electrical signal back to its original form such as sound, music, pictures or data.

Examples of output transducers : Loudspeakers, picture tubes, computer monitor, etc.

10. Attenuation

The loss of strength of a signal while propagating through a medium is known as attenuation.

11. Range

It is the maximum distance between the source and the destination up to which the signal is received with sufficient strength.

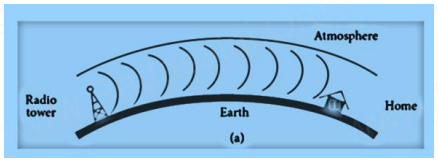
3. Explain the three modes of propagation of electromagnetic waves through space.

The electromagnetic wave transmitted by the transmitter travels in three different modes to reach the receiver according to its frequency range:

• Ground wave propagation (or) surface wave propagation **(nearly 2 kHz to 2 MHz)**
• Sky wave propagation (or) ionospheric propagation **(nearly 3 MHz to 30** MHz)
• Space wave propagation **(nearly 30 MHz to 400 GHz)**

GROUND WAVE PROPAGATION

- If the electromagnetic waves transmitted by the transmitter glide over the surface of the earth to reach the receiver, then the propagation is called ground wave propagation.
- The corresponding waves are called ground waves or surface
- Both transmitting and receiving antennas must be close to the earth. The size of the antenna plays a major role in deciding the efficiency of the radiation of signals.
- During transmission, the electrical signals are attenuated over a distance.



Reasons for attenuation are

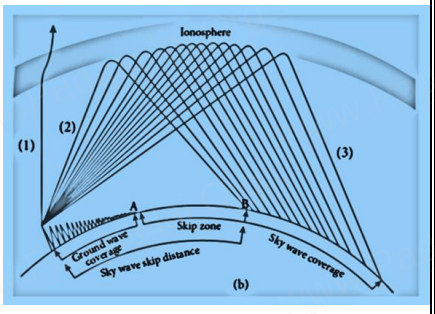
i) Increasing distance ,
ii) Absorption of energy by the Earth &
iii) Tilting of the wave

Used in

Local broadcasting, radio navigation for ship -to-ship, ship -to-shore communication and mobile communication.

SKY WAVE PROPAGATION

- The mode of propagation in which the electromagnetic waves radiated from antenna , directed upwards at large angles get reflected by the ionosphere back to earth is called sky wave propagation or ionospheric propagation. The corresponding waves are called sky waves
- The frequency range is 3 to 30 MHz
- It can easily penetrate through the ionosphere and does not undergo reflection.
- It is used for short wave broadcast services.
- Medium and high frequencies are for long-distance road communication.
- Ionosphere act as reflecting surface. It is at a distance of 50 Km and spreads up to 400 km above the Earth surface.
- Due to the absorption of ultraviolet rays, cosmic ray, and other high energy radiations like α, β rays from sun, the air molecules in the ionosphere get ionized.
- This produces charged ions and these ions provide a reflecting medium for the reflection of radio waves or communication waves back to earth within the permitted frequency range.

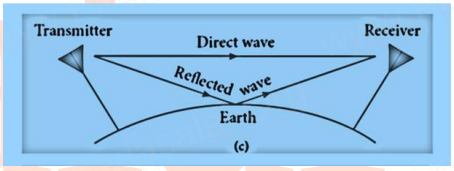


- The phenomenon of bending the radio waves back to earth is nothing but the total internal reflection.
- This is the reason why the EM waves are transmitted at a critical angle to ensure that the waves undergo total reflection and reaches the ground without escaping into space.

- **The shortest distance between the transmitter and the point of reception of the sky wave along the surface is called as the skip distance** .
- The electromagnetic waves are transmitted from the ground at particular angles.
- When the angle of emission increases, the reception of ground waves decreases. At one point there will be no reception due to ground waves .
- **There is a zone in between where there is no reception of electromagnetic waves neither ground nor sky, called as skip zone or skip area.**

SPACE WAVE PROPAGATION

- The process of sending and receiving information signal through space is called space wave communication The electromagnetic waves of very high frequencies above 30 MHz are called as space waves.
- These waves travel in a straight line from the transmitter to the receiver.
- Hence, it is used for a line of sight communication (LOS).
- For high frequencies, the transmission towers must be high enough so that the transmitted and received signals (direct waves) will not encounter the curvature of the earth and hence travel with less attenuation and loss of signal strength.
- Certain waves reach the receiver after getting reflected from the ground.
- The communication systems like television broadcast, satellite communication, and RADAR are based on space wave propagation.
- **Microwaves having high frequencies (super high frequency band) are used against radio waves due to certain advantages**:
- larger bandwidth, high data rates, better directivity, small antenna size, low power consumption, etc.



- The range or distance (d) of coverage of the propagation depends on the height (h) of the antenna given by the equation,

$$d = \sqrt{2Rh}$$

R is the radius of the earth which is, R = 6400 km

4. What do you know about GPS? Write a few applications of GPS.

- Its stands for Global Positioning System.
- It is a *global* navigation satellite system that offers geolocation and time information to a GPS receiver anywhere on or near the Earth.
- GPS system works with the assistance of a satellite network.
- Each of these satellites broadcasts a precise signal like an ordinary radio signal.
- These signals that convey the location data are received by a low-cost aerial which is then translated by the GPS software.
- The software is able to recognize the satellite, its location, and the time taken by the signals to travel from each satellite.

- The software then processes the data it accepts from each satellite to estimate the location of the receiver.

Applications

Global positioning system is highly useful many fields such as fleet vehicle management (for tracking cars, trucks and buses), wildlife management (for counting of wild animals) and engineering (for making tunnels, bridges etc).

5. Give the applications of ICT in mining and agriculture sectors.

(i) Mining

a) ICT in mining improves operational efficiency, remote monitoring and disaster locating system.

b) Information and communication technology provides audio-visual warning to the trapped underground miners.

c) It helps to connect remote sites.

(ii) Agriculture

a) ICT is widely used in increasing food productivity and farm management.

b) It helps to optimize the use of water, seeds and fertilizers etc.

c) Sophisticated technologies that include robots, temperature and moisture sensors, aerial images, and GPS technology can be used.

d) Geographic information systems are extensively used in farming to decide the suitable place for the species to be planted.

6. Modulation helps to reduce the antenna size in wireless communication – Explain.

Antenna is used at both transmitter and receiver end. Antenna height is an important parameter to be discussed. The height of the antenna must be a multiple of $\frac{\lambda}{4}$

$$h = \frac{\lambda}{4}$$

λ – wavelength $\lambda = \frac{c}{v}$

c is the velocity of light and v is the frequency of the signal to be transmitted.

- Consider two baseband signals. One signal is modulated and the other is not modulated.
- The frequency of the original baseband signal is taken as $v = 10\ kHz$ while the modulated signal is $v = 1\ MHz$.
- The height of the antenna required to transmit the original baseband signal of frequency $v = 10\ kHz$ is $h = \frac{\lambda}{4} = \frac{c}{4v} = 7.5\ Km$
- The height of the antenna required to transmit the modulated signal of frequency $v = 1\ MHz$ is

$$h = \frac{\lambda}{4} = \frac{c}{4v} = 75m$$

- It is practically feasible to construct an antenna of height 75 m while the one with 7.5 km is not possible.
- It clearly manifests that modulated signals reduce the antenna height and are required for long distance transmission.

7. Fiber optic communication is gaining popularity among the various transmission media -justify.

- The method of transmitting information from one place to another in terms of light pulses through an optical fiber is called fiber optic communication.
- As fibers are not electrically conductive, it is preferred in places where multiple channels are to be laid and isolation is required from electrical and electromagnetic interference.

i) Fiber cables are very thin and weigh lesser than copper cables.

ii) This system has much larger band width. This means that its information carrying capacity is larger.

iii) Fiber optic system is immune to electrical interferences.

iv) Fiber optic cables are cheaper than copper cables.

Long answers (Book inside)

1.Why attenuation is more in ground wave propagation? Explain briefly

Reasons for attenuation are as follows:

Increasing distance

The attenuation of the signal depends on

(i) power of the transmitter (ii) frequency of the transmitterand (iii) condition of the earth surface.

Absorption of energy by the Earth

When the transmitted signal in the form of EM wave is in contact with the Earth, it induces charges in the Earth and constitutes a current. Due to this, the earth behaves like a leaky capacitor

which leads to the attenuation of the wave.

Tilting of the wave

As the wave progresses, the wavefront starts gradually tilting according to the curvature of the Earth. This increase in the tilt decreases the electric field strength of the wave.

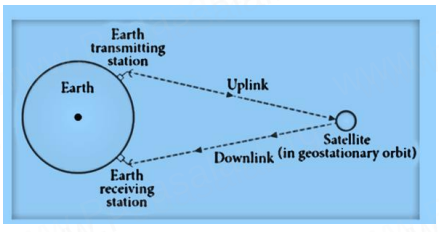
Finally, at some distance, the surface wave dies out due to energy loss.

2.What are advantage and disadvantage of amplitude modulation , frequency modulation , phase modulation?

Amplitude modulation	Frequency modulation	Phase modulation
Advantages	**Advantages**	**Advantages**
i) Easy transmission and reception	i)Large decrease in noise. This leads to an increase in signal-noise ratio.	i)FM signal produced from PM signal is very stable.
ii) Lesser bandwidth requirements	ii) The operating range is quite large.	ii) The centre frequency called resting frequency is extremely stable.
iii) Low cost	iii)The transmission efficiency is very high as all the transmitted power is useful.	
	iv)FM bandwidth covers the entire frequency range which humans can hear. Due to this, FM radio has better quality compared to AM radio.	
Limitations	**Limitations**	**Limitations**
i)Noise level is high	i) FM requires a much wider channel.	
ii) Low efficiency	ii)FM transmitters and receivers are more complex and costly	
iii) Small operating range	iii)In FM reception, less area is covered compared to AM.	

3.Explain about satellite communication and its application

- The satellite communication is a mode of communication of signal between transmitter and receiver via satellite. The message signal from the Earth station is transmitted to the satellite on board via an uplink (frequency band 6 GHz), amplified by a transponder and then retransmitted to another earth station via a downlink (frequency band 4 GHz)



Applications

Satellites are classified into different types based on their applications.

i) **Weather Satellites:**

They are used to monitor the weather and climate of Earth. By measuring cloud mass, these satellites enable us to predict rain and dangerous storms like hurricanes, cyclones etc.

ii) **Communication satellites**
They are used to transmit television, radio, internet signals etc. Multiple satellites are used for long distances.

iii) **Navigation satellites:**
These are employed to determine the geographic location of ships, aircrafts or any other object.

4.Explain about fibre optic communication and its demerits

- **The method of transmitting information from one place to another in terms of light pulses through an optical fiber is called fiber optic communication.**
- Light has very high frequency (400 THz – 790 THz) than microwave radio systems.
- The fibers are made up of silica glass or silicon dioxide which is highly abundant on Earth.
- It has been replaced with materials such as chalcogenide glasses, fluoro aluminate crystalline materials because they provide larger infrared wavelength and better transmission capability.
- As fibers are not electrically conductive, it is preferred in places where multiple channels are to be laid and isolation is required from electrical and electromagnetic interference.

Applications
Optical fiber system has a number of applications namely, international communication, inter-city communication, data links, plant and traffic control and defense applications.

Demerits
i) Fiber optic cables are more fragile when compared to copper wires.
ii) It is an expensive technology.

5.Explain about RADAR and its application

- Radar basically stands for Radio Detection and Ranging System.
- The angle, range, or velocity of the objects that are invisible to the human eye can be determined.
- Radar uses electromagnetic waves for communication.
- The electromagnetic signal is initially radiated into space by an antenna in all directions.
- When this signal strikes the targeted object, it gets reflected or reradiated in many directions.

- This reflected (echo) signal is received by the radar antenna which in turn is delivered to the receiver. Then, it is processed and amplified to determine the geographical statistics of the object.
- The range is determined by calculating the time taken by the signal to travel from RADAR to the target and back.

Applications.

i) In military, it is used for locating and detecting the targets.

ii) It is used in navigation systems such as ship borne surface search, air search and weapons guidance systems.

iii) To measure precipitation rate and wind speed in meteorological observations, Radars are used.

iv) It is employed to locate and rescue people in emergency situations.

6.Explain about mobile communication and its application

- Mobile communication is used to communicate with others in different locations without the use of any physical connection like wires or cables.

Advantages

It allows the transmission over a wide range of area without the use of the physical link.

It enables the people to communicate with each other regardless of a particular location like office, house, etc. It also provides communication access to remote areas.

It provides the facility of roaming – that is, the user may move from one place to another without the need of compromising on the communication. The maintenance and cost of installation of this communication network are also cheap.

Applications

i) It is used for personal communication and cellular phones offer voice and data connectivity with high speed.

ii) Transmission of news across the globe is done within a few seconds.

iii) Using Internet of Things (IoT), it is made possible to control various devices from a single device. Example: home automation using a mobile phone.

iv) It enables smart classrooms, online availability of notes, monitoring student activities etc. in the field of education.

7.What are the application of internet

i) **Search engine**

The search engine is basically a web-based service tool used to search for information on World Wide Web.

ii) **Communication**

It helps millions of people to connect with the use of social networking: emails, instant messaging services and social networking tools.

iii) **E-Commerce**

Buying and selling of goods and services, transfer of funds are done over an electronic network.