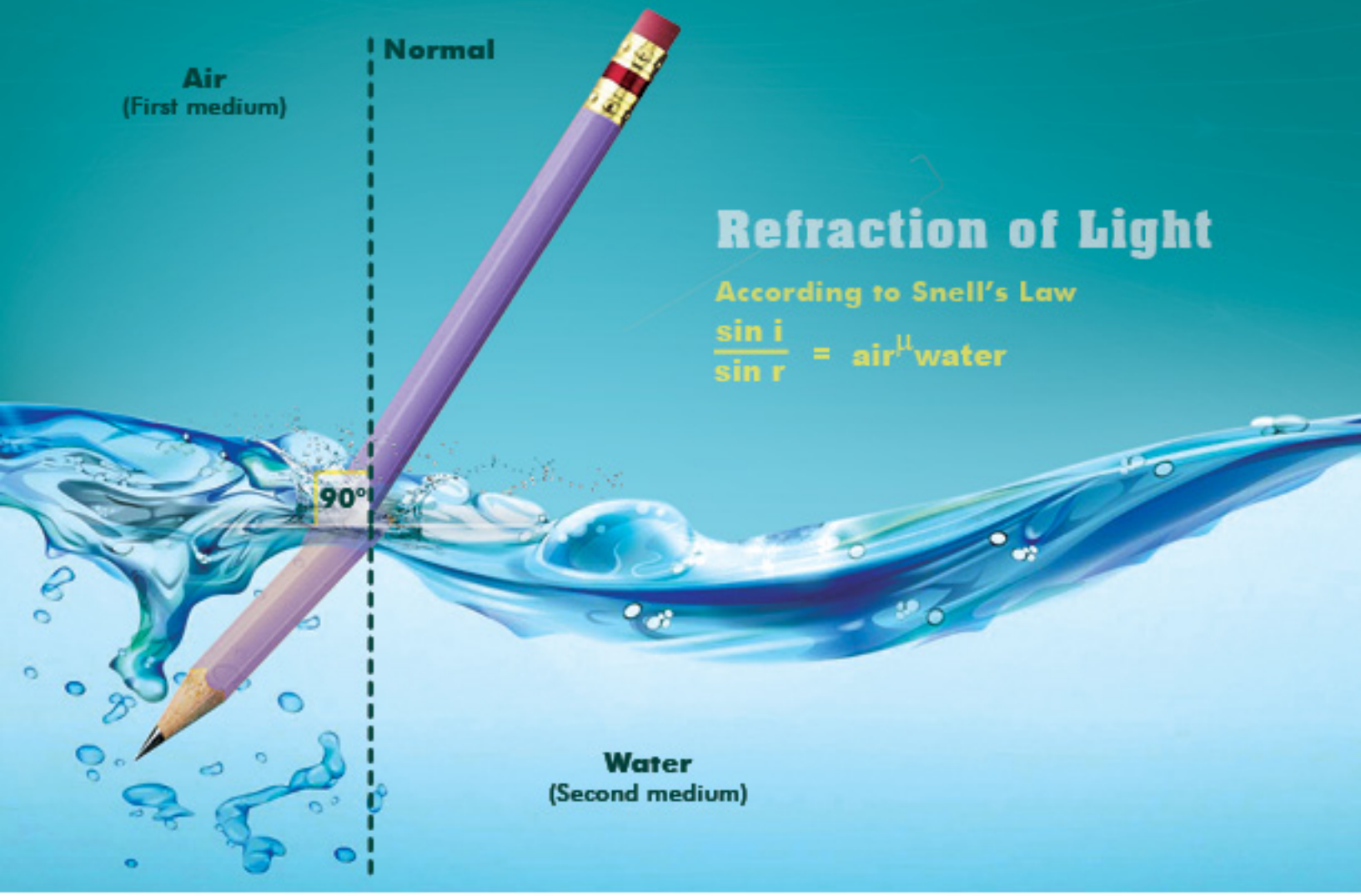
SAMPLE CONTENT

PERFECT

PHYSICS-II

Std. XII Sci.



Target Publications Pvt. Ltd.

Written as per the revised syllabus prescribed by the Maharashtra State Board of Secondary and Higher Secondary Education, Pune.

Perfect
Physics – II
STD. XII Sci.

Salient Features

- Exhaustive coverage of syllabus in Question Answer Format.
- Covers answers to all Textual Questions, Intext Questions and Numericals.
- Covers answers to all Board Questions till date.
- Includes Solved Board Questions from 2013 to 2018.
- Covers relevant NCERT Questions.
- Includes Board Question Papers of 2017 and 2018.
- Exercise, Multiple Choice Questions and Topic test at the end of each chapter for effective preparation.
- Important inclusions: NCERT Corner, Apply Your Knowledge, Brain Teasers, Concept builders.

Printed at: **Repro India Ltd.,** Mumbai

P.O. No.136466

TEID: 12901_JUP

Preface

In the case of good books, the point is not how many of them you can get through, but rather how many can get through to you.

"Std. XII Sci. : PERFECT PHYSICS - II" is a treasure house of knowledge that'd not only prepare you to face the conspicuous Std. XII final exam but also equip you up on parallel ground to face the prospective NEET and JEE exam.

This book is specifically aimed at Maharashtra Board students. The content of the book is framed in accordance with the latest Maharashtra State board syllabus splattered with additional snippets of information from the NCERT syllabus. This lethal combination of apt material from both the syllabus makes it the ultimate reference material for Std. XII.

This book has been developed on certain key features as detailed below:

- Sub-topic wise classified **Question and Answer** format of the book provides students with appropriate answers for all textual and intext questions. Selective questions and answers have been presented in 'tabular' format for students to correlate and understand the concept better. We've also included additional questions to ensure complete coverage of every concept.
- **Solved Examples** provide step-wise solution to various numerical problems. This helps students to understand the application of different concepts and formulae.
- **Solutions to Board Questions** along with marking scheme (wherever relevant) have been included.
- **NCERT Corner** and **Notes** cover additional bits of relevant information about discussed topic.
- **Apply Your Knowledge, Brain Teasers** cover brain-storming questions to stengthen the students' conceptual understanding.
- **Concept Builders** are designed to enable the students to guage their grasp of a given concept and strengthen it further.
- **Summary** and **Formulae** sections facilitate instant revision at a glance.
- **Exercise** helps the students to gain insight on the various levels of theory and numercial-based questions.
- **Board Questions** section contains questions of past board question papers which fall under the new syllabus.
- **Multiple Choice Questions** and **Topic Test** assess the students on their range of preparation and the amount of knowledge of each topic. Selected multiple choice questions have been provided with hints to help the students overcome conceptual or mathematical hinderances.

The journey to create a complete book is strewn with triumphs, failures and near misses. If you think we've nearly missed something or want to applaud us for our triumphs, we'd love to hear from you.

Please write to us at : mail@targetpublications.org

A book affects eternity; one can never tell where its influence stops.

Best of luck to all the aspirants!

Yours faithfully,
Publisher

Edition: Second

PAPER PATTERN

- There will be one single paper of 70 Marks in Physics.
- Duration of the paper will be 3 hours.

Section A: **(8 Marks)**

This section will contain Multiple Choice Questions and Very Short Answer(VSA) type of questions.

There will be 4 MCQs and 4 VSA type of questions, each carrying one mark.

Students will have to attempt all these questions.

Section B: **(14 Marks)**

This section will contain 7 Short Answer (SA-I) type of questions, each carrying 2 marks.

Internal choice is provided for only one question.

Section C: **(33 Marks)**

This section will contain 11 Short Answer (SA-II) type of questions, each carrying 3 marks.

Internal choice is provided for only one question.

Section D: **(15 Marks)**

This section will contain 3 Long Answer (LA) type of questions, each carrying 5 marks.

Internal choice is provided for each question.

Distribution of Marks According to Type of Questions

Type of Questions		
MCQ	1 Mark each	4 Marks
VSA	1 Mark each	4 Marks
SA I	2 Marks each	14 Marks
SA II	3 Marks each	33 Marks
LA	5 Marks each	15 Marks

Index

Sr. No.	Chapter	Marks	Page No.
10	Wave Theory of Light	03	1
11	Interference and Diffraction	04	36
12	Electrostatics	03	82
13	Current Electricity	03	129
14	Magnetic Effect of Electric Current	03	167
15	Magnetism	03	199
16	Electromagnetic Induction	04	220
17	Electrons and Photons	03	273
18	Atoms, Molecules and Nuclei	04	301
19	Semiconductors	03	346
20	Communication System	02	387
	Board Question Paper - March 2017		403
	Board Question Paper - July 2017		405
	Board Question Paper - March 2018		407
	Board Question Paper - July 2018		409

Note: 1. **** mark represents all Textual questions.***

2. ***# mark represents all Intext questions.***

20 Communication System

Subtopics

20.0 Introduction

20.1 Elements of a communication system

20.2 Bandwidth of signals

20.3 Bandwidth of transmission medium

20.4 Need for modulation

20.5 Production and detection of an amplitude modulated wave

20.6 Space communication

20.7 Propagation of electromagnetic waves in atmosphere

20.0 Introduction

The process of sending and receiving information is known as communication.

Radio, T.V, fax, mobile, etc, are some of the devices used in communication.

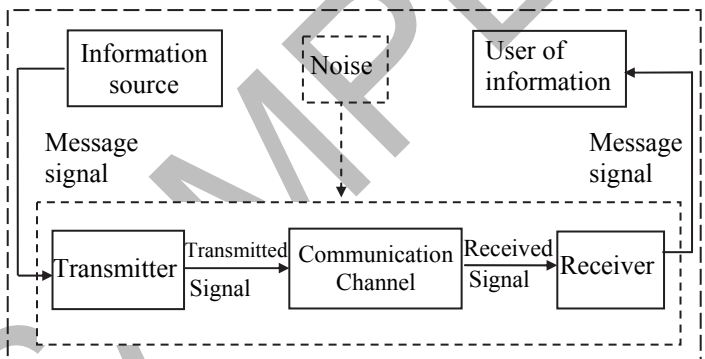
20.1 Elements of a communication system

Q.1. Define communication system.

***With a block diagram, explain elements of a communication system.**

Ans: Definition:

The set up used to send and receive information from one place to another is called communication system.



Block diagram of communication system

Elements of a communication system:

i. Transmitter:

a. It converts the message signal produced by the source of information into a form suitable for transmission through a channel and subsequent reception.

b. If the output of the information source is a non-electrical signal like a voice signal, a transducer is used which converts it into electrical form before giving it as an input to the transmitter.

ii. Communication channel:

a. It is the medium that bridges the information source to destination.
Example: pair of wires, co-axial cables, laser beam etc.

b. Every channel introduces some amount of transmission loss or attenuation, therefore signal power in the transmission channel progressively decreases.

iii. Receiver:

a. It is a device which extracts the original signal from the modulated signal.

b. It consists of a pickup antenna to pick up signal, demodulator, an amplifier and the transducer.

c. The receiver reconstructs a recognizable form of the original message signal for delivering it to the user of information.

Q.2. State two basic modes of communications.

Ans: Two basic modes of communications are as follow:

i. Point-to-point communication:
In this mode, communication takes place over a link between a single transmitter and a receiver.
Example: Telephony

ii. Broadcast:
In this mode, there are large numbers of receivers corresponding to a single transmitter.
Example: Radio, Television etc.

Q.3. What is signal? Explain different types of information signals.

Ans: Signal:

A signal is a single-valued function of time that carries the information.

Usually, it is in electrical form and is suitable for transmission.

Types of signals:

i. Analog signal:

Analog signal is the physical manifestation of a physical quantity that varies continuously with time.

Example: Sound and picture signals in T.V

ii. Digital signal:

Those signals which can take only discrete step-wise values are called digital signals. In digital signal, amplitude of wave is discontinuous.

Examples: BCD (Binary Coded Decimal), ASCII (American Standard Code for Information Interchange).

Q.4. Explain the following terms.

i. Transducer ii. Amplification

iii. Noise iv. Repeater

Ans: i. Transducer:

a. *A transducer is a device, which converts one form of energy into another.*

b. An electrical transducer is one, which converts some physical variable, such as displacement, pressure, force, temperature, etc into corresponding variations in the electrical signals at its output.

ii. Amplification:

a. *Amplification is the process of increasing the strength of the signal by making use of an amplifier.*

b. As the signal propagates, its strength decreases. As a result, the signal received at the destination may not be of adequate strength so as to be efficiently reproduced.

c. To compensate for the loss of strength of the signal, its amplification has to be done using an electronic circuit, called amplifier.

iii. Noise:

a. Noise is a form of amplitude variations in the signal.

b. The source of noise is usually due to atmospheric electricity, fluctuations of electric power in industries, etc.

c. Noise produces unwanted signals, which accompany the original signal.

iv. Repeater:

a. Repeater is a combination of receiver and transmitter placed along the path of signal so as to extend the range of the communication system.

b. When the distance of destination from the transmitter is very large or the transmitted signal is obstructed by mountains, repeaters are installed along the path of the signal.

c. It picks up the signal, amplifies it and then again transmits it to the receiver.

Q.5. Define the following terms.

i. Range ii. Attenuation

iii. Demodulation iv. Carrier waves

Ans: i. Range:

The maximum (largest) distance between a source and a destination upto which a signal is received with sufficient strength is called as range.

ii. Attenuation:

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

iii. Demodulation:

The process of recovering of information from a modulated carrier wave at the receiver is known as demodulation.

iv. Carrier waves:

The high frequency waves on which the signals to be transmitted are superimposed are called carrier waves.

20.2 Bandwidth of signals

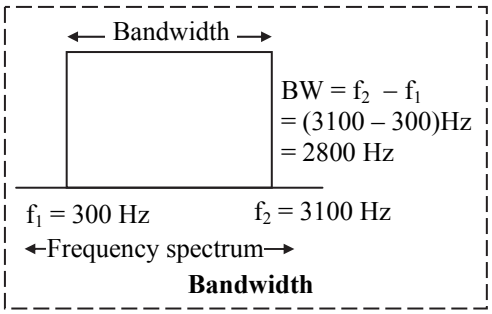
In a communication system, the message signal can be voice, music, picture or computer data; each having a different ranges of frequencies. The type of communication system chosen for given signal depends on the band of frequencies associated with the signal.

***Q.6.Write a note on bandwidth of signals.**

Ans: i. Bandwidth is the portion of electromagnetic spectrum occupied by a signal.

ii. It is the frequency range over which an information signal is transmitted or over which a receiver or other electronic circuits operate.

iii. Bandwidth is the difference between the upper and lower frequency limits of the signal or the equipment operation range.



iv. **Eg:** Bandwidth of speech (voice) frequency range from 300 to 3100 Hz. Therefore, speech signal requires a bandwidth of 2800 Hz (3100–300) for commercial telephonic communication.

Note

1. To transmit music, an approximate bandwidth of 20 kHz is required because of the high frequencies produced by the musical instruments. The audible range of frequencies ranges from 20 Hz to 20 kHz.
2. Video signals require bandwidth about 4.2 MHz to transmit pictures. As TV signal contains both voice and picture, it is allocated 6 MHz of bandwidth for transmission.

Q.7. State the frequency range of different waves in AM band and FM band.

Ans: Frequency range of amplitude modulation (AM) band:

High Frequency (HF)	3 MHz to 30 MHz
Very High Frequency (VHF)	30 MHz to 300 MHz
Ultra High Frequency (UHF)	300 MHz to 3000 MHz
Super High Frequency (SHF)	3 GHz to 30 GHz (80MHz to 108 MHz)

Frequency range of frequency modulation (FM) band:

Extra High Frequency (EHF)	30 GHz to 300 GHz

Note

Various frequency bands:

Extremely Low Frequency (ELF)	30 Hz to 300 Hz
Voice Frequency (VF)	300 Hz to 3100 Hz
Very Low Frequency (VLF)	3 kHz to 30 kHz
Low Frequency (LF)	30 kHz to 300 kHz
Medium Frequency (MF)	300 kHz to 3000 kHz

20.3 Bandwidth of transmission medium

***Q.8. Explain bandwidth of transmission media.**

Ans: i. Different types of transmission media offer different band widths.
The commonly used transmission media are wire, free space and fibre optic cable.

ii. Coaxial cable is a widely used wire medium, which offers a bandwidth of approximately 750 MHz. Such cables are normally operated below 18 GHz.

iii. Communication through free space using radio waves takes place over a very wide range of frequencies from a few hundreds of kHz to a few GHz.

iv. The frequency range of 1 THz to 1000 THz (i.e., from microwave to ultraviolet region) is used in communication using fibre optic cables. The band width of such optic fibre is more than 100 GHz.

Note

Some important wireless communication frequency bands are as follows:

Service	Frequency bands	Comments
Standard AM broadcast	540 kHz - 1600 kHz	–
FM broadcast	88 MHz - 108 MHz	–
Television	54 MHz - 72 MHz	VHF (very high frequencies)
	76 MHz - 88 MHz	T.V
	174 MHz - 216 MHz	UHF(Ultra High Frequencies)
	420 MHz - 890 MHz	T.V
Cellular Mobile Radio	896 MHz - 901 MHz	Mobile to base station
	840 MHz - 935 MHz	Base station to mobile
Satellite Communication	5.925 GHz - 6.425 GHz	Uplink
	3.7 GHz - 4.2 GHz	Downlink

Q.9. In which frequency range optical communication through fibre is performed?

Ans: Optical communication through optical fibre is performed through the frequency range of 1 THz to 1000 THz (microwaves to ultraviolet)

Q.10. State different types of guided media.

Ans: Different types of guided media:

i. Parallel wire ii. Twisted pair
iii. Co-axial cable iv. Fibre optic cable

20.4 Need for modulation

Q.11. Define base band signals.

Ans: *The message signals which designate (mark-out) the band of frequencies representing the original signal, as directed by the source of information are called base band signals.*

Note

No signal is a single frequency sinusoid, but it spreads over a range of frequencies called the signal band width.

Q.12. State the factors which affect the transmission of electronic signal in the audio frequency range.

Ans: Following factors affect the transmission of electronic signal in the audible frequency range.

i. Size of the antenna or aerial.
ii. Effective power radiated by an antenna.
iii. Mixing up of signals from different transmitters.

***Q.13. Explain need of modulation.**

Ans: There are many difficulties in transmitting signal frequencies directly.

i. Size of the antenna:

a. For transmitting a signal, we need an antenna or an aerial. This antenna should have length comparable to the wavelength of the signal (at least $\lambda/4$) so that the antenna properly senses the time variation of signal.

b. For an electromagnetic wave of frequency 20 kHz, wavelength λ is 15 km. Vertical antenna of size of (15/4) km is impracticable. Hence, direct transmission of such baseband signals is not practical.

ii. Effect of power radiation:

a. The power radiated is proportional to $(l/\lambda)^2$. This implies that for the same antenna length, the power radiated increases with decreasing λ, i.e., increasing frequency.

b. Hence, the effective power radiated by a long wavelength baseband signal would be small.

c. For a good transmission, we need high power and hence there is a need of using high frequency transmission.

iii. Mixing up of signals:

Audible sound lies in a large of 20 Hz to 20 kHz. All signals from various source would get mixed up if transmitted directly. Hence, to separate various signals it is essential to convert them to different portions of electromagnetic spectrum.

Hence, there exists a need for modulation.

Q.14. What is modulation? State different types of modulation.

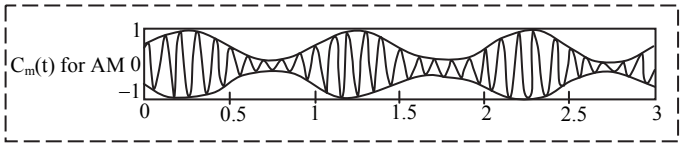
Ans: Modulation:

The process of superimposing a low frequency signal on a high frequency wave, which acts as a carrier wave for long distance transmission is known as modulation.

There are three types of modulation.

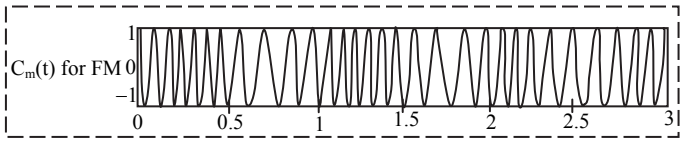
i. Amplitude modulation (AM):

When the amplitude of carrier wave is varied in accordance with the modulating signal, the process is called amplitude modulation.



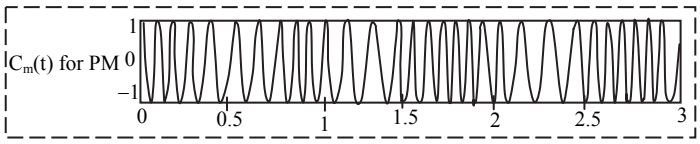
ii. Frequency modulation (FM):

When the frequency of carrier wave is varied in accordance with the modulating signal, the process is called frequency modulation.



iii. Phase modulation (PM):

When the phase angle of the carrier wave is varied in accordance with the modulating signal, the process is called phase modulation.



Q.15. Explain need for translating the original low frequency base band signal into high frequency wave before transmission.

Ans: Need for translating low frequency signal into high frequency signal.

i. An unmodulated carrier has a constant amplitude, a constant frequency and a constant phase relationship with respect to some reference.

ii. A message consists of ever-varying quantities. Speech, for instance is made up of rapid and unpredictable variations in amplitude (volume) and frequency (pitch).

iii. Since it is impossible to represent these two variables by a set of three constant parameters, an unmodulated carrier cannot be used to convey information.

iv. The above discussion suggests that there is a need for translating the original low frequency base band signal or information message into high frequency wave before transmission such that the translated signal continues to possess the information contained in the original signal.

Q.16. Explain different types of carrier waves.

Ans: i. *High frequency waves on which signals to be transmitted are superimposed are called carrier waves.*

ii. Carrier waves are either in the form of continuous (sinusoidal) or pulses as shown in figure.

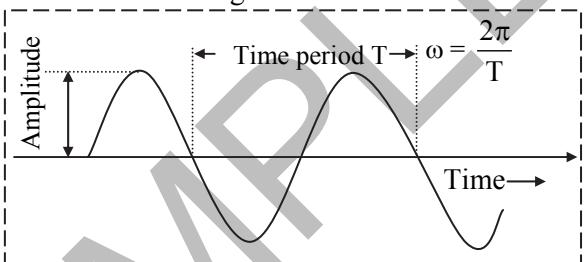


Figure (a) Sinusoidal signal

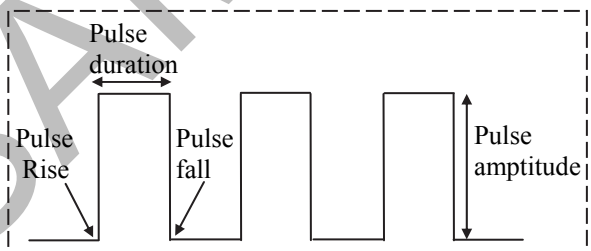


Figure (b) Pulse shaped signal

iii. A sinusoidal carrier wave can be represented as, $c(t) = A_c \sin(\omega_c t + \phi)$ where, c(t) is the signal strength (voltage or current), A_c is the amplitude, ω_c ($= 2\pi f_c$) is the angular frequency and ϕ is the initial phase of carrier wave.

iv. During the process of modulation, any of the three parameters viz. A_c, ω_c and ϕ of the carrier wave can be controlled by the message or information signal resulting into three types of modulation namely, amplitude modulation (AM), frequency modulation (FM) and phase modulation (PM).

***Q.17. What is amplitude modulation?**

Ans: i. In amplitude modulation, the amplitude of the carrier wave is varied in accordance with the information (modulating) signal.

ii. To explain this, consider a sinusoidal signal as the modulating signal.

Let $c(t) = A_c \sin \omega_c t$ represent a carrier wave and $m(t) = A_m \sin \omega_m t$ represent the message or the modulating signal where, $\omega_m = 2\pi f_m$ is the angular frequency of the message signal.

iii. The modulated signal $c_m(t)$ can be written as,

$$c_m(t) = [c(t) + m(t)] \sin \omega_c t$$
$$= [A_c + A_m \sin \omega_m t] \sin \omega_c t$$
$$= A_c \left(1 + \frac{A_m}{A_c} \sin \omega_m t\right) \sin \omega_c t \quad \ldots(1)$$

Thus, the modulated signal contains the message signal.

iv. Equation (1) can be written as,

$$c_m(t) = A_c \sin \omega_c t + \mu A_c \sin \omega_m t . \sin \omega_c t \quad \ldots(2)$$

where $\mu = \frac{A_m}{A_C}$ is the modulation index.

(or modulating factor or degree of modulation)

In practice, μ is kept ≤ 1 to avoid distortion.

v. By using,

$$\sin A \sin B = \frac{1}{2}[\cos(A - B) - \cos(A + B)],$$

equation (2) can be written as,

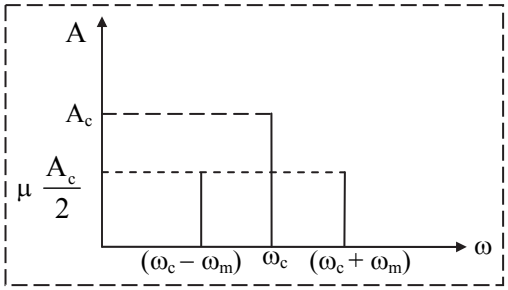
$$c_m(t) = A_c \sin \omega_c t + \frac{\mu A_c}{2} \cos(\omega_c - \omega_m) t - \frac{\mu A_c}{2} \cos(\omega_c + \omega_m) t$$

Here, $(\omega_c - \omega_m)$ and $(\omega_c + \omega_m)$ are called the lower side and upper side frequencies respectively.

vi. The modulated signal consists of the carrier wave of frequency ω_c plus two sinusoidal waves each with a frequency slightly different from ω_c, known as side bands.

Q.18. Plot amplitude versus ω curve for an amplitude modulated signal.

Ans: A plot of amplitude versus ω of an amplitude modulated signal is as shown in figure.



$(\omega_c - \omega_m)$ and $(\omega_c + \omega_m)$ are respectively called the lower side and upper side frequencies.

Q.19. What is modulation index?

Ans: i. *The modulation index (μ) of an AM wave is the ratio of the amplitudes of the modulating signal (A_m) and carrier wave (A_c).*

ii. Modulation index, $\mu = \frac{A_m}{A_c}$

iii. A moderate value of modulation index is desirable so as to avoid distortion in the wave form.

Note

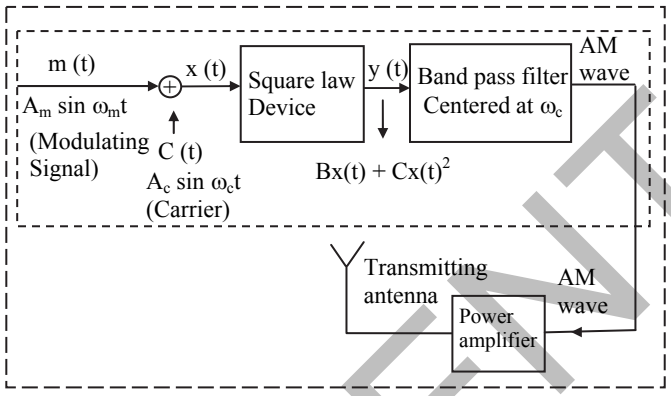
1. The antenna works efficiently when its size is greater than $\frac{\lambda}{4}$.
2. The length of an antenna is such that it acts as a resonant circuit at the frequency of operation.

20.5 Production and detection of an amplitude modulated wave

***Q.20. Explain the production of amplitude modulation.**

Ans: Production of amplitude modulation:

i. The block diagram depicts a simple method of the production of AM waves.



ii. The modulating signal $A_m \sin\omega_m t$ is superimposed on the carrier wave $A_c \sin \omega_c t$ to get a signal given by the equation,

$x(t) = A_m \sin \omega_m t + A_c \sin \omega_c t$

iii. This signal is now passed through a square law device (a non-linear device) which produces a wave given by the equation,

$y(t) = Bx(t) + Cx^2(t)$

where, B and C are constants

$$\therefore \quad y = B[A_m \sin \omega_m t + A_c \sin \omega_c t] + C[A_m \sin \omega_m t + A_c \sin \omega_c t]^2$$

$$\therefore \quad y = BA_m \sin \omega_m t + BA_c \sin \omega_c t + CA_m^2 \sin^2 \omega_m t + CA_c^2 \sin^2 \omega_c t + 2CA_mA_c \sin \omega_m t \sin \omega_c t \quad \ldots(1)$$

iv. But, $\sin^2 \omega t = \frac{1-\cos 2\omega t}{2}$

and $2 \sin \omega_m t \sin \omega_c t$

$= \cos(\omega_c - \omega_m)t - \cos(\omega_c + \omega_m)t$

Therefore, equation (1) can be written as,

$$y = BA_m \sin\omega_m t + BA_c \sin\omega_c t + \frac{CA_m^2}{2} - \frac{CA_m^2 \cos 2\omega_m t}{2} + \frac{CA_c^2}{2} - \frac{CA_c^2}{2}\cos 2\omega_c t + CA_mA_c \cos(\omega_c - \omega_m)t - CA_m A_c \cos(\omega_c + \omega_m)t$$

$$\therefore \quad y = BA_m \sin\omega_m t + BA_c \sin\omega_c t + \frac{C}{2}\left(A_m^2 + A_c^2\right) - \frac{C}{2}\left(A_m^2 \cos 2\omega_m t + A_c^2 \cos 2\omega_c t\right) + CA_mA_c[\cos(\omega_c - \omega_m)t - \cos(\omega_c + \omega_m)t] \quad \ldots(2)$$

v. Equation (2) consists of the following terms:

a. d.c term $\frac{C}{2}\left(A_m^2 + A_c^2\right)$

b. Sinusoidal a.c terms of angular frequencies ω_m, ω_c, $2\omega_m$, $2\omega_c$

c. Sinusoidal terms of angular frequencies $(\omega_c - \omega_m)$ and $(\omega_c + \omega_m)$

vi. This signal is passed through a band pass filter which is centred at ω_c. The band pass filter provides the following function:

a. It rejects d.c.

b. It rejects a.c terms of angular frequencies ω_m, $2\omega_m$, $2\omega_c$

c. It passes the frequencies ω_c, $\omega_c - \omega_m$, $\omega_c + \omega_m$.

vii. The output of the band pass filter is the amplitude modulated wave.

viii. The AM wave is amplified by passing it through a power amplifier and sent to the transmitting antenna.

Q.21.*Explain detection of amplitude modulated wave.

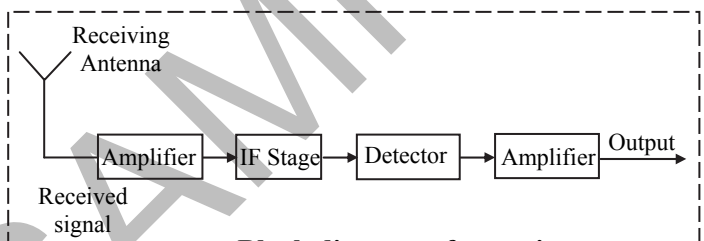
OR

Explain demodulation of AM wave.

Ans: Detection of amplitude modulated wave:

i. Once the amplified AM wave is radiated out of the transmitting antenna, it gets attenuated while propagating through the channel. The receiving antenna is followed by amplifier and a detector which picks up the weak signals and passes it to the amplifier.

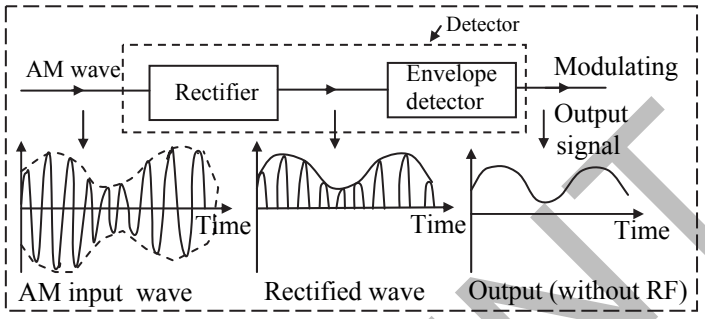
ii. The amplifier amplifies the signal and sends it to intermediate frequency (IF) stage. The function of intermediate frequency stage is to decrease the frequency of the carrier wave. This helps in the detection of the modulating signal.



Block diagram of a receiver

iii. The main function of demodulation is carried out in the detector. Here, the modulating signal (message signal) is separated from the carrier wave.

The modulated wave sent to the detector has the following frequencies: ω_C, $\omega_c - \omega_m$, $\omega_c + \omega_m$.



iv. The AM wave is passed through a rectifier. The modulating signal is retrieved from the rectified wave in the envelope detector which may consist of a simple R.C circuit.

Q.22. State applications of AM (amplitude modulation).

Ans: Applications of AM:

i. AM-radio broadcasting

ii. TV picture (video)

iii. Two way radio: Aircraft, Amateur radio (SSB), Citizen's band radio, Military.

iv. Digital data transmissions

v. Computer modems (used in combination with phase modulation)

vi. NIST time signals

Q.23. What are the drawbacks of amplitude modulation?

Ans: Drawbacks of amplitude modulation:

i. The efficiency of amplitude modulation is low (20 to 30 % is useful).

ii. AM signal is easily affected by external atmosphere and electrical disturbances.

iii. Operating range is small.

iv. The allowed AM bandwidth is only 10 kHz and for transmission of all audio frequencies, about 30 kHz bandwidth is required which affects fidelity. Due to limited bandwidth, stereotype transmission is not possible.

20.6 Space communication

***Q.24.What do you mean by space communication?**

Ans: i. *The communication process in which space acts as the communication channel, is called space communication.* Example: Radio, television and satellite communication etc.

ii. Space waves are useful for the transmission of information (i.e. messages, speech, music etc.) from one place to another without the help of wires or the material medium between the two places.

iii. The signals which are to be transmitted are first converted into electrical signals, then superimposed on a high frequency oscillating current flowing through transmitted antenna. This antenna radiates corresponding radio waves in the atmosphere.

iv. When the radio waves are intercepted by receiving antenna at the receiving station, a small varying e.m.f is induced in the antenna. This e.m.f is amplified and decoded to obtain the information contained in the original signal.

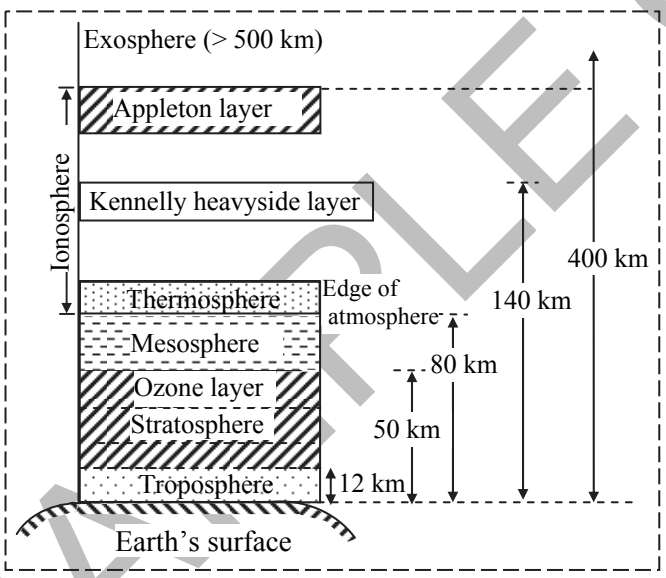
Q.25. Give the limitations of space wave communication.

Ans: In space wave communication, range of transmission is limited both by the curvature of the earth's surface and partial absorption of signal by it.

***Q.26. Explain in brief idea of structure of atmosphere.**

Ans: *The gaseous envelope surrounding the earth is called earth's atmosphere.*

The earth's atmosphere is broadly divided into various layers as shown in figure.



i. Troposphere:

a. The lowest region of atmosphere extending upto 12 km from surface of the earth is called Troposphere.

b. Its density varies from 1 kg m^{-3} to 0.1 kg m^{-3}. It contains all the water vapours of the atmosphere. The temperature of this layer decreases with the height from 290 K to 200 K.

c. This layer is responsible for all the weather phenomenon like clouds formation, rain, fog, etc. Electromagnetic waves of FM transmitter and T.V transmitter propagate through this layer.

ii. Stratosphere:

a. The region of atmosphere extending from 12 km to 50 km is called stratosphere.

b. The density in this region varies from 0.1 kg m^{-3} to 10^{-3} kg m^{-3} and temperature varies from 220 K to 280 K.

c. In the lower region from 30 km to 50 km there is a layer of ozone. Ozone layer absorbs large amount of ultraviolet radiations radiated by the sun and thus protects life on the earth from its harmful effects. The ozone layer is also called ozonosphere.

iii. Mesosphere:

a. The region of the earth's atmosphere between 50 km to 80 km from the surface of the earth is called Mesosphere.

b. Mesosphere has temperature varying from 290 K to 180 K. The density of this layer varies from 10^{-3} kg m^{-3} to 10^{-5} kg m^{-3}.

iv. Ionosphere:

The region of the atmosphere extending between 80 km to 400 km from the earth's surface is called Ionosphere. This is the outermost part of the earth's atmosphere. The temperature of the layer between 80 km to 110 km varies from 180 K to 700 K and the density of this layer varies from 10^{-5} kg m^{-3} to 10^{-10} kg m^{-3}. This layer is further classified into three sub-layers.

a. Thermosphere:

The region which extends from 80 km to 110 km from the earth's surface is called thermosphere. It receives energy directly from the solar radiation produced by ultra-violet radiation and X-rays from the sun. As a result, the concentration of electrons and positive ions is very large in this region and for this reason, it is called ionosphere. The ionised ions are present along with thermal energy. Because of ionised particles it plays an important role in communication. It transmits radio waves round the curved earth's surface.

b. Kennelly Heavyside layer (E layer):
At about 90 km from earth's surface, the electron concentration becomes very high and extends vertically upto 140 kilometres approximately.
This layer of electrons is known as Kennelly heavyside layer (E layer).

c. Appleton layer (F layer):
In this layer, electron and positive ion concentration is average. This layer receives maximum energy from the sun and hence positive and negative (electron) ions are produced due to low pressure. This layer extends upto 400 km.

Note

For long distance radio broadcast, we use short wave band only because ionosphere easily reflects the waves in this band.

v. Exosphere: The Exosphere (> 500 km) is a transitional zone between the Earth's atmosphere and inter planetary space. The pressure in this region is very low.

Note

Density of gases of earth's atmosphere remains same upto height 100 km above sea level.

20.7 Propagation of electromagnetic waves in atmosphere

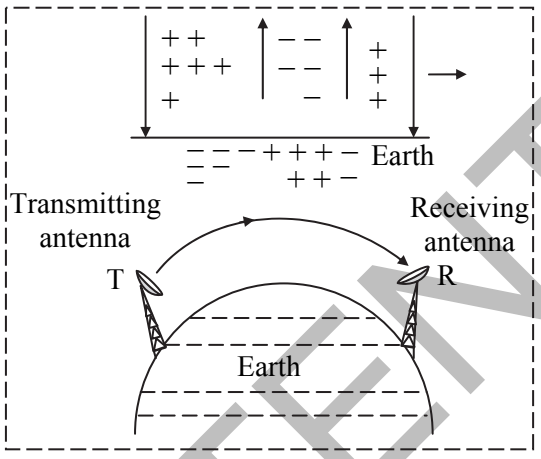
Q.27. *Explain ground wave propagation. OR Define and explain ground wave propagation. [Mar 09]

Ans: Definition:
When the electromagnetic waves (radiowaves) from the transmitting antenna propagate along the surface of the earth so as to reach the receiving antenna, the wave propagation is called ground wave propagation (surface wave propagation).

Explanation:

i. Ground waves are the radiowaves which propagate along the surface of the earth.

ii. The electromagnetic waves which are vertically polarised can travel along the surface of earth. The horizontal component of electric field in contact with earth is short circuited. The electric field vector of the wave induces charge in the earth as shown in figure.



iii. There is loss of power in a signal during its propagation on the surface of the earth due to partial absorption of energy by ground. Loss of energy is also due to diffraction effect. The absorption of energy is high for high frequency.
Hence ground wave propagation is suitable for low frequency and medium frequency. It is used for local broadcasting For examples: ship, communication, radio navigation.

iv. Ground wave propagation is possible only when the transmitting and receiving antenna are close to the earth's surface.

Q.28. On what factors does the maximum range of ground wave propagation depend?

Ans: The maximum range of ground wave propagation depends on:

i. the frequency of the radio waves and

ii. power of the transmitter.

Q.29. Explain why are T.V and FM signals not transmitted by using ground wave propagation.

Ans: i. T.V and FM waves are high frequency signals. They do not use ground wave propagation because at high frequency, the strength of the ground wave signal gets reduced by absorption.

ii. Because of this, it virtually becomes useless beyond an area of a few kilometres around the transmitting antenna.

Q.30. Define space wave. State the main components of space wave.

Ans: Definition:
The radiowaves which travel directly from the transmitting antenna to the receiving antenna are called the space waves.

Components of space wave:
There are three components of space waves.

i. **Direct wave:** Radiowaves reach receiving antenna directly.

ii. **Ground reflected wave:** Radiowaves reach the receiving antenna after reflection from ground.

iii. **Tropospheric wave:** Radiowaves reach the receiving antenna after reflection from troposphere.

Q.31.*Explain space wave propagation. OR What is space wave propagation? Draw a neat labelled diagram to show space wave propagation. [Oct 08]

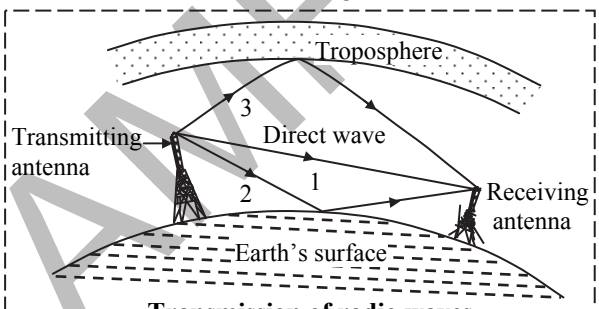
Ans: Space wave propagation:

i. *When the radiowaves from the transmitting antenna reach the receiving antenna either directly or after reflection from the ground or from troposphere, the wave propagation is called space wave propagation or tropospheric wave propagation or line of sight propagation.*

ii. The T.V signals, FM radio, radar are in the range 100 MHz to 200 MHz and these can be transmitted only by space wave propagation. In this, the receiving antenna directly intercepts the signal sent out by the transmitter.

iii. But the earth is spherical, so long distance transmission is not possible. Therefore, the height of the antenna should be as large as possible or repeater transmission stations are necessary.

iv. The range for line of sight propagation is given by, $d = \sqrt{2Rh}$ which is of the order of few km where 'R' is radius of earth and 'h' is height of antenna.



Transmission of radio waves

Q.32. What is line of sight distance in communication?

Ans: Line of sight distance in communication:

i. Line of sight distance in communication system is the distance between transmitting antenna and receiving antenna at which they can see each other.

ii. It is given by, $d = \sqrt{2Rh}$

where, R = radius of curvature of earth

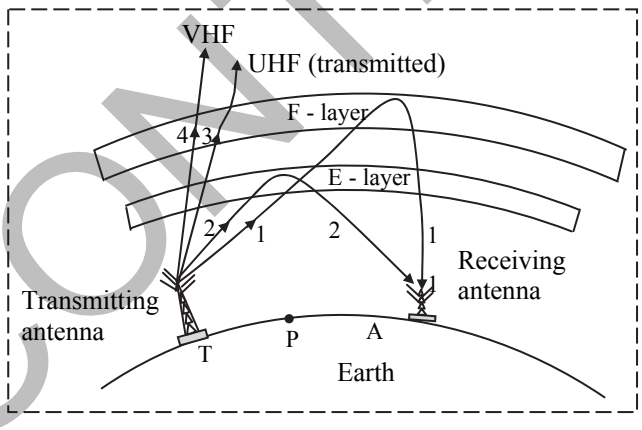
h = height of transmitting antenna

Range of line of sight communication is of the order of few km.

***Q.33.Explain sky wave propagation. [Mar 09]**

Ans: Sky wave propagation:

i. *When the radiowaves from the transmitting antenna propagate through sky so as to reach the receiving antenna after reflection in the ionosphere, the wave propagation is called sky wave propagation or ionospheric wave propagation.*



ii. The transmitting waves go up in the sky and are reflected from ionosphere as shown in figure.

iii. The refractive index of ionosphere is less than that of free space. R.I of each layer decreases with height. Hence, radio waves from ground station undergo total internal reflection towards earth.

iv. Because of diurnal and seasonal variation in thickness of E or F layer and concentration of charge in each layer, sky wave propagation is least reliable.

Note

1. The radio waves having frequency less than 3 MHz are absorbed in the ionosphere, whereas those having frequency greater than 30 MHz pass through ionosphere with small deviation.
2. The radio waves from 3 MHz to 30 MHz undergo multiple reflections between the earth and ionosphere. Hence, they are called as sky waves and they can be transmitted over large distances.

Q.34. Explain with neat labelled diagram ground wave propagation and sky wave propagation. [Oct 11]

Ans: *Refer Q.27 and Q.33*

Q.35. Define the following terms.

i. Angle of radiation

ii. Critical frequency

Ans: i. Angle of radiation:

The maximum angle made by transmitted radio waves with the horizontal, above which the radio waves are no longer reflected back by ionosphere is called angle of radiation.

ii. Critical frequency:

The maximum frequency of transmitted radio waves, above which the radio waves are no longer reflected back by ionosphere, is called critical frequency.

It is given by, $f_C = 9\sqrt{N_{max}}$

where, N_{max} is maximum electron density of ionosphere.

Q.36. Define the following terms.

i. Sky waves

ii. Fading

Ans: i. Sky waves:

The radio waves having frequency between 3 MHz to 30 MHz are called sky waves.

ii. Fading:

The disappearance of the signals for short time due to variations in the height and density of ionisation of ionosphere is called fading.

Note

1. If 'h_t' and 'h_r' be the height of transmitting and receiving antenna respectively, then range of signal is given by,
   $d = \sqrt{2R}\left(\sqrt{h_t} + \sqrt{h_r}\right)$.
   where, R = radius of curvature of the earth
2. Sky waves are called short waves due to its high frequency.
3. Frequency range of sky wave propagation varies from 3 MHz to 30 MHz. This region is called short wave band.
4. If the frequency of radio wave is more than critical frequency f_c, then it will cross the ionosphere and do not return back to earth.
5. The critical frequency ranges approximately from 5 MHz to 10 MHz.

Q.37. Is it necessary for a transmitting antenna to be at the same height as that of the receiving antenna for line of sight communication?

Ans: i. For line of sight communication, the receiving antenna must intercept the transmitted signal.

ii. If the signal is to be received beyond horizon, the receiving antenna must be high enough to intercept the transmitted signal.

iii. Therefore, it is not necessary for a transmitting antenna to be at the same height as that of the receiving antenna.

Q.38. What is the factor which limits the covering range of T.V transmission?

Ans: The T.V transmission by T.V tower use space wave. The covering range of space wave is limited by the curvature of the earth.

Q.39. What are radio waves?

Ans: *The electromagnetic waves of frequency ranging from a few kilo hertz to about few hundred mega hertz (i.e., wavelength 0.3 m and above) are called radio waves.*

Q.40. What are T.V signals? How are they received?

Ans: i. T.V signals are those signals which have frequency range 80 MHz to 200 MHz.

ii. Since these waves neither follow the curvature of the earth nor get reflected by ionosphere, their reception is possible either by using communication geostationary satellite which reflects the T.V signals back to earth or by using tall antennas which may directly intercept the signals.

Q.41. Write three differences between AM and FM.

Ans:

No.	AM	FM
i.	Alternation in amplitude of the desired signal amounts to marked distortion.	Noise can be easily minimised in FM system.
ii.	In AM, use of an excessively large modulating signal may result in distortion because of over modulation.	No restriction is placed on the modulation index. The instantaneous frequency deviation is proportional to the instantaneous magnitude of the signal.
iii.	The average power in amplitude modulated wave is greater than that contained in unmodulated wave.	The average power in frequency modulated wave is the same as that contained in the unmodulated wave.

#Q.42. Why does conductivity of earth's atmosphere increases with altitude?

Ans: i. Due to low pressure at high altitude, ionisation is produced by ultra-violet radiation and X-rays from the sun.

ii. As a result, the concentration of electrons and positive ions is very large. For this reason, it is called ionosphere.

iii. At about 90 km from earth's surface, the electron concentration becomes very large and extends vertically up to 140 km approximately.

iv. This layer of electrons is known as Kennelly Heavyside layer.

Apply Your Knowledge

Q.43. What is the relation between rms value of total modulated current and rms value of unmodulated carrier current in amplitude modulation?

Ans: The average power in the unmodulated carrier wave is $P_c = \frac{A_c^2}{2R}$ where, R = Resistance of antenna

The total power in the modulated wave is

$P_t = P_c\left(1+\frac{\mu^2}{2}\right)$ i.e., $\frac{P_t}{P_c} = 1+\frac{\mu^2}{2}$

where, μ = modulation index

If I_t is rms value of total modulated current and I_c is the rms value of unmodulated carrier current, then $P_t = I_t^2R$ and $P_c = I_c^2R$

$\therefore \quad \frac{P_t}{P_c} = \frac{I_t^2}{I_c^2} = \left(1+\frac{\mu^2}{2}\right)$ or $\frac{I_t}{I_c} = \sqrt{1+\frac{\mu^2}{2}}$

Q.44. Find the length of Marconi antenna at

i. 20 MHz ii. 80 MHz

Ans: i. $\lambda = \frac{C}{\nu} = \frac{3\times10^8}{20\times10^6} = 15$ m

For Marconi antenna, $l = \frac{\lambda}{4} = \frac{15}{4} =$ **3.75 m**

ii. $\lambda = \frac{C}{\nu} = \frac{3\times10^8}{80\times10^6} = 3.75$ m

$l = \frac{\lambda}{4} = \frac{3.75}{4} =$ **0.93 m**

Summary

1. Communication is the basic process of exchanging information.
2. A communication system acts as a messenger. It consists of a transmitter, communication channel and a receiver.
3. Bandwidth is the portion of electromagnetic spectrum occupied by a signal.
4. Modulation is necessary for a good transmission, efficient radiation and reception of signals without interference.
5. In amplitude modulation, the amplitude of carrier wave is varied according to information signal.
6. Detection (or demodulation) is the process of recovering the modulating signal from the modulated carrier wave.
7. Earth's atmosphere is a gaseous envelope which surrounds the earth. Various regions of earth's atmosphere are troposphere, stratosphere, mesosphere and ionosphere.
8. Space waves are the electromagnetic waves which travel in free space. These are used for line of sight communication.
9. Space communication refers to the sending, receiving and processing of information through space. With space communication, the information can be passed on from one place to another on the surface of earth in extremely short interval of time.
10. Depending on factors like frequency of operation of radio waves, distance between two communication stations etc., the radio waves can be sent via the following modes of propagation:
    i. Ground wave propagation
    ii. Sky wave propagation
    iii. Space wave propagation
11. The radio waves which travel through atmosphere following the surface of the earth are known as ground waves and their propagation is called ground wave propagation.
12. Sky waves are the electromagnetic waves which are capable of reflecting (returning) back from the ionosphere. These are used for transmission over large distances.

Exercise

One Mark Questions

1. What is communication?

Ans: *Refer section 20.0*

2. Give two types of guided media.

Ans: *Refer Q.10.*

3. What is space wave propagation?

Ans: *Refer Q.31.*

4. What is sky wave propagation?
Ans: *Refer Q.33.*

5. Define angle of radiation.
Ans: *Refer Q.35.(i)*

6. What is critical frequency?
Ans: *Refer Q.35.(ii)*

7. What are radio waves?
Ans: *Refer Q.39.*

Two Marks Questions

1. Explain
   i. Point to point communication
   ii. Broadcast.
Ans: *Refer Q.2.*

2. Explain two types of signal.
Ans: *Refer Q.3.*

3. What is bandwidth of signals? Give examples.
Ans: *Refer Q.6.*

4. Give any two factors that affect the transmission of electronic signal in the audio frequency range.
Ans: *Refer Q.12.*

5. Give any four drawbacks of amplitude modulation.
Ans: *Refer Q.23.*

6. What is
   i. E layer? ii. F layer?
Ans: *Refer Q.26.(iv,b and c)*

7. 'Ground wave propagations is not used for transmission of T.V and FM signals.' Explain why.
Ans: *Refer Q.29.*

8. Define
   i. Fading ii. Sky waves
Ans: *Refer Q.36.*

9. Why is it necessary for a transmitting antenna to be at a same height as that of the receiving antenna for line of sight communication?
Ans: *Refer Q.37.*

10. Differentiate between amplitude modulation and frequency modulation.
Ans: *Refer Q.41.*

11. Draw a neat, labelled block diagram for a generalised communication system. **[Oct 14]**
OR
Draw a block diagram of generalised communication system. **[Mar 15]**
Ans: *Refer Q.1 (Diagram)*
*[Diagram – **1 Mark**, Labelling – **1 Mark**]*

12. Explain the terms: (a) Transmitter and (b) Receiver in communication system. **[Mar 14]**
Ans: *Refer Q.1 (i, iii)*
*[Explanation of transmitter and receiver – **1 Mark each**]*

13. Explain the need for modulation related to the size of antenna (aerial). **[Oct 13]**
Ans: *Refer Q.13 (i)*
*[Explanation – **2 Marks**]*

14. Define modulation and transducer. **[Oct 15]**
Ans: *Refer Q.14(definition only) and Q.4(i.)*
*[Definition of modulation and transducer – **1 Mark each**]*

15. Draw a neat, labelled block diagram of a receiver for the detection of amplitude modulated wave. **[Mar 17]**
OR
Draw a neat and labelled block diagram of a receiver. **[Mar 18, Similar in July 16]**
Ans: *Refer Q. 21 (diagram only)*
*[Diagram – **1 Mark**, Labelling – **1 Mark**]*

16. Draw a neat, labelled diagram showing different layers of the Earth's atmosphere. **[July 17]**
OR
Draw a neat and labelled diagram of earth's atmosphere. **[July 18]**
Ans: *Refer Q.26 (Only diagram)*
*[Diagram – **1 Mark**, Labelling – **1 Mark**]*

17. Write a short note on surface wave propagation of electromagnetic waves. **[Mar 16]**
Ans: *Refer Q.27* *[Explanation – **2 Marks**]*

18. What is space wave propagation? State its three components. **[Mar 13]**
Ans: *Refer Q.31 and Q.30*
*[Explanation – ½ **Mark**, Stating the three components – ½ **Mark each**]*

Three Marks Questions

1. Explain three basic elements of a communication system.
Ans: *Refer Q.1.*

2. Explain the terms:
   i. Transducer ii. Repeater
   iii. Amplification
Ans: *Refer Q.4.*

3. Explain different types of carrier waves with diagram.
Ans: *Refer Q.16.*

4. Explain sky wave propagation with neat diagram.
Ans: *Refer Q.33.*

5. What is space wave propagation? Explain with diagram.
Ans: *Refer Q.31.*

Five Marks Questions

1. Explain the terms.
   i. Noise ii. Range
   iii. Attenuation iv. Carrier waves
   v. Demodulation
Ans: *Refer Q.5, Q.4 (iii).*

Board Questions

Theory:

1. Write a short note on space wave propagation. **[Oct 08]**
2. Explain in brief, types of wave propagation in space communication. **[Mar 09]**
3. State different types of wave propagation. Describe sky wave propagation in brief. **[Mar 11]**

Multiple Choice Questions

1. Basic components of a transmitter are
   (A) message signal generator and antenna
   (B) modulator and antenna
   (C) signal generator and modulator
   (D) message signal generator, modulator and antenna
2. The process of changing some characteristics of a carrier wave in accordance with the incoming signal is called
   (A) amplification (B) modulation
   (C) rectification (D) demodulation
3. The process of superimposing a low frequency signal on a high frequency wave is _____. **[Mar 16]**
   (A) detection (B) mixing
   (C) modulation (D) attenuation
4. A device that converts one form of energy into another form is termed as _____. **[Oct 13, Mar 17]**
   (A) transducer (B) transmitter
   (C) amplifier (D) receiver
5. A microphone which converts sound into electrical signal is an example of _____. **[July 18]**
   (A) a thermister
   (B) a rectifier
   (C) a modulator
   (D) an electrical transducer
6. The process of regaining of information from carries wave at the receiver is called _____. **[Mar 13]**
   (A) modulation (B) transmission
   (C) propagation (D) demodulation
7. Troposphere reflects the waves having frequencies from
   (A) 100 MHz to 200 MHz
   (B) 2 MHz to 30 MHz
   (C) 0 Hz to 20 KHz
   (D) 20 Hz to 20 KHz
8. Frequencies in the UHF range normally propagate by means of **(NCERT)**
   (A) ground waves (B) sky waves
   (C) surface waves (D) space waves
9. Tropospheric line-of-sight mode of propagation is used for the carrier frequencies
   (A) less than 30 MHz
   (B) less than 1600 kHz
   (C) greater than 30 MHz
   (D) less than 100 kHz
10. Range of communication can be increased by
   (A) increasing the heights of transmitting and receiving antennas.
   (B) decreasing the heights of transmitting and receiving antennas.
   (C) increasing height of transmitting antenna and decreasing the height of receiving antenna.
   (D) increasing height of receiving antenna only.
11. Ionosphere mainly consists of _____. **[Oct 15]**
   (A) positive ions and electrons
   (B) water vapour and smoke
   (C) ozone layer
   (D) dust particles
12. The reflected waves from the ionosphere are **[Mar 10, 18]**
   (A) ground waves.
   (B) sky waves.
   (C) space waves.
   (D) very high frequency waves.
13. Communication is the process of
   (A) keeping in touch.
   (B) exchanging information.
   (C) broadcasting.
   (D) entertainment.
14. The message fed to the transmitter are generally
   (A) radio signals (B) audio signals
   (C) both (A) and (B) (D) optical signals

15. Space wave propagation is suitable for radiowaves of frequency
(A) above 30 MHz
(B) upto 2 MHz
(C) from 2 MHz to 30 MHz
(D) from 2 KHz to 30 MHz

16. Line of sight propagation is also called as _____ propagation. **[Oct 14]**
(A) sky wave (B) ground wave
(C) sound wave (D) space wave

17. In space communication, the information can be passed from one place to another at a distance of 100 km in
(A) 1 s (B) 0.5 s
(C) 0.003 s (D) none of these

18. VHF radio signals are propagated _____.
(A) via ionosphere
(B) through troposphere
(C) along the ground
(D) via stratosphere

19. The original electrical information signal to be transmitted is called as _____.
(A) modulating signal
(B) base band signal
(C) carrier signal
(D) source signal

20. UHF is used in _____ scatter.
(A) tropospheric (B) stratospheric
(C) ionospheric (D) mesospheric

21. The ozone layer in the atmosphere absorbs
(A) only the radiowaves.
(B) only the visible light.
(C) only the γ rays.
(D) X-rays and ultraviolet rays.

22. From earth's surface, ionospheric layer of atmosphere lies between _____. **[July 16]**
(A) 12 km to 50 km
(B) 50 km to 80 km
(C) 80 km to 400 km
(D) 400 km to 700 km

23. In which region does temperature decrease with height?
(A) Troposphere (B) Ionosphere
(C) Stratosphere (D) Ozone layer

24. Modern communication systems consist of
(A) electronic systems
(B) electrical system
(C) optical system
(D) all of these

25. What determines the absorption of radiowaves by the atmosphere?
(A) Frequency
(B) Polarisation
(C) Interference
(D) Distance of receiver

26. The portion of the atmosphere closest to the earth's surface is _____.
(A) troposphere (B) stratosphere
(C) mesosphere (D) ionosphere

27. An antenna behaves as resonant circuit only when its length is
(A) $\lambda/2$ (B) $\lambda/4$
(C) λ (D) $n\,\lambda/2$

28. Space wave travels through _____.
(A) ionosphere (B) mesosphere
(C) troposphere (D) stratosphere

29. Transmission lines start radiating
(A) at low frequencies.
(B) at high frequencies.
(C) at both high and low frequencies.
(D) none of the above.

30. The maximum distance upto which TV transmission from a TV tower of height 'h' can be received is proportional to
(A) $h^{1/2}$ (B) h (C) $h^{3/2}$ (D) h^2

31. Which of the following frequency/frequencies will be suitable for beyond the horizon communication using sky waves? **(NCERT)**
(A) 10 kHz (B) 10 MHz
(C) 1 GHz (D) 1000 GHz

32. If 'h_t' and 'h_r' are height of transmitting and receiving antennae and 'R' is radius of the earth, the range of space wave is
(A) $\sqrt{2R}\,(h_t + h_r)$ (B) $2R\sqrt{(h_t + h_r)}$
(C) $\sqrt{2R(h_t + h_r)}$ (D) $\sqrt{2R}\left(\sqrt{h_t} + \sqrt{h_r}\right)$

33. In a communication system, noise is most likely to affect the signal _____.
(A) at the transmitter
(B) in the transmission medium
(C) in the information source
(D) at the destination

34. What is the modulation index of an over modulated wave?
(A) 1 (B) Zero (C) < 1 (D) > 1

35. In which frequency range, space waves are normally propagated?
(A) HF (B) EHF
(C) UHF (D) SHF

36. If f_a and f_f represent the carrier wave frequencies for amplitude and frequency modulations respectively, then
(A) $f_a > f_f$ (B) $f_a < f_f$
(C) $f_a \approx f_f$ (D) $f_a \geq f_f$

37. The power radiated by linear antenna of length 'l' is proportional to (λ = wavelength) **[Mar 15]**
(A) $\frac{\lambda}{l}$ (B) $\left(\frac{\lambda}{l}\right)^2$ (C) $\frac{l}{\lambda}$ (D) $\left(\frac{l}{\lambda}\right)^2$

38. For efficient radiation and reception of signal with wavelength λ, the transmitting antennas would have length comparable to _____. **[July 17]**
(A) λ of frequency used
(B) $\lambda/2$ of frequency used
(C) $\lambda/3$ of frequency used
(D) $\lambda/4$ of frequency used

Answers to Multiple Choice Questions

1.	(D)	2.	(B)	3.	(C)	4.	(A)
5.	(D)	6.	(D)	7.	(A)	8.	(D)
9.	(C)	10.	(A)	11.	(A)	12.	(B)
13.	(B)	14.	(B)	15.	(A)	16.	(D)
17.	(D)	18.	(B)	19.	(A)	20.	(A)
21.	(D)	22.	(C)	23.	(A)	24.	(D)
25.	(A)	26.	(A)	27.	(D)	28.	(C)
29.	(B)	30.	(A)	31.	(B)	32.	(D)
33.	(B)	34.	(D)	35.	(C)	36.	(B)
37.	(D)	38.	(D)				

Hints to Multiple Choice Questions

8. Frequencies in the UHF range (≈ few GHz) normally propagate by means of space wave.

31. Choice (B) is correct. This is because 10 kHz cannot be radiated due to large antenna size. 1 GHz and 1000 GHz will penetrate.

TOPIC TEST

Total : 25 Marks

Section A (1 × 5 = 5 Marks)

Choose the correct alternative.

1. The outermost layer of the earth's atmosphere is _____.
(A) stratosphere (B) mesosphere
(C) troposphere (D) ionosphere

2. Ionosphere contains
(A) only neutral molecules.
(B) only positive ions.
(C) only free electrons.
(D) mixture of neutral molecules, positive ions and equal number of free electrons.

3. Ground wave is propagated over long distance for the frequencies from
(A) 100 Hz to 300 kHz
(B) 30 kHz to 1600 kHz
(C) 30 kHz to 300 kHz
(D) 30 MHz to 300 MHz

Answer the following.

1. What is angle of radiation?
2. What is a signal?

Section B (2 × 3 = 6 Marks)

1. Explain bandwidth of transmission media?
2. Why original low frequency base band signal is translated into high frequency wave before transmission?
3. Plot amplitude versus ω curve for an amplitude modulated signal.
OR
3. What is modulation index? Give formula.

Section C (3 × 3 = 9 Marks)

1. What are the difficulties in transmitting signal directly?
2. Explain demodulation of AM waves with diagram.
3. Define and explain ground wave propagation.
OR
3. Explain
i. Troposphere ii. Stratosphere

Section D (5 × 1 = 5 Marks)

1. What is modulation? Explain different types of modulation with graph.
OR
1. Explain the production of amplitude modulation with a neat labelled diagram.