According to new syllabus of all intermediate boards of Sindh.

Prof. Rawala's .....

PHYSICS

HELPING BOOK

For
Class XI
(All science students)

UNIT -14

Communction.

Notes .... (03)
Multiple choice questions **M.C.Qs.** ..... . (08)

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- **Amplitude modulation (AM), Advantages/disadvantages of AM- modulation.**
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Thoroughly revised and updated 2026 – 2027

- ***Detailed notes.***
- ***Multiple Choice Questions (M.C.Q's).***
- ***Solution of text book numericals.***
- ***MCQs and solution of numericals from Karachi board past papers.***

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Unit.14.....

Communication

Communication:

Communication is the exchange of information between two or more bodies. Modern telecommunication may be **wired** or **wireless**.
Massages are transmitted using electromagnetic waves by an antenna (**transmitter antenna**) at one end and are received by another antenna at the other end. Message may be voice message, video, voice message etc.

Wave length of waves (λ):

It is the distance between two consecutive crests or troughs of a wave.
S.I unit is **m**.

Frequency of waves (f):

It is the number of waves passing through a point in one second.
S.I unit is **Herz Hz**.

Relation between f and λ:

Wave length "λ" of a wave is inversely proportional to its frequency "f". (higher the frequency shorter is the wave length and vice versa)

$$\lambda \propto \frac{1}{f}$$

λf = speed v of a wave

Since all electromagnetic waves, including radio waves, travel with speed of light "c", therefore,

$$\boxed{\lambda f = c}$$ ($c = 3 \times 10^8$ m/s, actually it is 2.98×10^8 m/s)

Energy "E" of a wave depends upon its frequency "f". High frequency waves are more **energetic** (High frequency and therefore, high energy waves are of **short** wave length).

***Q.No.1*: *What are fiber optics*?**

Fiber optics:

A fiber optic cable consists of a large number of very thin glass or plastic strands bundled together inside a strong insulating pipe.
A single fiber can carry thousands of telephone calls at the same time.

Working: First of all any signal in the form of electromagnetic waves, to be transmitted through an optic fiber, is converted into **coded light signals**. These light signals are coded with information to be transmitted. These coded light signals travel through the fiber cable undergoing **total internal reflection** whenever it touches sides of the cable, thus always remaining in the middle. Since these are now in the form of light signals they travel with a very high speed (close to speed of light).

There is **minimum energy loss** in signals to be transmitted in fiber cables as compared to copper wires and the method of transmission is **cost effective** also.

***Radio waves*:**

Radio waves are the **longest wave length**, **lowest frequency** and hence of **lowest energy** electromagnetic waves. Since radio waves are lowest energy waves therefore, they are non-ionizing electromagnetic waves.

In radio communication radio waves are emitted in all directions by **transmitter antenna**. These transmitted radio waves are received by another antenna called **receiver antenna**.

Length of receiving antenna must be about one fourth ($\lambda/4$) of wave length "λ" of signal waves.

Data signal waves, such as radio waves, TV waves, sound, music etc. are of few kHz. frequency, ***in other words***, they are basically long wave length signals. Their wave length is usually such that at the receiving side a very long receiving antenna will be required, which is not practical. Besides such signals cannot be sent efficiently over long distances. Hence before transmission these signals are **modulated**. (see modulation)

***Microwaves*:**

Microwaves are **electromagnetic waves** having frequency range of 1GHz to 300 GHz. These electromagnetic waves due to their short wave length, higher frequency (more energy) are widely used for transmitting signals over long distances even through space. These signals can not pass through or around large solid obstacles, such as mountains elc. Because of their relatively short wave length they can be received by small sized antenna.

They are widely used in radar systems.

***Satellite communication*:**

Satellites revolving around the earth at suitable heights, are used for long distance communication. The path at a suitable height around the earth where the satellite revolves is called its **orbit**. Three satellites placed at different locations, in suitable orbit separated from each other by a suitable distance can cover most populated part of our beautiful little earth.

Satellites are used to keep track of weather conditions, for communication, for civil and military use, for global mobile communication etc. Now a days GPS (Global Positioning System) has become a simple daily life application of satellite communication.

Q.No.2*: *What are data or signal waves?

***Data or signal waves*:**

Waves which carry voice messages, music, speeches, videos, in general any type of data are called ***signal waves*** or ***data signals***.

Data or signal waves are usually of low frequency hence of long wavelength.

***Type of data signals*:**

Data signals are basically of two types:

(1) **Analog signals**. Analog signals are basically in the form of electromagnetic waves.

(2) **Digital signals**. Digital signals are basically in the form Binary digits (which means that there are two digits). Hence binary system needs only two digits 0 and1, 1 bit is equal to either of these two numbers (0 or 1), and any data can be represented by the

combination of these two numbers. Whereas 1 byte = 8 bits. (it means that 1 byte will have 00001111).

Digital signals are used in modern devices such as computers, mobile phones, internet, Wi Fi, satellite communication etc.

***Basic memory units*:**

Memory units are the standard units to calculate the size of data.

Binary system is used in a computer. In binary system there are two units either 0 or 1, each of them is called a **bit**,

Smallest unit in computer memory is a **bit (b)**,

8 bits make a **Byte (B).** Hence.

1 Byte (B) = 8 bits (b)
1 Kilo Byte (KB) = 1024 Bytes
1 Megabyte (MB) = 1024 KB
I Giga byte (GB) = 1024 MB
1 Terabytes (TB) = 1024 GB
1 Petabytes (PB) = 1024 TB

These memory units tell you about size of memory or the size of data storing capacity of a computer device.

Q.No.3*: *What are carrier waves?

***Carrier waves*:**

Waves that carry **signal or data waves** over long distances are called **carrier waves**. Carrier waves carry signal (data) waves after a process called **modulation**.

Frequency of carrier waves is much **higher** than the frequency of signal waves. Since energy of a wave depends upon its frequency therefore, carrier waves are **high energy waves** and, therefore, they can travel long distances with a very small loss of energy. Besides they also **reduce** size of receiving antenna.

Q.No.4*: *What is modulation?

***Modulation*:**

The process of super-imposing the data signal over the carrier wave to change its **amplitude**, **frequency** or **phase** is called **modulation**.

Modulation changes a particular characteristic of a carrier wave while keeping the other characteristics constat.

Modulation can be done with both analog and digital information signals.

Q.No.5*: *Why is modulation needed?

***Need for modulation*:**

- **To transmit the signal over long distances**. Signel waves are low frequency

waves. Low frequency signals cannot be transmitted over long distances. In modulated signal high frequency carrier wave (having more energy) caries the data signal to long distance.

- **To reduce the size of receiving antenna**. Since data signal is of low frequency,

therefore, its wavelength will be long. To receive a long wavelength signal longmreceiving antenna is needed (practically not feasible). In modulated signal carrier wave is of high frequency and small wavelength therefore, small sized receiving antenna will be needed.

- **Avoid mixing of signals**.

***Types of modulation*:**

Depending upon the modification basically there are three types of modulations:
(1) Amplitude modulation (AM).
(2) Frequency modulation (FM).
(3) Phase modulation.

- ❖ In **amplitude modulation** only the amplitude of the carrier wave is changed, whereas its frequency and phase remain unchanged.
- ❖ In **frequency modulation** only the frequency of the carrier wave is changed, whereas its amplitude and phase remain unchanged.
- ❖ In **phase modulation** only phase of the carrier wave is changed, whereas its amplitude and frequency remain unchanged.

***Q.No.6*: *What is amplitude modulation*?**

***Amplitude modulation (AM)*:**

The process of super-imposing the data signal over the carrier wave to change the amplitude is called **amplitude modulation (AM)**.

In amplitude modulation (AM), amplitude of carrier wave is changed corresponding to the data signal wave.

Carrier wave after modulation is called **modulated wave**.

Amplitude of the carrier wave at the crest of modulated wave is strongest and weakest at the trough of modulated wave.

Frequency of modulated wave remains equal to the **frequency of signal** wave only its **amplitude changes**.

***Q.No.7*: *What are the advantages/disadvantages of amplitude modulation*?**

***Advantages/disadvantages of AM- modulation*:**

- ❖ Frequency range of AM is **much lower** than the frequency range of FM, due to this reason AM covers **larger area**. This is the reason why most news stations use AM, so that any news can reach lager population living is large area.
- ❖ AM signals are **easily affected** by noise because noise affects amplitude, as a result of which we hear static.

***Q.No.8*: *What is frequency modulation*?**

***Frequency modulation (FM- modulation)*:**

The process of super-imposing the data signal over the carrier wave to change its frequency is called **frequency modulation (FM)**.

In frequency modulation (FM), frequency of carrier wave is changed according to frequency of data signal wave.

Frequency of the carrier wave at the crest of modulated wave is highest and lowest at the trough of modulated wave.

Amplitude of modulated wave remains equal to the amplitude of signal wave only the **frequency changes**.

Q.No.9*: *What are the advantages/disadvantages of frequency modulation?

***Advantages/disadvantages of FM- modulation*:**

- FM frequency range is **much higher**, therefore it can carry **more date** than AM.
- Effect of interference (such as of noise) on FM signal is **very small** as a result of which there is **no static effect** on FM broadcast.
- Due to the above two reasons FM radio has better **sound quality**.

Q.No.10*: *What are the advantages of transmission in digital form over analog form?

Transmission in digital form has many advantages over transmission in analog form, such as it has less noise and distortion, it has maximum security, digital signals can be stored and retrieved more accurately etc.

Section–A Multiple-Choice Questions MCQs:

Q.No.1: In radio and television broadcast, the information signal is in the form of:
(A) analog signal. (B) digital signal.
(C) Both analog and digital signals.
(D) neither analog nor digital signal.

Q.No.2: A communication channel consists of:
(A) Transmission line only.
(B) Optical fiber only.
(C) Free space only.
(D) All of them.

Q.No.3: Voltage signal generated by a microphone is:
(A) Digital in nature. (B) Analog in nature.
(C) Hybrid in nature.
(D) Consists of bits and bytes.

Q.No.4: As compared to sound waves frequency of radio waves is:
(A) Higher. (B) Equal.
(C) Lower. (D) may be higher or lower.

Q.No.5: The process of superimposing signal frequency on the carrier wave is known as:
(A) Transmission. (B) Detection.
(C) Reception. (D) Modulation.

Q.No.6: What is the frequency range of signals that can be transmitted in case of twisted pair of wires.
(A)10MHz. to 15MHz. (B) 5 MHz. to 10MHz.
(C)100MHz. to 5MHz. (D)10 Hz. to 100Hz.

Q.No.7: The maintenance of a satellite's orbital position is called:
(A)Maintenance keeping. (B)Station keeping.
(C) Station maintenance. (D) altitude control.

Q.No.8: Process of mapping the sampled analog voltage values to discrete voltage levels is called:
(A) Sampling. (B) Sampling frequency.
(C) Quantizing. (D) Encoding.

Q.No.9: AM is used for broadcasting because:
(A) It requires less transmitting power compared with other systems.
(B) It is more noise immune than other modulation systems.
(C) No other modulation can provide the necessary bandwidth faithful transmission.
(D) Its use avoids receiver complexity.

Q.No.10: Data in compact disc is stored in the form of:
(A) Analog signal. (B) Digital signal.
(C) Noise. (D) Both (A) and (B).

Q.No.11: The process of superposing signal frequency onto carrier wave is called: (***2025 Karachi Board***)
(A) Modulation. (B) Detection.
(C) Transmission. (D) Reception.

Q.No.12: The nature of voltage signal generated by a microphone is: (***2026 Karachi Board***)
(A) Digital. (B) Analog.
(C) Hybrid. (D) Modulated.

***Answers*:**

(1) (A) analog signal.
(2) (D) All of them.
(3) (B) Analog in nature.
(4) (A) Higher.
(5) (D) Modulation.
(6) (C)100MHz. to 5MHz.
(7) (B)Station keeping.
(8) (C) Quantizing.
(9) (C) No other modulation can provide the necessary bandwidth faithful transmission.
(10) (B) Digital signal.
(11) (A) Modulation.
(12) (B) Analog.

Read this .....

Gamma (γ-) rays are highly penetrating nuclear radiations emitted by excited nuclei. They interact with matter in variety of ways. These nuclear radiations can be used for peace full as well as for destructive purposes. Their destructive power is evident from the after effects of atomic bomb blasts carried out during World War II.

Gamma rays break cells and tissues of living organisms. This behavior of Gamma rays is used for the treatment of cancer and other kind of tumors formed at inaccessible parts of the body, such as those formed in and around the brain. The machine used for this purpose is called Gamma knife.

First of all location of the tumor is determined precisely by scanning the brain and then with the help of a high tech. computer a large number of gamma ray beams of low intensity are focused at the tumor.

These beams, obtained from more than about 200 cobalt-60 sources are of low intensity, if focused accurately at the tumor they do not have much appreciable adverse effect on the brain and the surrounding nerves and tissues. Only at the tumor as a target, where they all converge, they have power high enough to destroy it. Tumor cells after being destroyed change into other products, which are carried away by the circulating blood.

This method of treatment is most effective for small sized tumors. When gamma rays are focused (just like focusing of light by a convex lens) it affects cells in the central part of the tumor. If the tumor is of large size then to destroy all the tumor cells, either gamma ray focusing must be repeated several times at different parts of the tumor or conventional surgery must be preferred. Conventional surgery involving the brain is very dangerous, because in this case patient's life is at stake. Even if it is performed properly, in case of a tumor, called acoustic neuroma there is a risk of about 70% negative to a nerve called facial nerve. This nerve controls various functions of half (right or left) of our face. If this nerve is destroyed /weakened the corresponding side of face is paralyzed /deformed. Moreover there are many other side effects.

Patient recovers (partially) from these side effects, after several months, with his /her strong will power.

Prof. M.H.Rawala

***A piece of advice to students*:**

Dear students your examination paper comprises of a number of ***numericals/problems***. For high scoring rate ***solve numericals*** from text book as well as from last several year's board papers. Try to ***understand*** the theoretical background of each. Do real good practice. Do not take any chance. Hard work with systematic approach, courage and determination always pays.

College years are a turning point of your life*!!!*