Short Answer Questions – I (PYQ)

Q. 1. Write the functions of the following in communication systems:

(i) Modulator,

(ii) Demodulator [CBSE (AI) 2014]

Ans. (i) Modulator: It is a device in which amplitude of a high frequency carrier wave is made to change in accordance with the amplitude of message/information signal during superposition.

(ii) Demodulator: It is a device used to retrieve information/message signals from the carrier wave at the receiver.

Q. 2. Explain the terms (i) Attenuation and (ii) Demodulation used in Communication System. [CBSE Delhi 2016]

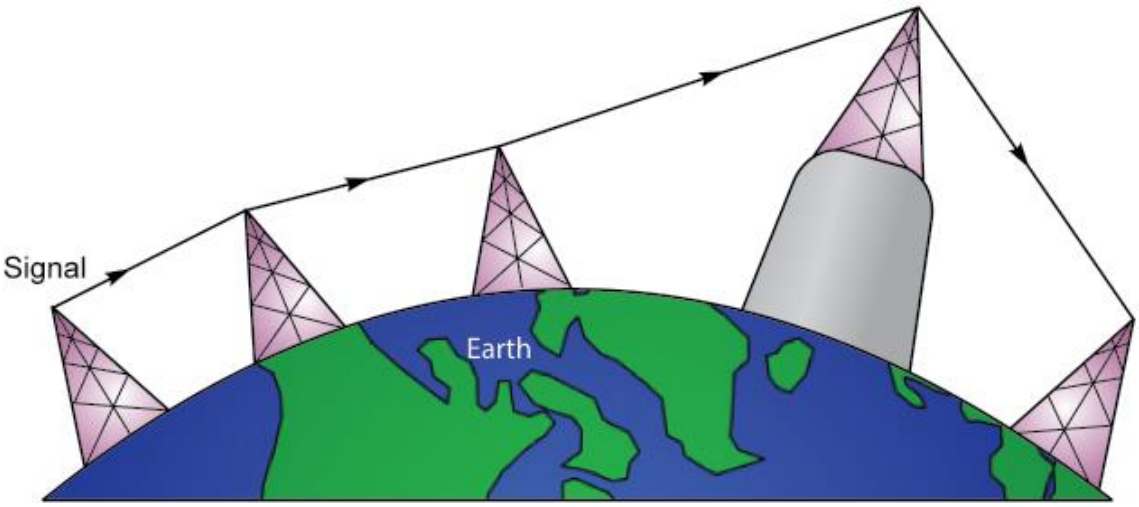
Ans. Attenuation: The loss in strength of a signal while propagating through a medium is known as attenuation.

Demodulation: The process of retrieval of information, from the carrier wave at the receiver end is called demodulation. This is the reverse process of modulation.

Q. 3. Explain the function of a repeater in a communication system. [CBSE (F) 2011, Delhi 2010]

Ans. Functions of a Repeater: A repeater is a device which picks up a signal from the transmitter, amplifies it and transmits it to the receiver. Repeaters are used to increase the range of communication of signals.

A typical example of repeater station is a communication satellite.



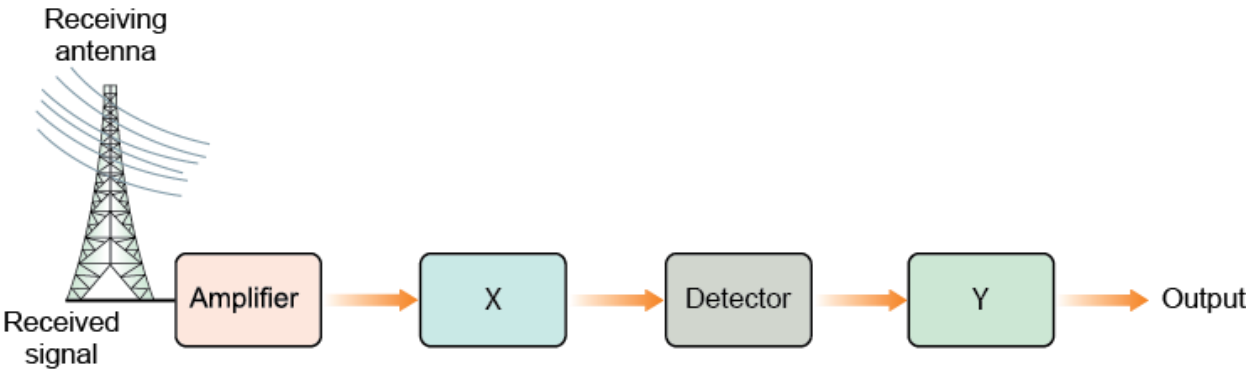
Q. 4. Which basic mode of communication is used in satellite communication? What type of wave propagation is used in this mode? Write, giving reason, the frequency range used in this mode of propagation. [CBSE Delhi 2017]

Ans. The basic mode of communication used in satellite communication is point to point broadcast communication.

Space wave propagation is used in this mode. Frequency range of this mode of propagation is above 40 MHz.

This is because the electromagnetic wave of frequencies above 40 MHz are not reflected back by the ionosphere but penetrate through it and escape.

Q. 5. In the given block diagram of a receiver, identify the boxes labelled as X and Y and write their functions. [CBSE Delhi 2013, (AI) 2012]



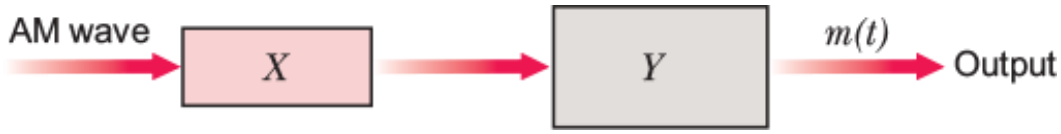
Ans. Here, X→ IF stage (Intermediate Frequency stage)

Its function is to change the carrier frequency to lower frequency.

Y→ Amplifier

Its function is to amplify the signal because the detected signal may not be strong enough to use by the user.

Q. 6. Figure shows a block diagram of a detector for amplitude modulated signal. Identify the boxes 'X' and 'Y' and write their functions. [CBSE (F) 2012]



Ans. Here X → Rectifier

Y → Envelope detector

Rectifier: It allows only the positive half of the AM input wave to go onwards.

Envelope Detector: It separates the message signal from the carrier wave.

Q. 7. (i) Which mode of propagation is used by shortwave broadcast services having frequency range from a few MHz upto 30 MHz? Explain diagrammatically how long distance communication can be achieved by this mode.

(ii) Why is there an upper limit to frequency of waves used in this mode? [CBSE Central 2016]

Ans. (i) Sky wave propagation is used by short wave broadcast services.

Long distance communication can be achieved by reflection of radio waves by the ionosphere, back towards the Earth. This ionosphere layer acts as a reflector only for a certain range of frequencies. (3 MHz to 30 MHz)

(ii) Electromagnetic waves of frequencies higher than 30 MHz, penetrate the ionosphere and escape whereas the waves less than 30 MHz are reflected back to the earth by the ionosphere.

For Fig. refer to Basic Concepts 6.

Q. 8. What is the range of frequencies used for T.V. transmission? What is common between these waves and light waves? [CBSE Delhi 2010]

Ans. Range of frequencies used in TV transmission is 76 MHz–88 MHz and 420 MHz–890 MHz.

Similarity: Speed of waves is same for both TV waves and light waves.

Q. 9. Distinguish between 'point to point' and 'broadcast' communication modes. Give one example of each. [CBSE (F) 2016, 2017]

Ans. Point to Point Communication: The communication which takes place over a link between a single transmitter and receiver is called point to point communication mode. Telephone is an example of such a system.

Broadcast Mode: In such a mode, large number of receivers is linked to a single transmitter. Example: Radio, Television.

Q. 10. Answer the following questions:

(i) What is the line of sight communication?

(ii) Why is it not possible to use sky waves for transmission of TV signals? Upto what distance can a signal be transmitted using an antenna of height 'h'? [CBSE Delhi 2017]

Ans. (i) Communication using waves which travel in straight line from transmitting antenna to receiving antenna is line of sight communication.

(ii) This is because TV signal waves are not reflected back by the ionosphere.

Coverage range of an antenna, d = $\sqrt{2hR}$.

Q. 11. Why is communication using line of sight mode limited to frequencies above 40 Mhz? [CBSE Delhi 2010]

Ans. The line of sight (LOS) mode is limited to frequencies above 40 MHz, because at these frequencies antennas are relatively smaller and can be placed at heights of many wavelengths above the ground.

The direct waves can get blocked by curvature of earth. If the signal is to be received beyond horizon, then the receiving antenna must be high enough to intercept the line of sight waves.

Q. 12. Distinguish between 'sky wave' and 'space wave' modes of propagation. Why is the sky wave mode of propagation restricted to frequencies upto 40 MHz? [CBSE Bhubaneshwar 2015]

Ans.

S.No.	Sky Wave	Space Wave
(i)	In this mode, the waves are achieved by the ionospheric reflection.	In this mode, the waves travels in straight line from transmitting antenna to the receiving antenna.
(ii)	Frequency range from few MHz upto 30 to 40 MHz.	The same frequency (or any frequency) are used for LOS communication.
(iii)	Electromagnetic waves of frequencies higher than 30 MHz penetrate the ionosphere and escape.	Electromagnetic waves above 40 MHz are used in satellite communication.
(iv)	Electromagnetic waves follow total internal reflection at any layer of ionosphere.	In satellite communication the em waves do not follow total internal reflection at any stage in the space.

The electromagnetic waves of frequency greater than 40 MHz penetrate the ionosphere and escape. So sky wave mode is restricted upto 40 MHz.

Q. 13. A transmitting antenna at the top of a tower has a height of 32 m and the height of the receiving antenna is 50 m. What is the maximum distance between them, for satisfactory communication in LOS mode? (Radius of earth = 6400 km). [CBSE Delhi 2010]

Ans. Given h_T = 32 m, h_R = 50 m, and R_e = 6400 km = 6.4×10^6 m.

Maximum LOS distance, $d_m = \sqrt{2R_e h_T} + \sqrt{2R_e h_R}$

$$\sqrt{2R_e}(\sqrt{h_T} + \sqrt{h_R})$$

$$= 3.578 \times 10^3 \left(5.66 + 7.07\right)$$

$$= 3.578 \times 10^3 \times 12.73 \text{ m}$$

$$= 45.5 \times 10^3 \text{ m} = \mathbf{45.5 \text{ km}}$$

Q. 14. For an amplitude modulated wave, the maximum amplitude is found to be 10V while the minimum amplitude is 2V. Calculate the modulation index. Why is modulation index generally kept less than one? [CBSE (F) 2011]

Ans. A_{max} = 10V, A_{min} = 2 V

$$\text{Modulation index} = \frac{A_{max} - A_{min}}{A_{max} + A_{min}} = \frac{10 - 2}{10+2} = \frac{8}{12} = 0.67$$

Generally, the modulation index is kept less than one to avoid distortion.

Short Answer Questions – I (OIQ)

Q. 1. Give the frequency ranges of the following:

(i) High frequency band (HF)

(ii) Very high frequency band (VHF)

(iii) Ultra-high frequency band (UHF)

(iv) Super-high frequency band (SHF)

Ans. (i) High frequency band : Range is 3 MHz to 30 MHz.

(ii) Very high frequency band : Range is 30 MHz to 300 MHz.

(iii) Ultra-high frequency band : Range is 300 MHz to 3000 MHz.

(iv) Super-high frequency band : Range is 3000 MHz to 30,000 MHz.

Q. 2. The maximum amplitude of an A.M. wave is found to be 15V while its minimum amplitude is found to be 3V. What is the modulation index? [NCERT Exemplar]

Ans. $A_c + A_m = 15$ and $A_c - A_m = 3$

$2A_c = 18$, $2A_m = 12$

$$m = \frac{A_m}{A_c} = \frac{6}{9} = \frac{2}{3}$$

Q. 3. Which of the following would produce analog signals and which would produce digital signals?

(i) A vibrating tuning fork.
(ii) Musical sound due to a vibrating sitar string.
(iii) Light pulse
(iv) Output of NAND gate. [HOTS] [NCERT Exemplar]

Ans. (i) Analog,

(ii) Analog,

(iii) Digital,

(iv) Digital

Q. 4. Would sky waves be suitable for transmission of TV signals of 60 MHz frequency?
[HOTS] [NCERT Exemplar]

Ans. No, signals of frequency greater than 30 MHz will not be reflected by the ionosphere, but will penetrate through the ionosphere.

Q. 5. 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?
[HOTS] [NCERT Exemplar]

Ans. The refractive index increases with increase in frequency which implies that for higher frequency waves, angle of refraction is less, i.e., bending is less. Hence, the condition of total internal reflection is attained after travelling larger distance (by 3MHz wave).