

Class: 12
Subject: Physics
Topic: Communication Systems
No. of Questions: 20

1. What is remote control? How has it been used in T.V. working? Name the main types of remote control receivers.

Sol.

Remote control is an electronic device which helps the observer to operate the television from a distance without leaving his or her seat. In a remote control, there are three main units.

A transmitting unit; Which transmits the command signal, (ii) a frequency controller, which selects the suitable frequency for a particular function to be performed and (iii) a mechanical drive or electronic colour unit, which changes the volume or colour according to the signal

There are two main types of remote control receivers; (i) Electro-mechanical system (ii) Electronic system.

2. What do you understand by AM range of radio communication? Can these waves pass through atmosphere?

Sol.

The electromagnetic waves of frequency less than 30 MHz (or wavelength 10 m or more) form amplitude modulated range (i.e. A.M. range). These waves more or less can pass through the lower atmosphere of the earth. But these waves are reflected back by the topmost layer of the atmosphere, the ionosphere.

3. Is it necessary to use satellite for long distance T.V. transmission? Give reasons.

Sol.

The T.V. transmission involves the television signal waves having the frequency range 80 MHz to 200 MHz. These waves neither follow the curvature of earth nor get reflected by ionosphere. Therefore, their communication via sky wave is not possible. The reception of television signals is possible either

- (i) By using communication geostationary satellite which reflects the television signals back to earth or
- (ii) By using tall receiver antenna which may directly intercept the signals.

4. Why is communication using line of sight mode limited to frequencies above 40 MHz?

Sol.

At frequencies above 40 MHz, communication is limited to line-of sight communication. At these frequencies, the sizes of transmitting and receiving antennas are relatively smaller and can be placed at heights of many wavelengths above the ground. During line of sight communication, the waves coming directly from transmitting antenna towards receiving antenna get blocked at some point by the curvature of the earth.

5. Would sky waves be suitable for transmission of TV signals of 60 MHz frequency?

Sol.

No, because the TV signal of frequency 60 MHz is greater than 40 MHz (i.e., the upper limit of signal frequency for sky wave propagation). Therefore T.V. signal will not be reflected by the ionosphere but will penetrate through the ionosphere.

6. Explain that microwaves are better carriers of signals than radio waves?

Sol.

Microwaves are the electromagnetic waves of wavelength of the order of a few millimeters, which is less than those of T.V. signals. On account of smaller wavelength, the microwaves can be transmitted as beam signals in a particular direction, much better than radiowaves because microwaves do not spread or bend around the corners of any obstacle coming in their way. Therefore, microwaves are better carriers of signals than radio waves.

7. Ground/surface wave propagation is a mode of propagation in which the signal wave glides over the surface of earth, while going from transmitter to receiver. In this mode, there is a loss of power (i.e., attenuation) of signal wave due to diffraction and absorption of signal wave energy by ground. The attenuation of ground/surface wave signal increases very rapidly with the increase in its frequency. Therefore, the ground/surface wave propagation is not suitable for the propagation of high frequency signal wave and for very long range communication.

Read the above passage and answer the following questions:

- (i) What is the frequency range of a signal wave employed for the ground wave propagation?
- (ii) For what purpose the ground wave propagation is used?
- (iii) What does the study of ground wave propagation imply in day to day life?

Sol.

- (i) For ground wave propagation, the frequency range of signal wave is 530 kHz to 1710 kHz.

- (ii) The ground wave propagation is used for local broadcasting as a medium wave broadcast service.
- (iii) In day to day life, the ground wave propagation can be compare, to the movement of a small child along the surface of ground. As child can go only upto certain distance on ground and gets exhausted, similarly the ground wave frequency signal loses its energy while gliding over the surface of earth and hence can go up to limited distance. As ground wave propagation is for local broadcasting, similarly, the small child movement is confined within home under the supervision of some elders.

8. Satellite communication is a mode of communication of signal between transmitter and receiver through satellite. The satellite communication is like the line of sight microwave communication. A communication satellite is a space craft placed in an orbit around the earth provided with microwave transmitting and receiving equipment called Radio transponder. The range of microwave frequency used in satellite communication for uplink is 5.925 GHz to 6.425 GHz and for downlink is 3.7 GHz to 4.2 GHz.

Read the above passage and answer the following questions:

- (i) How is the line of sight microwave communication possible through satellite?
- (ii) Why can't a single satellite cover the whole earth for microwave communication?
- (iii) What is the practical utility of satellite communication?

Sol.

- (i) The line of sight communications stands for the transmitter and receiver in sight of each other. The line of sight microwave communication is possible if the communication satellite is always at a fixed location with respect to earth i.e., the satellite which is acting as a radio transponder must be at rest with respect to earth. It is so for a satellite known as geo-stationary satellite.
- (ii) A single satellite cannot cover the whole earth because, the large part of the earth is out of sight due to curvature of the earth. The satellite communication is like the line of sight communication.
- (iii) In order to have microwave communication link over the entire globe of earth, at least three geostationary satellites are required, which are 120° apart from one another. The satellite communication is also used effectively in mobile communication especially in remote hilly areas. It is highly economical compared to other communication systems.

9. What is an active satellite? How is it different from a passive satellite?

Sol.

Active satellite is that satellite which carries equipment like antenna system, power supply, receiver and transmitter. It receives the UHF or microwave signal from the earth station,

processes it, amplifiers it and then retransmits it towards earth at different frequency. Thus active satellite works as an active microwave repeater in the sky, called transponder.

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

Sol.

In amplitude modulation, the instantaneous voltage of carrier waves is varied by the instantaneous voltage of modulating waves. On transmission through a channel noise signals can also be added, resulting a change in the amplitude of modulated waves. Due to it, the receiver receives the modulating signal having a part of noise.

However, in frequency modulation, the frequency of carrier waves is changed as per instantaneous voltage of modulating waves. This can only be done at the mixing or modulating stage and not while signal is transmitted in channel. Hence noise does not effect FM signal.

11. In a transistor amplifier,

- A. the power dissipated at the base-collector junction is much higher than that dissipated at the emitter-base junction
- B. the power dissipated at the base-collector junction is much lower than that dissipated at the emitter-base junction
- C. the power dissipated is the same at both the junctions.
- D. there is no power dissipation at any junction.

Right Answer Explanation:

The correct choice is (1) because then the output power is much greater than the input power.

12. In an npn transistor, the p-type crystal acts a

- A. base only
- B. emitter only
- C. collector only
- D. either base or emitter or collector

Right Answer Explanation:

The correct choice is (1).

13. In a transistor circuit, the collector current is 50 mA and the base current is 1 mA. The current gain α is

- A. $\frac{51}{50}$
- B. $\frac{50}{49}$
- C. $\frac{50}{51}$
- D. $\frac{49}{51}$

Right Answer Explanation:

Current gain $\beta = \frac{I_C}{I_B} = \frac{50}{1} = 50$. Therefore, current gain α is
 $\alpha = \frac{\beta}{1+\beta} = \frac{50}{1+50} = \frac{50}{51}$

Hence, the correct choice is (3).

14. In a transistor amplifier, the two ac current gains α and β as defined as $\alpha = \delta I_C / \delta I_E$ and $\beta = \delta I_C / \delta I_B$. The relation between α and β is

- A. $\beta = \frac{1+\alpha}{\alpha}$
- B. $\beta = \frac{1-\alpha}{\alpha}$
- C. $\beta = \frac{\alpha}{1-\alpha}$
- D. $\beta = \frac{\alpha}{1+\alpha}$

Right Answer Explanation:

We know that $I_E = I_C + I_B$ or $\delta I_E = \delta I_C + \delta I_B$. Dividing both sides by δI_C , we get

$$\frac{\delta I_E}{\delta I_C} = 1 + \frac{\delta I_B}{\delta I_C}$$

Or $\frac{1}{\alpha} = 1 + \frac{1}{\beta}$

Or $\beta = \frac{\alpha}{1-\alpha}$

15. In a semiconductor, it is found that $\frac{4}{5}$ th of the total current is carried by electrons and the remaining $\frac{1}{5}$ th by the holes. If at this temperature, the drift speed of electrons is 2.5 times that of holes, then the ratio of the number densities of electrons and holes is

- A.
- B. $\frac{8}{5}$
- C. $\frac{8}{25}$
- D. $\frac{25}{8}$

$\frac{1}{2}$

Right Answer Explanation:

$$n_e e v_e + n_h e v_h = I. \text{ Given}$$

$$\frac{n_e e v_e}{n_h e v_h} = \frac{4I/5}{I/5} = 4$$

or
$$\frac{n_e v_e}{n_h v_h} = 4 \text{ or } \frac{n_e}{n_h} = 4 \frac{v_h}{v_e} = \frac{4}{2.5} = \frac{8}{5}$$

Hence the correct choice is (1).

16. For a transistor, current gain $\alpha = 0.96$. It is used as an amplifier in a common base circuit with a load resistance of $4 \text{ K } \Omega$. If the dynamic resistance of the emitter-base junction is 48Ω , then the voltage gain is

- A. 40
- B. 80
- C. 120
- D. 160

Right Answer Explanation:

$$\text{Voltage gain} = \alpha \times \frac{R_L}{R_D} = 0.96 \times \frac{4000}{48} = 80.$$

17. A sample of n-type silicon

- A. contains an excess of free electrons, therefore it is negatively charged
- B. contains an excess of free electrons and it is electrically neutral
- C. predominantly contains trivalent impurities
- D. contains only tetravalent impurities

Right Answer Explanation:

The correct choice is (2).

18. The width of depletion region in a pn junction diode

- A. increases when a reverse bias is applied
- B. increases when a forward bias is applied
- C. decreases when a reverse bias is applied
- D. remains the same, irrespective of the bias voltage

Right Answer Explanation:

The correct choice is (1).

19. The dominant mechanisms for motion of charge carriers in forward and reverse biased silicon p-n junctions are

- A. drift in forward bias, diffusion in reverse bias
- B. diffusion in forward bias, drift in reverse bias
- C. diffusion in both forward and reverse bias
- D. drift in both forward and reverse bias.

Right Answer Explanation:

The correct choice is (2).

20. Which of the following statements is not true?

- A. The resistance of intrinsic semiconductors decreases with increase of temperature.
- B. Doping pure Si with trivalent impurities gives p-type semiconductors.
- C. The majority carriers in n-type semiconductors are holes.
- D. A p-n junction can act as a semiconductor diode.

Right Answer Explanation:

The correct choice is (3). The majority carriers in n-type semiconductors are electrons.

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