Chapter

15 COMMUNICATION SYSTEM

1. Languages and methods used in communication have kept evolving from prehistoric to modern times, to meet the growing demands in terms of….and…..of information

   (a) receive, sender (b) receiver, sender

   (c) speed, complexity (d) language, quality

2. Quality of transmission depends upon

   (a) nature of the medium only

   (b) nature of signal only

   (c) Both (a) and (b)

   (d) Neither (a) nor (b)

3. Which of the following project was undertaken by US defence department?

   (a) ETHERNET (b) ARPANET

   (c) INTERNET (d) INTRANET

4. Which of the following optical systems are superior and more economical as compared to traditional communication system?

   (a) Ray optical (b) Fibre optical

   (c) Wave optical (d) Light optical

5. Which type of communication system is used in Fax machine?

   (a) Binary (b) Analog

   (c) Hybrid (d) All of these

6. A device that converts some physical variable (pressure, displacement, force, temperature, etc.) into the corresponding variation in the electrical signal at its output is that

   (a) transducer (b) receiver

   (c) noise (d) transmitter

7. Signals are essentially single-valued function of

   (a) distance (b) dispacement

   (c) speed (d) time

8. Fading in the variation in the strength of a signal at a receiver is due to

   (a) interference of waves

   (b) diffraction of waves

   (c) polarization of waves

   (d) None of these

9. Which is the largest distance between a source and a destination upto which the signal is received with sufficient strength?

   (a) Bandwidth (b) Demodulation

   (c) Repeater (d) Range

10. Rectangular wave can be decomposed into a superposition of sinusoidal waves of frequencies are

    (a) $v_0, 3v_0, 6v_0, 9v_0 \ldots\ldots, nv_0$

    (b) $4v_0, 8v_0, 12v_0, 16v_0 \ldots\ldots, nv_0$

    (c) $v_0, 2v_0, 3v_0, 4v_0 \ldots\ldots, nv_0$

    (d) $2v_0, 4v_0, 6v_0, 8v_0 \ldots\ldots, nv_0$

11. Message signals are called

    (a) band signals

    (b) electronic signal

    (c) electromagnetic signals

    (d) baseband signals

12. How many signals, is a single frequency sinusoid?

    (a) Two bandwidth (b) No signal

    (c) One signal (d) Three signals

13. The radio waves frequency 80 MKHz of 300 MHz belong to

    (a) high frequency band

    (b) very high frequency band

    (c) ultra frequency band

    (d) super high frequency band

14. Communication through free space using…. Waves take place over a very wide range of frequencies: from a few hundreds of kHz to a GHz

    (a) gamma waves (b) microwaves

    (c) radio waves (d) None of these

15. For mobile communication to base station , the required frequency band is

    (a) 896-901 MHz (b) 896-901 kHz

    (c) 840-935 MHz (d) 840-935 kHz

16. Optical communication is performed in the frequency range of

    (a) 100 GHz (b) 2 THz to 1000 THz

    (c) 1 THz to 100Tz (d) Only 1000 THz

17. How much bandwidth, is required by an optical fibre for data transmission?

    (a) 100 GHz (b) 1000 GHz

    (c) 100 kHz (d) 1000 kHz

18. The range of frequency allotted for UHF TV Broadband is

    (a) 470-960 kHz (b) 47-960 MHz

    (c) 470-960 MHz (d) 174-216 MHz

19. The Cellular Mobile Radio wave of frequency 840-935 MHz belongs to

    (a) base station to mobile

    (b) mobile to base station

    (c) ultra high frequency

    (d) very high frequency

20. Which size of the antenna should have comparable to the wavelength λ of the signal, to radiate signals with high frequency?

    (a) Atleast $\sim \lambda/2$

    (b) Atleast $\sim \lambda/4$

    (c) At maximum $\sim \lambda/2$

    (d) At maximum $\sim \lambda/4$

21. The part of the ionosphere which exists during day and night time is

    (a) D – layer (b) E – layer

    (c) F_1 - layer (d) F_2 – layer

22. On which path, a space wave travels from transmitting antenna to the receiving antenna?

    (a) Parabola (b) Straight line

    (b) Circular path (d) Rectangular path

23. Line- of- Sight (LOS) communication is only possible when the frequency is

    (a) above 40 MHz

    (b) above 40 kHz

    (c) equal to 40 MHz

    (d) below 40 MHz

24. A transmitting antenna at the top of tower has a height 32 m and the height of the receiving antenna is 50 m. What is the maximum distance between them for satisfactory communication is LOS mode?

    (given, radius of earth $= 6.4 \times 10^6$ m)

    (a) 45.5 km (b) 4.55m

    (c) 45.5 m (d) 45.5 cm

25. Frequencies in the UHF range, normally propagate by means of

    (a) ground waves (b) sky waves

    (c) surface waves (d) space waves

26. A radar has a power of 1 kW and is operating at a frequency of 10 GHz . It is located on a mountain top of height 500 m. The maximum distance up to which it can detect object located on the surface of the earth(Radius of earth $= 6.4 \times 10^6 m$) is

    (a) 80 km (b) 16 km

    (c) 40 km (d) 64 km

27. The highest frequency of ratio waves which when sent at some angle towards the ionosphere, gets reflected from that and returns to the Earth is called

(a) critical frequency

(b) maximum usable frequency

(c) polarization of waves

(d) None of the above

28. A transmitting antenna of height 20 m and the receiving antenna of height h are separated by a distance of 40 km for satisfactory communication in line of sight mode. Then, the value of h is

(Given radius of the earth is 6400 km)

(a) 40 m (b) 45 m

(c) 30 m (d) 1140 km

29. A TV transmission tower antenna is at a height of 20 m. The percentage increase in area covered in case if the receiving antenna is at ground level to that at a height of 25 m is (Radius of earth $= 6.4 \times 10^6$ m)

(a) 248% (b) 348.9% (c) 150% (d) 360.2%

30 The area of the region covered by the TV broadcast by a TV tower of 100 m height is (radius of the earth$= 6.4 \times 10^6$m)

(a) 46.5 km (b) 45.5 km

(c) 42.75km (d) 35.77 km

31. What should be the length of the dipole antenna for a carrier wave of frequency $3 \times 10^8\ Hz$?

(a) 1 m (b) 1 cm (c) 0.5 m (d) 5 cm

32. A theoretical study of radiation from linear antenna (length l) shows that the power radiated is

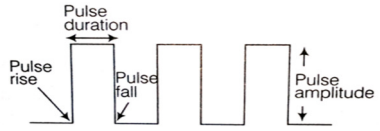
(a) Proportional to $(\lambda/l)^2$

(b) inversely proportional to $(l/\lambda)^2$

(c) Proportional to $(l/\lambda)^2$

(d) inversely proportional to $(l/\lambda)^2$

33. A figure shows the nature of wave is



(a) sinusoidal (b) pulses

(c) Both (a) and (b) (d) None of these

34. Choose the correct statements.

(a) In amplitude modulation, the amplitude of the high frequency carrier wave is made to vary in proportion to the amplitude of the audio signal

(b) In amplitude modulation, the frequency of the high frequency carrier wave is made ti vary in proportion to the amplitude of the audio signal

(c) In frequency modulation, the amplitude of the high frequency carrier wave is made to vary in proportion to the frequency of the signal.

(d) In frequency modulation, the amplitude of the high frequency carrier wave is made to vary in proportion to the frequency of the audio signal

35. To avoid distortion modulation index μ is kept.

(a) < 1 (b) > 1 (c) $= 1$ (d) ≤ 1

36. A signal of 5 khz frequency is amplitude modulated on a carrier wave of frequency 2MHZ. The frequencies of the resultant signal is/are

(a) 2 MHz only

(b) 2005 kHz and 1995 kHz

(c) 2005 KHz, 2000 kHz and 1995 kHz

(d) 2000 kHz and 1995 kHz

37. A message signal of frequency 10 kHz and peak voltage of 10 V is used to modulate a carrier of frequency 1 MHz and peak voltage of 20 V. Determine the modulation index.

(a) 0.5 (b) 0.2 (c) 2 (d) 5

38. A sinusoidal carrier voltage of amplitude 100 V is amplitude modulated by a sinusoidal voltage to give as amplitude modulation wave to minimum voltage amplitude of 70 V. Find the modulation index

(a) 0.03 (b) 30 (c) 0.3 (d) 0.003

39. If the minimum voltage in an AM wave was found to be 2 V and maximum voltage 10 V. Find percent modulation index will be.

(a) 80% (b) 66.67%

(c) 64.25% (d) 76.25%

40. A carrier is simultaneously modulated by two sine waves having modulation index of 0.3 and 0.4. The total modulation index will be

(a) 0.1 (b) 0.5 (c) 0.7 (d) 0.35

41. In order to retrieve m (t), the signal is passed through

(a) rectifier

(b) amplifier

(c) envelope detector

(d) Both (a) and (c)

42. A 100 m long antenna is mounted on a 500 m tall building. The building can become a transmission tower for waves with λ is

(a) $\sim 400\ m$ (b) $\sim 25\ m$

(c) $\sim 150\ m$ (d) $\sim 2400\ m$

43. A speech signal of 3 kHz is used to modulate a carrier signal of frequency 1 MHz using amplitude modulation. The frequencies of the sidebands will be

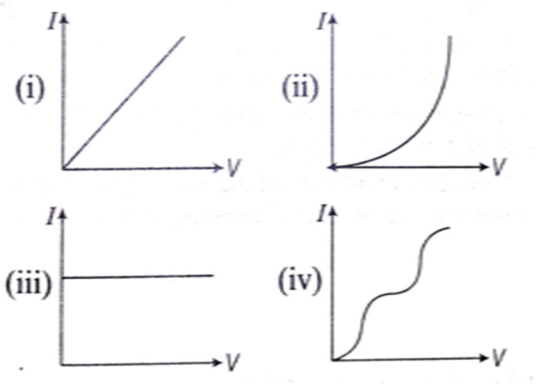
(a) 1.003 MHz and 0.997 MHz

(b) 3001 kHz and 2997 kHz

(c) 1003 kHz and 1000 kHz

(d) 1 MHz and 0.997 MHz

44. I-V characteristics of four devices are shown in figure



Identify devices that be used for modulation.

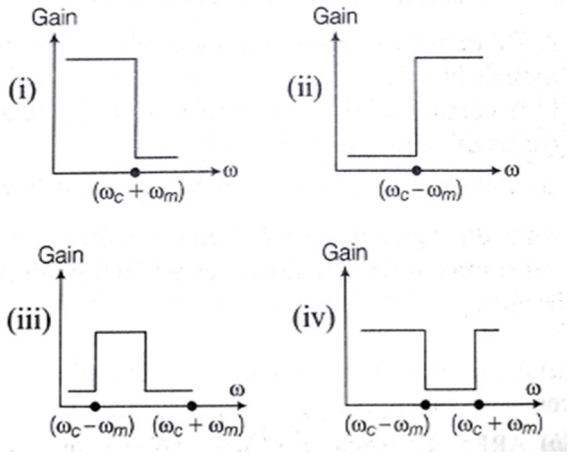
(a) (i) and (iii)

(b) Only (iii)

(c) (ii) and some regions of (iv)

(d) All devices can be used

45. The frequency response curve for the filter circuit used for production of AM wave should be



(a) (i) followed by (ii)

(b) (ii) followed by (i)

(c) (iii)

(d) (iv)

Hints and Explanations

1. (c)
2. (c)
3. (b)
4. (b)
5. (a)
6. (d)
7. (d)
8. (a)
9. (d)
10. (c) Rectangular wave can be decomposed into a superposition of sinusoidal waves of frequencies $v_0, 2v_0, 3v_0, 4v_0 \ldots., nv_0$, where n is an integer extends to infinity.
11. (d)
12. (b)
13. (a)
14. (c)
15. (a)
16. (b)
17. (a)
18. (d)
19. (a)
20. (b)
21. (d)
22. (b)

A space wave travels in a straight line from transmitting antenna to the receiving antenna because its frequency is below 2 MHz. So , it cannot travel over the horizon or behind obstacles

23. (a)
24. (a)

The maximum Line of Sight(LoS) distance d_M between the two antennas having heights h_T and h_R is

$$d_M = \sqrt{2Rh_T} + \sqrt{2Rh_R}$$

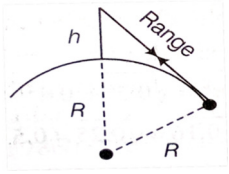
$$d = \sqrt{2 \times 64 \times 10^5 \times 32} + \sqrt{2 \times 64 \times 10^5 \times 50m}$$

$$= 64 \times 10^2 \times \sqrt{10} + 8 \times 10^3 \times \sqrt{10}\, m$$

$$= 144 \times 10^2 \times \sqrt{10} m = 45.5km$$

25. (d)
26. (a)

Range of radar on earth's surface(optical distance, for space $wave$ $i, e.$,line of view



$$\text{Range} = \sqrt{(R+h)^2 - R^2} = \sqrt{2Rh + h^2}$$

$$= \sqrt{2Rh} = \sqrt{2 \times 6400 \times \frac{1}{2} km} = 80km$$

27. (b)

The highest frequency of radio waves that can be reflected by the ionosphere is called maximum usable

Frequency(MUF),so MUF= $\frac{Critical\ frequency}{cos\theta}$

28. (b)

$$d_M = \sqrt{2Rh_R} + \sqrt{2Rh_T}$$

where, h_R and h_T are the heights of receiving and transmitting antenna and R is the radius of the earth

$$40 \times 10^3 = \sqrt{2 \times 6400 \times 10^3 \times h} + \sqrt{2 \times 6400 \times 10^3 \times 20}$$

$$40 \times 10^3 = \sqrt{2 \times 6400 \times 10^3 \times h} + 16 \times 10^3$$

$$h = \frac{[(40-16) \times 10^3]^2}{2 \times 6.4 \times 10^6} = 45\ m$$

29. (b)
30. (b)

Area of broadcast, $A = \pi d^2 = \pi(2hR)$

Given, h = $100\ m$ and R = 6.4×10^6m

$\Rightarrow \quad A = \pi(2 \times 100 \times 6.4 \times 10^6)$

$= 1.28\pi \times 10^3 km^2$

31. (c) Wavelength of an antenna, $\lambda = \frac{c}{v} = \frac{3 \times 10^8 ms^{-1}}{3 \times 10^8\ Hz} = 1\ m$

Length of the dipole antenna $= \frac{\lambda}{2} = \frac{1}{2} = 0.5\ m$

32. (c)

33. (b)

34. (b)

35. (d)

36. (c)

Frequency associated with AM are

$f_c - f_m, f_c, f_c + f_m$.

Thus frequency of the resultant signal is / are carrier frequency $f_c = 2000$kHz, LSB frequency

$f_c - f_m = 2000kHz - 5kHz$

$= 1995\ kHz\ and\ USB\ frequency\ f_c + f_m = 2005kHz$

37. (a)

38. (c)

Here, $A_c = 100\ V, M_2$ (minimum voltage amplitude of AM wave) $= 70\ V$

Since, $M_2 = A_c(1 - \mu)$

So, modulation index

i.e., $\mu = 1 - \frac{M_2}{A_c} = 1 - \frac{70\ V}{100\ V} = 1 - 0.7 = 0.3$

39. (b) Modulation index,

$\mu = \frac{E_{max} - E_{min}}{E_{max} + E_{min}} = \frac{10-2}{10+2} = \frac{2}{3} \times 100 = 66.67\%$

40. (b)

41. (c)

42. (a)

43. (a) Here, $v = 1MHz,\ \Delta v = 3\ kHz = 0.003$ MHz

Using amplitude modulation, the frequencies of the side band

$= (v + \Delta v)\ and (v - \Delta v)$

Upper sideband $= (v_c + v_m) = 1\ MHz + 3kHz$

$= 1\ MHz + 0.03\ MHz = 1.003MHz$

Lower sideband $= (v_c - v_m)$=1 MHz$-3kHz$

$= 1MHz - 0.003\ MHz = 0.997\ MHz$

44. (c)

45. (a,b,c)