PHYSICS

BOOKS - CHHAYA PHYSICS (BENGALI ENGLISH)

COMMUNICATION STSTEM

Example

1. If the height of a television tower is 300 m, how far would the TV transmission be

possible? (Given, the radius of earth = 6400 km

)

2. At what height is the transmitting antenna to be placed to make a TV transmission up to a distance of 32 km? The radius of earth = 6.4×10^6 m.

3. Equation of a waves: V = 10 sin $\left(10^6 t + 0.4 \sin 1000t\right)$.

What is its index of modulation?

4. Electron number density in a layer of ionosphere is $4 \times 10^5 cm^{-3}$. For an electromagnetic wave of frequency 40 MHz, what would be the refractive index of that layer?

5. Modulation index of an amplitude modulated wave is 50% and power dissipated in transmission 18 kW. What is the rate of energy dissipation for each side band?

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Section Related Questions

1. What do you mean by communication system?

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2. Give two examples each of one-way, full-duplex and half duplex communication system.

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3. What is meant by information signal?

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4. What type of wave are used as carrier wave in a communication system?

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5. Name two widely used transmission media.

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6. What role does 'noise' play in a communication system?

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7. Draw a block diagram showing the main components of a communication system.

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8. What is meant by audio data and video data?

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9. How are audio and video data converted into data signal?

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10. What is digital data?

11. What do you mean by bandwidth of carrier waves ?

12. What are modulation and demodulation?

13. What is modulation index in amplitude modulation?

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14. What is single sideband (SSB) communication?

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15. Define frequency modulation.

16. What is modulation index in frequency modulation?

17. What are the main difference between amplitude modulated and frequency modulated waves?

18. What is modem?

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19. What is 'radio horizon'?

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20. Ionosphere is a reflective medium for radio

waves' - discuss.

21. What is meant by communication channel?

Give an example.

22. What is 'broadband communication'?

Higher Order Thinking Skill Hots Questions

1. Why is a message communicated through a medium, instead of communicating it directly?

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2. Why is long range communication not possible in atmosphere through ground wave?

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3. Write down the differences between amplitutde modulation (AM) and frequency modulation (FM).

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4. Why do we have better reception of short wave transmission at night than in day?

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5. What are the advantages and disadvantages of the communication system using space wave in atmosphere?

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6. In sky wave propagation, the ionosphere plays a very important role'- explain.

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7. Why ionosphere cannot reflect space wave?

8. Mention the difference of the three important methods of radiowave propagation. In which of these three methods, are microwaves transmitted?

9. Define modulation index. Draw a plot of veriation of amplitude vs. ω for an amplitude modulated wave.

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Ncert Textbook Questions With Answer Hint

1. Which of the following frequencies will be suitable for beyond-the-horizon communication using sky waves?

A. 10 kHz

B. 10 MHz

C. 1 GHz

D. 1000 GHz

Answer: B

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2. Frequencies in the UHF range normally propagate by means of

A. ground waves

B. sky waves

C. surface waves

D. space waves

Answer: D

3. Digital signals

(i)do not provide a continuous set of values,

(ii)represent values as a discrete steps,

(iii) can utilise only binary system, and

(iv)can utillise decimal as well as binary systems

Which of the above statements are ture?

A. (i) and (ii) only

B. (ii) and (iii) only

C. (i),(ii) and (iii) but not (iv)

D. all of (i), (ii),(iii) and (iv)

Answer: C

4. Is it necessary for a tansmitting antenna to be at the same height as that of the receiving antenna for line-of-sight communication? A TV transmitting antenna is 81 m tall. How much service area can it cover if the receiving antenna is at the ground level?
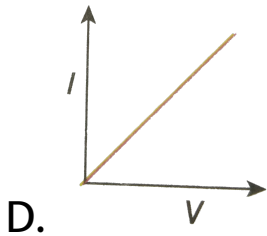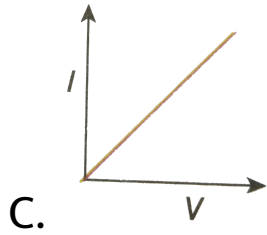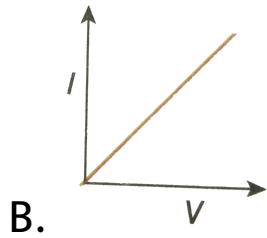
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5. A carrier wave of peak voltage 12 V is used to transmit a message signal. What should be

the peak voltage of the modulating signal in order to have a modulation index of 75%?

6. For an amplitude modulated wave, the maximum amplitude is found to be 10 V while minimum amplitude is found to be 2 V. Determine the modulation index μ. What would be the value of μ if the minimum amplitude is zero?

A.

B.

C.

D.
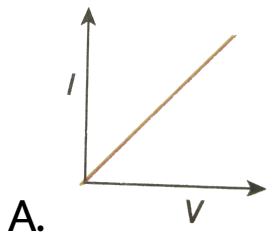
Answer:

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7. Due to economic reasons, only the upper sidebards of an AM wave is transmitted, but at the receiving station there is a facility for generating the carrier.

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1. Three wave A,B and C of frequencies 1600 KHz, 5 MHz and 60 MHz respectively are to be transmitted from one place to another. Which of the following is the most appropriate mode of communication?

A. A is transmitted via space wave while B and C are transmitted via sky waves

B. A is transmitted via ground wave, B via sky wave and C via space wave

C. B and C are transmitted via ground wave

while A is transmitted via sky wave.

D. B is transmitted via ground wave while A

and C are transmitted via space wave

Answer: B

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2. A 100 m long antenna is mounted on a 500

m tall building. The complex can become a

transmitting tower for waves with λ

A. ~ 400 m

B. ~ 25 m

C. ~ 150 m

D. ~2400 m

Answer: A

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3. A 1 KW signal is transmitted using a communication channel which provides attenuation at the rate of -2dB per km. If the

communication channel has a total length of 5 km, the power of the signal received is [gain in dB = 10 log (P_0 / P_t).

A. 900 W

B. 100 W

C. 990 W

D. 1010 W

Answer: B

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4. 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. 3001 kHz and 2997 kHz

    B. 1.003 MHz and 0.997 MHz

    C. 1003 kHz and 1000 kHz

    D. 1 MHz and 0.997 MHz

Answer: B

5. A message signal of frequency ω_m is superposed on a carrier wave of frequency ω_c to get an amplitude modulated wave (AM). The frequency of the AM wave will be

    A. ω_m

    B. ω_c

    C. $\dfrac{\omega_c + \omega_m}{2}$

    D. $\dfrac{\omega_c - \omega_m}{2}$

Answer: B

6. I-IV characteristics of four devices are shown. Identify devices that can be used for modulation

A. (i) and (iii)

B. only (iii)

C. (ii) and some regions of (iv)

D. all the devices can be used

Answer: C

7. A male voice after modulation transmission sounds like that of a female to the receiver. The problem is due to

    A. poor selection of modulation index (selected $0 < m < 1$)

    B. poor bandwidth selection of amplifiers

    C. poor selection of carrier frequency

    D. loss of energy in transmission

Answer: B

8. Identify the mathematical expression for amplitude modulated wave:

    A. $A_c \sin[\{\omega_c + k_1 v_m(t)\}t + \phi]$

    B. $A_c \sin[\{\omega_c t + \phi + k_2 v_m(t)\}$

    C. $\{A_c + k_2 v_m(t)\}\sin(\omega_c t + \phi)$

    D. $A_c v_m(t)\sin(\omega_c t + \phi)$

Answer: C

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1. An audio signal of 15 kHz frequency cannot be transmitted over long distances without modulation because

A. the size of the required antenna would

be at least 5 km which is inconvenient

B. the audio signal cannot be transmitted

through sky waves

C. the size of the requied antenna would

be at least 20 km which is inconvenient

D. effective power transmitted would be

very low, if the size of the antenna is less

than 5 km

Answer: A::B::D

2. Audio sine waves of 3 kHz frequency are used to amplitude modulate a carrie signal of 1.5 MHz. Which of the following statement are true?

A. the sideband frequencies are 1506 kHz and 1494 kHz

B. the bandwidth required for amplitude modulation is 6 kHz

C. the bandwidth required for amplitude modulation is 3 MHz

D. the sideband frequencies are 1503 kHz and 1497 kHz

Answer: B::D

3. In amplitude modulation, the modulation index m, is kept less than or equal to 1 because

A. m $>$ 1 will result in interference between carrier frequency and message frequency, resulting into distortion

B. m $>$ 1 will result in overlapping of both sidebands resulting into loss of information

C. m $>$ 1 will result in change in phase between carrier signal and message signal

D. $m > 1$ indicates amplitude of message signal greater than amplitude of carrier signal resulting into distortion

Answer: B::D

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4. A TV transmission tower has a height of 240 m. Signals broadcast from this tower will be received by LOS communication at a distance

of (assume the radius of earth to be 6.4×10^6 m)

A. 100 km

B. 24 km

C. 55 km

D. 50 km

Answer: B::C::D

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Exercise Multiple Choice Questions

1. Out of the following which is an essential element of a communication system?

A. transistor

B. transmitter

C. computer

D. both A and C

Answer: b

2. The distortion in the transmission and processing of signals is called

A. interference

B. diffraction

C. noise

D. scattering

Answer: B

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3. If the maximum frequency of an audio signal be f, then what would be the bandwidth of an Amplitude Modulated (AM) wave?

A. $\dfrac{f}{2}$

B. f

C. $2f$

D. $4f$

Answer: C

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4. If the frequencies of carrier waves for AM and FM be f_A and f_F respectively, then

A. $f_A \approx f_F$

B. $f_A < f_F$

C. $f_A > f_F$

D. $f_A \geq f_F$

Answer: B

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5. If modulation frequency of an FM wave is f , then the modulation index will be directly proportional to:

A. $\dfrac{1}{f}$

B. f

C. $\dfrac{1}{f^2}$

D. f^2

Answer: A

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6. In ampitude modulation modulation index of a transmitted carrier wave is β.The increase in power dissipation would be directly proportional to

    A. β

    B. β^2

    C. $1 + \beta^2$

    D. $1 + \dfrac{\beta^2}{2}$

Answer: B

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7. Rate of energy dissipation in a carrier wave transmission is 10 kW. What would be the rate of energy dissipated if the wave is frequency modulated to 10% level?

A. 10 kW

B. 10.05 kW

C. 10.1 kW

D. 10.5 kW

Answer: A

8. In an amplitude modulated wave, the circular frequency of the carrier wave is Ω and that of the data signal lies in the range between ω and $\omega' > \omega$. Then the width of a single sideband is

A. $\Omega + \omega'$

B. $\Omega + (\omega' - \omega)$

C. $2\omega'$

D. $\omega' - \omega$

Answer: D

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9. A MODEM is used

A. to superimpose a data signal on a

carrier wave

B. to retrieve a data signal from its mixture

with a carrier wave

C. to amplify a data signal

D. to convert an analogue signal to a

digital signal and vice-versa

Answer: D

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10. The process in which the amplitude of the carrier wave is made proportional to the instantaneous amplitude of the signal wave is called

    A. amplitude modulation

    B. demodulation

    C. rectification

    D. amplification

Answer: A

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11. Radio waves of low frequencies cannot be transmitted to long distances. So thes are superposed on a high frequency carrier signal. This process is known as

A. amplification

B. rectification

C. modulation

D. demodulation

Answer: C

12. Long distance transmission is not possible using ground waves due to which characteristics of electromagnetic waves?

A. scattering

B. interference

C. diffraction

D. polarisation

Answer: D

13. A transmitting antenna and a receiving antenna, both of height H, are used for a space wave transmission. At another place, a similar transmission uses a transmitting antenna of height 2H, but the receiving antenna is set very near the ground. The ratio of the radio horizons for these two cases is

A. $1 : 1$

B. $2 : 1$

C. $\sqrt{2} : 1$

D. $1 : \sqrt{2}$

Answer: C

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Very Short Answer Type Questions

1. with respect to any data signal, the frequency of a carrier wave is much _____.

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2. Data signal, communicated through internet is a _____ signal.

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3. What quantity remains unchanged in FM wave?

4. What quantity remains unchanged in AM wave?

5. What is the name of the device converts an analogue data to a digital data and vice versa?

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6. How does the dissipated power change, if a transmitted carrier wave is frequency modulated?

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7. The process of superimposing any data signal on a carrier wave is called ____

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8. Separation of a data signal from a carrier wave is called _____

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9. How does the refractive index of a layer of ionosphere change for propagation of a radio wave, if the rate of ionisation increases?

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10. In transmission through the layers of ionosphere, if the frequency of radio wave increases, how does the refractive index of the layers change?

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11. The refractive indices of the layers of ionosphere are _____ than those of air.

12. Which one between space wave and sky waves, used in distant communication through atmopsphere, has a higher frequency?

1. Why is long distance transmission through ground waves not possible?

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1. Draw a block diagram of a communication system.

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1. Equation of an AM wave:

$$V = 10(1 + 0.05 \sin 5000t)\sin(6.28 \times 10^6)t$$

volt

Find the voltage amplitude and frequency of the carrier wave, frequency of the data signal and the modulation index.

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2. Equation of a FM wave:

$$v = 18 \sin\left[(1.256 \times 10^8)t + 0.2\sin(6280)t\right]$$

Find out the voltage amplitude and frequency of the carrier wave, frequency of the data signal and modulation index.

3. Modulation index of an amplitude modulated waves is 0.2. What is the percentage increases of energy dissipation

rate with respect to that due to the carrier wave only?

4. Electron number densities of a layer in the ionosphere and of just its upper layer are respectively $4 \times 10^{11} m^{-3}$ and $10^{12} m^{-3}$. What would be the value of the critical angle at the interface of these two layers, for an upward motion of a radio wave of frequency 40 MHz.

5. A transmitting antenna and a receiving antenna are both 100m high. Find out the maximum distance between them for which distant transmission through space waves is possible. How many such antennas are to be installed for transmission up to 500 km ? Given, radius of the earth = 6400 km

6. A TV tower is 80 m tall. Calculate the maximum distance upto which the signal transmitted from the tower can be received. Given, earth's radius = 6400km.

7. A TV tower has a height of 100 m. How much population is covered by the TV broadcast if the average population density around this

tower is $1000km^{-2}$? Given, radius of the

earth $= 6.37 \times 10^6$ m.

Problem Set Ii

1. In a distant communication system, the carrier wave has an amplitude of 15 V and a frequency of 10 MHz. A data signal of frequency 500 Hz has modulated its amplitude

with a modulation index of 0.01 Establish the equation of the amplitude modulated wave.

2. A frequency modulated wave is formed by superimposing a data signal of frequency 500 Hz on a carrier wave of amplitude 15 V and frequency 40 MHz, with modulation index of 0.01. Establish the equation of the FM wave.

3. When a broadcast AM transmitter is 50% modulated, its antennacurrent is 12 A. What will be the carrier current?

4. A signal of frequency 12 KHz and peak voltage 12 V is used to modulate a carrier of frequency 1 MHz and peak voltage 24 V. What is the modulation index and the produced side. Bands?

5. A transmitter (AM) records an antenna current of 10.5 A The antenna current drops to 10 A when only carrier is transmitted. What is the percentage of modulation?

6. What in the value of frequency at which electromagnetic wave must be propagated for a certain region of atmosphere to have a

refractive index of 0.5? Electron density for the region is 400 electrons/cm^3.

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7. A TV transmission tower at a particular station has a height of 160 m.

What is its coverage range ?

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8. A TV transmission tower at a particular station has a height of 160 m.

How much population is coverd by transmission, the average population density around the tower 1200 km^{-2}?

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Entrance Corner

1. Statement I: Sky wave suffers total internal reflection in ionosphere, whereas space wave directly penetrates the ionosphere and advances towards higher altitude.

Statement II: Frequency of sky wave is less than that of space wave. As frequency decreases, the refractive indices of the layers of ionosphere also go down below the refractive index of air.

    A. Statement I is true, statement II is true, statement II is a correct explanation for

statement I.

B. Statement I is true, statement II is true,

statement II is not a correct explanation

for statement I.

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true.

Answer: A

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2. Statement I: If a carrier wave is amplitude modulated, the amplitude of its wave changes very slowly.

Statement II: Generally, amplitude of wave of a data signal is much less than that of a carrier wave.

A. Statement I is true, statement II is true, statement II is a correct explanation for statement I.

B. Statement I is true, statement II is true,

   statement II is not a correct explanation

   for statement I.

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true.

Answer: B

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3. Statement I: Space wave is almost neve employed in long distance communication.

Statement II: Space wave propagates in a straight line. Due to the curvature of earth it can not advance to a long distance.

A. Statement I is true, statement II is true, statement II is a correct explanation for statement I.

B. Statement I is true, statement II is true, statement II is not a correct explanation

for statement I.

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true.

Answer: D

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4. Statement I: For distant communication of audio signal, microphone and loudspeaker are used at transmitting end and receiving end respectively.

Statement II: In communication of audio signal, the sound wave is to be converted to a similar electromagnetic wave.

A. Statement I is true, statement II is true, statement II is a correct explanation for statement I.

B. Statement I is true, statement II is true, statement II is not a correct explanation for statement I.

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true.

Answer: A

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5. Statement I: If a carrier wave is frequency modulated for transmission, the rate of dissipated energy remains unchanged at transmitting antenna.

Statement II: If a carrier wave is frequency modulated, there is no change in its amplitude

only its frequency undergoes a slow, periodic change.

A. Statement I is true, statement II is true, statement II is a correct explanation for statement I.

B. Statement I is true, statement II is true, statement II is not a correct explanation for statement I.

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true.

Answer: A

Multiple Correct Answer Type

1. The example of employing electromagnetic wave, with a range of frequency from 30 MHz to very high 300 MHz, as carrier wave is

A. radio transmission of short distance

B. transmission of FM radio

C. television transmission

D. radar system

Answer: B::C

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2. In distant communication, the data signal is not transmitted directly without the help of carrier wave. The reason is

A. extremely large transmitting antenna is necessary

B. the transmitting antenna is to be installed at very high attitude

C. the chance of mixing noise in data signal increased

D. due to overlapping of many data signals, the data at receiving end becomes very unclear

Answer: A::D

3. If properly modulated carrier wave is transmitted through antenna, then rate of energy dissipated at the antenna

    A. remains same for AM wave

    B. increases for AM wave

    C. remains same for FM wave

    D. increases for FM wave

Answer: B::C

4. Long distance communication is possible through space wave

   A. due to reflection at ionosphere

   B. due to reflection at artificial satellite

   C. through successive reflections from earth surface

   D. by installing many antennas one after another at a specific distance apart

Answer: B::D

5. Which of the following is used as carrier wave, in a communication system?

    A. ultraviolet wave

    B. infrared wave

    C. microwave

    D. radio wave

Answer: C::D

Comperhension Type

1. In long distance communication, the similar potential wave produced from a carrier wave is V = $V_0 \sin\Omega t$. On the other side, potential wave corresponding to data signal is , v = $v_0 \sin\omega t$, $v_0 <\, < \Omega$. Superimposing data signal on carrier wave, generally two types of

modulated waves are produced, they are:

(a) Amplitude Modulated (AM) wave:

$$V_{AM} = V_0(1 + \beta_1 \sin \omega t)\sin \Omega t$$

where, $\beta_1 = k_1 \dfrac{v_0}{V_0}$ = modulation index

(k_1 constant).

Frequency Modulated (FM) wave:

$$V_{FM} = V_0 \sin(\Omega t - \beta_2 \cos \omega t)$$

where, $\beta_2 = k_2 \dfrac{v_0}{\omega}$ = modulation index

(k_2 =

constant).

Mathematical analysis of two modulated

waves shows that, for AM wave, apart from Ω

frequency, there are two sine wave

components of frequencies $\Omega - \omega$ and $\Omega + \omega$

. As a result, the bandwidth of the waves

becomes $(\Omega + \omega) - (\Omega - \omega) = 2\omega$. On the

other hand, in FM wave, the number of sine

wave components are infinite and their

frequencies are $\Omega n \pm$, $\Omega \pm 2\omega$, ...

Basides that, if the dissipated power for a

transmitting antenna to transmit a carrier

wave be P_c and dissipated power for

transmitting AM and FM wave be

P_{AM} and P_{FM} then,

$$P_{AM} = P_c \left(1 + \frac{\beta^2}{2} \right), \ P_{FM} = P_c$$

The unit of constant k_1

A. does not have any unit

B. $V \cdot s^{-1}$

C. $V^{-1} \cdot s$

D. $V^{-1} \cdot s^{-1}$

Answer: A

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2. In long distance communication, the similar potential wave produced from a carrier wave is

$V = V_0 \sin\Omega t.$ On the other side, potential

wave corresponding to data signal is , v =

$v_0 \sin \omega t,$ $v_0 < < \Omega.$ Superimposing data

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$$V_{FM} = V_0 \sin(\Omega t - \beta_2 \cos \omega t)$$

where, $\beta_2 = k_2 \dfrac{v_0}{\omega}$ = modulation index

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constant).

Mathematical analysis of two modulated waves shows that, for AM wave, apart from Ω frequency, there are two sine wave components of frequencies $\Omega - \omega$ and $\Omega + \omega$. As a result, the bandwidth of the waves becomes $(\Omega + \omega) - (\Omega - \omega) = 2\omega$. On the other hand, in FM wave, the number of sine wave components are infinite and their frequencies are $\Omega n \pm$, $\Omega \pm 2\omega$, ...

Basides that, if the dissipated power for a transmitting antenna to transmit a carrier wave be P_c and dissipated power for transmitting AM and FM wave be

P_{AM} and P_{FM} then,

$$P_{AM} = P_c\left(1 + \frac{\beta^2}{2}\right), P_{FM} = P_c$$

The unit constant K_2

A. 1

B. $V \cdot s^{-1}$

C. $V^{-1} \cdot s$

D. $V^{-1} \cdot s^{-1}$

Answer: D

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3. In long distance communication, the similar potential wave produced from a carrier wave is $V = V_0 \sin\Omega t$. On the other side, potential wave corresponding to data signal is, $v = v_0 \sin \omega t$, $v_0 < \ < \Omega$. Superimposing data signal on carrier wave, generally two types of modulated waves are produced, they are:

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Basides that, if the dissipated power for a transmitting antenna to transmit a carrier wave be P_c and dissipated power for transmitting AM and FM wave be P_{AM} and P_{FM} then,

$$P_{AM} = P_c\left(1 + \frac{\beta^2}{2}\right), \quad P_{FM} = P_c$$

What would be the bandwidth of an amplitude modulated wave if there is a mixing of frequencies 1000 Hz to 1500 Hz in the data signal?

A. 500 Hz

B. 1500 Hz

C. 2000 Hz

D. 3000 Hz

Answer: D

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4. In long distance communication, the similar potential wave produced from a carrier wave is $V = V_0 \sin\Omega t$. On the other side, potential wave corresponding to data signal is , $v = v_0 \sin \omega t$, $v_0 < < \Omega$. Superimposing data

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frequency, there are two sine wave components of frequencies $\Omega - \omega$ and $\Omega + \omega$. As a result, the bandwidth of the waves becomes $(\Omega + \omega) - (\Omega - \omega) = 2\omega$. On the other hand, in FM wave, the number of sine wave components are infinite and their frequencies are $\Omega n \pm , \Omega \pm 2\omega, \ldots$.

Besides that, if the dissipated power for a transmitting antenna to transmit a carrier wave be P_c and dissipated power for transmitting AM and FM wave be P_{AM} and P_{FM} then,

$$P_{AM} = P_c \left(1 + \frac{\beta^2}{2} \right), P_{FM} = P_c$$

What would be the width of sideband on either side of the amplitude modulated (AM) wave, if there is a mixing of frequencies of 1000 Hz to 1500 Hz in the data signal?

A. 500 Hz

B. 1000 Hz

C. 1500 Hz

D. 2000 Hz

Answer: A

5. In long distance communication, the similar potential wave produced from a carrier wave is $V = V_0 \sin\Omega t$. On the other side, potential wave corresponding to data signal is , $v = v_0 \sin\omega t$, $v_0 < < \Omega$. Superimposing data signal on carrier wave, generally two types of modulated waves are produced, they are:

(a) Amplitude Modulated (AM) wave:

$$V_{AM} = V_0(1 + \beta_1 \sin\omega t)\sin\Omega t$$

where, $\beta_1 = k_1 \dfrac{v_0}{V_0}$ = modulation index

$(k_1$ constant).

Frequency Modulated (FM) wave:

$$V_{FM} = V_0 \sin(\Omega t - \beta_2 \cos \omega t)$$

where, $\beta_2 = k_2 \dfrac{v_0}{\omega}$ = modulation index

$(k_2 \quad =$

constant).

Mathematical analysis of two modulated waves shows that, for AM wave, apart from Ω frequency, there are two sine wave components of frequencies $\Omega - \omega$ and $\Omega + \omega$. As a result, the bandwidth of the waves becomes $(\Omega + \omega) - (\Omega - \omega) = 2\omega$. On the other hand, in FM wave, the number of sine wave components are infinite and their

frequencies are $\Omega n \pm$, $\Omega \pm 2w$, ...

Basides that, if the dissipated power for a transmitting antenna to transmit a carrier wave be P_c and dissipated power for transmitting AM and FM wave be P_{AM} and P_{FM} then,

$$P_{AM} = P_c \left(1 + \frac{\beta^2}{2} \right), \ P_{FM} = P_c$$

In converting a carrier wave into an Amplitude Modulated (AM), modulation index was 0.05. Then, what would be the percentage increases in dissipated power at transmitting antenna?

    A. 2.5

B. 1.25

C. 0.25

D. 0.125

Answer: D

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1. As radio waves of low frequencies cannot be

transmitted to long distances, a high

frequency carrier signal is superposed on it. This process is called

A. A) amplification

B. B) rectification

C. C) modulation

D. D) oscillation

Answer: C

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2. Write down different modes by which electromagnetic waves can propagate from transmitting to receiving antenna. Mention one important use of microwaves.

3. Draw a neat diagram of amplitude modulated waveform. Write down the expression of 'modulation index' and show each term in the diagram.

4. Satellite communication is done with

A. ground waves

B. sky waves

C. space wave

D. nono of these

Answer: C

5. Why is satellite used for TV transmission to far places?

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6. What do you mean by demodulation? What is the importance of modulation index?

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7. Define amplitude modulation. The height of a TV tower is 125m. Find the maximum distance up to which transmitted signal from the tower is available (radius of the earth $= 6.4 \times 10^6$m).

8. What is an antenna? Find the length of a dipole antenna for a carrier wave of frequency 3×10^8Hz.

1. A signal of 5 kHz frequency is amplitude modulated on a carrier wave of frequency 2 MHz. 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

Answer:

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2. Choose the correct statement :

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 to 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 amplitude od the audio 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

Answer: A

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3. In amplitude modulation, sinusoidal carrier

frequency used is denoted by ω_c and the

signal frequency is denoted by ω_m. The

bandwidth $(\Delta\omega_m)$ of the signal is such that

$\Delta\omega_m << \omega_c$. Which of the following

frequencies is not contained in the modulated wave?

A. ω_m

B. ω_c

C. $\omega_m + \omega_c$

D. $\omega - \omega_m$

Answer:

4. A telephonic communication service is working at carrier frequency of 10 GHz. Only 10% of it is utilized for transmission. How many telephonic channels can be transmitted simultaneously if each requires a bandwidth of 5 kHz?

A. 2×10^5

B. 2×10^6

C. 2×10^3

D. 2×10^4

Answer:

1. In the given block diagram of a receiver, identify the boxes labelled as X and Y and write their functions.

2. Explain briefly the following terms used in communication system:

Transducer

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3. Explain briefly the following terms used in communication system:

Repeater

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4. Explain briefly the following terms used in communication system:

Amplification.

5. In the block diagram of simple modulator for obtaining an AM signal, shown in the figure, identify the boxes A and B. Write their functions.

6. Name the type of wave which are used for line of slight (LOS) communication. What is the range of their frequencies?

A transmitting antenna at the top of a tower has a hight of 20 m and the height of the receiving antenna is 45 m. Calculate the maximum distance between them for satisfactory communication in LOS mode. (Radius of the earth = 6.4×10^6 m)

7. Write the function of the following in communication system:

Transmitter,

8. Write the function of the following in communication system:

Modulator

9. Write two basic modes of communication. Explain the process of amplitude modulation. Draw a schematice sketch showing how amplitude modulated signal is obtained by superposing a modulating signal over a sinusoidal carrier wave.

10. Write the function of the following in communication system:

Receiver

11. Write the function of the following in communication system:

Demodulator

12. Write the function of a transducer in communication system:

13. Distinguish between 'sky wave' and ' space wave' modes of propagation. Why is the sky wave mode of propagation restricted to frequencies upto 40 MHz ?

14. Draw a block diagram of a simple modulator for obtaining amplitude modulated signal.

A carrier waves of peak voltage 12 V is used to

transmit a message signal. What should be the peak voltage of the modulating signal in order to have a modulation index of 75% ?

15. A signal of 5 kHz frequency is amplitude modulated on a carrier wave of frequency 2 MHz. What are the frequencies of the sidebands produced?

16. Why is baseband signal not transmitted directly? Give any two reasons.

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17. What is space wave propagation? State the factors which limit its range of propagation. Derive an expression for the maximum line of sight distance between two antennas for space wave propagation.

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18. Distinguish between a transducer and a repeater.

19. Which basic mode of communication is used in satellite communication? What type of wave propagation is used in this mode? Write, given reason, the frequency range used in this mode of propagation.

20. What is the line of sight communication?

21. Why is it not possible to use sky waves for transmission of TV signals? Up to what distance can a signal be transmitted using an antenna of height h?

22. Difine the term 'amplitude modulation'. Explain any two factors which justify the need for modulating a low frequency baseband signal.

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23. How is amplitude modulation achieved ?

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24. The frequencies of two side bands in an AM wave are 640 kHz and 660 kHz respectively. Find the frequencies of carrier and modulating signal. What is the bandwidth required for amplitude modulation?

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25. Given three reasons why modulation of a message signal is necessary for long distance transmission.

26. Show graphically an audio signal, a carrier

wave and an amplitude modulated wave.

27. A carrier wave of peak voltage 15 V is used

to transmit a message signal. Find the peak

voltage of the modulating signal in order to

have a modulation index of 60%.

28. Which mode of propagation is used by short wave broadcast services?

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