PHYSICS

BOOKS - DC PANDEY ENGLISH

COMMUNICATION SYSTEM

Example

1. A TV tower has a height of 60m. What is the maximum distance and area up to which TV

transmission can be received? (Take radius of earth as $6.4 \times 10^6 m$).

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2. A message signal of frequency 10 KHz and peak voltage of 10V is u sed to modulate a carrier of frequency 1 MHz and peak voltage of 20V. The frequency of the side bands produced is

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Solved Examples

1. Name the device fitted in the satellite which receives signals from Earth station and transmits them in different directions after amplification.

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2. An eletromagnetic wave of frequency 28 MHz passes through the lower atmosphere of earth and gets incident on the

ionosphere.Shall the ionosphere reflects these waves?

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3. Which waves constitude amplitude-modulated band?

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4. Give the frequency ranges of the following (i) High frequency band (HF) (ii) Very high

frequency band (VHF) (iii) Ultra high band (UHF) (iv) Super high frequency band (SHF).

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5. State the two functions performed by a modem.

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6. Why is the transmission of signals using ground waves restricted up to a frequency of

1500 kHz?

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7. How does the effective power radiated by an antenna vary with wavelength?

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8. It is necessary ton use satellites for long distance TV transmission. Explain why?

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9. Long distance radio broadcasts use short wave bands. Explain why?

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10. What is a channel bandwidth?

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11. Give any one difference between FAX and e-mail systems of communication.

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12. Why ground wave propagation is not suitable for high frequency?

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13. What is the purpose of modulating a singnal in transmission?

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14. What is a transducer?

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15. Why do we need a higher bandwidth for transmission of music compared to that for

commercial telephone communicaton?

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16. From which layer of the atmosphere,radio waves are reflected back?

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

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18. Why are short waves used in long distance broadcasts?

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19. Define the term critical frequency in relation to sky wave propagation of electromagnetic waves.

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20. What mode of communication is employed for transmission of Tv signals?

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Single Correct

1. Three waves A,B and C of frequencies 1600 KHz, 5MHz and 60 MHz, respectively are to be trasnmitted 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 transmitted via sky wave.

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

C. B and C are transmitted via ground wave while A is transmiites via sky wave.

D. B is transmitted vis ground wave while A and C are transmitted via space wave.

Answer: B

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2. A 100m long antenna is mounted on a 500m tall building. The complex can become a transmission 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 speech signal of 3 kHz is used to modulate a carrier signal of frequency 1 MHz, using amplitude modulation. The frequencies of the side bands will be

A. 1.003 MHz and 2. 997 MHz

B. 3001 kHz and 2997 kHz

C. 1003 kHz and 1000 kHz

D. 1 MHz and 0.997 MHz

Answer: A

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

A. ω_m

B. ω_c

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

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

Answer: B

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5. A basic communication system consists of

(A) transmitter (B) information source

(C) user of information (D) channel

(E) reciever

Choose the correct sequence in which these are arranged in a basic communication system.

A. ABCDE

B. BADEC

C. BDACE

D. BEADC

Answer: B

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6. 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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7. Frequencies in the UHF range normally propagate by means of

A. ground waves

B. sky waves

C. surface waves

D. space waves

Answer: D

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8. Digital signals

(i) do not provide a continuous set of values

(ii) represent values as discrete steps

(iii) can utilize binary system and

(iv) can utilize decimal as well as binary systems

Which of the above statements are true?

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

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More Than Correct

1. 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 $6.4 \times 10^6 m$)

A. 100 km

B. 24 km

C. 55 km

D. 50 km

Answer: B::C::D

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

A. the size of the required anteena would be at least 5 km which is not convenient.

B. the audio signal cannot be transmitted through sky waves.

C. the size of the required antenna would be at least 20 km, which is not convenient.

D. effective power transmitted would be very low, if the size of the antenna is less than 5 km

Answer: A::B::D

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

A. The sideband frequencies are 1506 kHz and 1494 kHz.

B. The bandwidth required foe amplitude modulation is 6 kHz.

C. The bandwidth required for amplitude modulation is 3 MHz

D. The sideband frequencies are 1503 kHz and 1494 kHz

Answer: B::D

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

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

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

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

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

Answer: B::D

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Subjective

1. The LC product of a tuned amplifier circuit require to generate a carrier wave of 1 MHz for amplitude modulation is

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2. 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 intex of 75 % ?

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

A. A vibrating tuning fork

B. Musical sound due to a vibrating sitar string.

C. Light pulse.

D. Output of NAND gate.

Answer: A::D

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4. Two waves A and B of frequencies 2MHz 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?

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5. The maximum amplitude of an AM wave is found to be 15 V while its minimum amplitude is found to be 3 V.What is the modulation index?

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

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7. Is it necessary for a transmitting antenna to be at the same height asthat of the receiving antanna for line of sight communication? A TV transmitting antenna is 81 m tall. How much service area can it cover, if the receiving antena is at the ground level?

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8. A TV transmission tower of antenna is at a height of 20 m. How much service area can it

cover if the receiving antenna is (i) at ground level (ii) at a height of 25 m ? Calculate the percentage increase in area covered in case (ii) relative to case (i). Radius of earth =6.4×106m

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9. If the whole earth is to be connected by LOS communication using space waves (no restriction of antenna size or tower height), what is the minimum number of antennas

required? Calculate the tower height of these antennas in terms of earth's radius.

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10. The maximum fequency for reflection of sky waves from a certain layer of the ionosphere is found to be $f_{\max} = 9(N_{\max})^{1/2}$, Where N _max is the maximum electron density at that layer of the ionosphere.On a certain day it is observed that signals of frequencies higher than 5 MHz are not received by reflection from

the F_1 layer of the ionosphere while signals of frequencies higher than 8 MHz are not received by reflection from the F_2 layer of the ionosphere. Estimate the maximum electron densities of the F_1 and F_2 layers on that day.

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11. A 50MHz sky wave takes 4.04 ms to reach a receiver via retransmission from a satellite 600km above earht's surface. Assuming re-

transmission time by satellite negligible, find the distance between source and reciever.

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