PHYSICS

BOOKS - NCERT PHYSICS (ENGLISH)

COMMUNICATION SYSTEM

Mcq

1. Three waves 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 appropriate mode of communication?

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

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 $100m$ long antenna is mounted on a $500m$ tall building. The complex can become a transmission tower of waves with λ

A. ~$400m$

B. ~$25m$

C. ~$150m$

D. ~$2400m$

Answer: A

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3. A $1KW$ signal is transmitted using a communication channel which provides attenuatiom at the rate of $-2dBperkm$. If the communication channel has a total length of $5km$, the power of the signal received is [gain in $dB = 10\log\left(\frac{P_0}{P_i}\right)$]

A. 900 W

B. 100 W

C. 990 W

D. 1010 W

Answer: B

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4. A speech signal of $3kHz$ is used to modulate a carrier signal of frequency $1MHz$, using amplitude modulation. The frequencies of the

side bands 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

Answer: A

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5. A message signal of freuency ω_m is superposed on a carrier wave of frequency ω_c to get an amplititude modulated wave (AM). The frequency of the AM 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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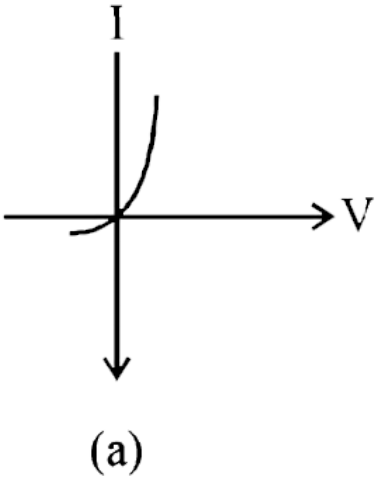
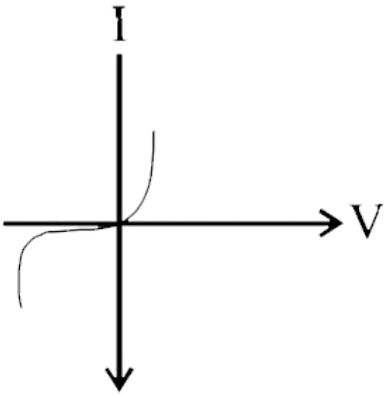
6. Identify the semiconductor devices whose characteristics are given below , in the order (a) ,(b) ,(c) ,(d) :



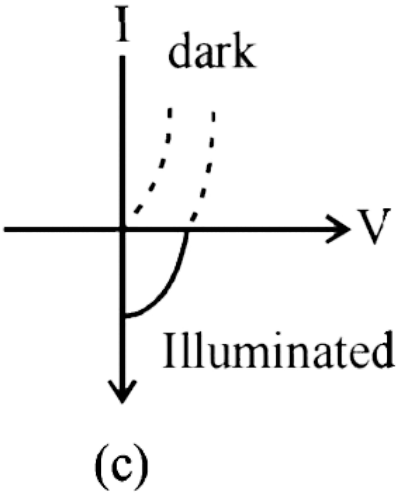
(a)

(a)



(b)

(b)



(c)

(c)

(d)

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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

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8. A basic communication system consists of (A) transmitter (B) information source (C) user of information (D)channel (E) receiver `

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

A. ABCDE

B. BADEC

C. BDACE

D. BEADC

Answer: B

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

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

B. the audio signal can not 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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11. 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 side band frequencies are 1506 kHz and 1494 kHz

B. The bandwidth requried for amplitude modulation is 6kHz

C. The bandwidth required for amplitude modulation is 3 MHz

D. The side band frequencies are 1503 kHz and 1497 kHz

Answer: B::D

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12. 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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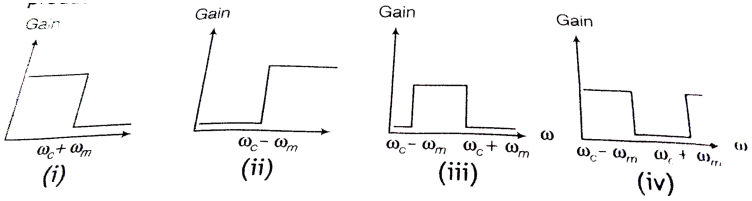
13. The frequency response curve (figure) for the filter circuit used for production of AM wave should be



A. (i) followed by (ii)

B. (ii) followed by (i)

C. (iii)

D. (iv)

Answer: A::B::C

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14. In amplitude modulation, the modulation index mu, 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 side bands 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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Very Short Answer Type Questions

1. 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:

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

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3. 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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4. 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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5. Compute LC product of a tuned amplifer circuit required to generate a carrier $wave$ of $1MHz$ for amplitude modulation

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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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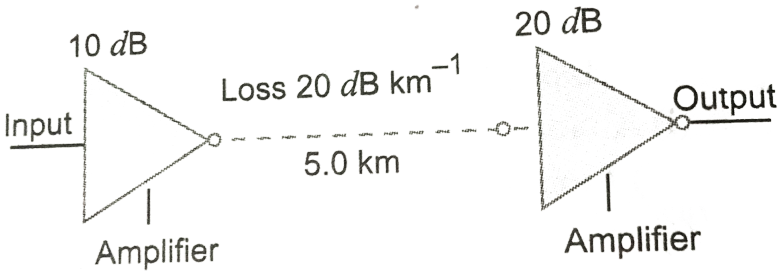
Short Answer Type Questions

1. Figure (EP) shows a communication system. What is the output power when input signals is of 1.01 mW? [gain in $dB = 10\log_{10}(P_0 / P_t)$].



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2. 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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3. 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 no of antennaas required ? Calculate the tower height of these antennas in terms of earth's radius?

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4. 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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5. On radiation (sending out) an AM modulated signal, the total radiated power is due to energy carried by $\omega_c, \omega_c - \omega_m$ and $\omega_c + \omega_m$. Suggest ways to minimise cost of radiation without compromising on information.

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Long Answer Type Questions

1. The intensity of a light pulse travelling along a communication channel decreases exponetially with distance x according to the relation $I = I_0 e^{-ax}$ where I_0 is the intensity at x=0 and α is the attenuation

constant. The percentage decrease in intensity after a distance of $\left(\frac{\text{In}4}{\alpha}\right)$ is

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2. A 50 MHz sky wave sky wave takes 4.04 ms to reach a receiver via re-transmission from a satellite 600 km above earth's surface. Assuming re-transmission time by satellite negligible, find the distance between source and receiver. If communication between the two was to be done by Line of sight (LOS) method,what should be the size of transmitting antenna ?

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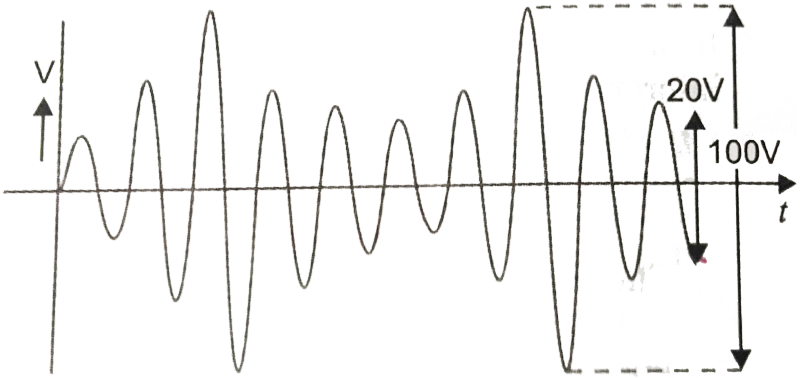
3. An amplitude modulated wave is as shown in figure. Calculate (i) the percentage modulation, (ii) peak carrier voltage and , (iii) peak value of

information voltage.



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4. (i) Draw the plot of amplitude versus ω for an amplitude modulated were whose carrier wave (ω_c) is carrying two modulating signals, ω_1 and ω_2 $(\omega_2 > \omega_1)$.

(ii) Is the plot symmetrical about ω_c ? Comment especially about plot in region $\omega < \omega_c$.

(iii) Extrapolate and predict the problems one can expect if more waves are to be modulated.

(iv) Suggest solutions to the above problem. In the process can one understand another advantage of modulation in terms of bandwidth?

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5. An audio signal is modulated by a carrier wave of 20 MHz such that the bandwidth required for modulation is 3 kHz. Could this wave be demodulated by a diode detector which has the values of R and C as (i) $R = 1k\Omega, C = 0.01\mu F (ii) R = 10k\Omega, C = 0.01\mu F (iii) R = 10k\Omega, C = 1\mu$

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