

Communication Systems

1. Which of the following four alternatives is *not* correct? [AIEEE-2011]

We need modulation :

- (1) To reduce the fractional band width, that is, the ratio of the signal band width to the centre frequency
 - (2) To increase the selectivity
 - (3) To reduce the time lag between transmission and reception of the information signal
 - (4) To reduce the size of antenna
2. 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 upto which it can detect object located on the surface of the earth (Radius of earth = 6.4×10^6 m) is [AIEEE-2012]

- (1) 16 km
- (2) 40 km
- (3) 64 km
- (4) 80 km

3. A diode detector is used to detect an amplitude modulated wave of 60% modulation by using a condenser of capacity 250 pico farad in parallel with a load resistance 100 kilo ohm. Find the maximum modulated frequency which could be detected by it. [JEE (Main)-2013]

- (1) 10.62 MHz
- (2) 10.62 kHz
- (3) 5.31 MHz
- (4) 5.31 kHz

4. 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

[JEE (Main)-2015]

- (1) 2 MHz only
- (2) 2005 kHz and 1995 kHz
- (3) 2005 kHz, 2000 kHz and 1995 kHz
- (4) 2000 kHz and 1995 kHz

5. Choose the correct statement: [JEE (Main)-2016]

- (1) In amplitude modulation the frequency of the high frequency carrier wave is made to vary in proportion to the amplitude of the audio signal.
- (2) In frequency modulation the amplitude of the high frequency carrier wave is made to vary in proportion to the amplitude of the audio signal.
- (3) In frequency modulation the amplitude of the high frequency carrier wave is made to vary in proportion to the frequency of the audio signal.
- (4) In amplitude modulation the amplitude of the high frequency carrier wave is made to vary in proportion to the amplitude of the audio signal.

6. 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 $\Delta\omega_m \ll \omega_c$. Which of the following frequencies is not contained in the modulated wave? [JEE (Main)-2017]

- (1) ω_m
- (2) ω_c
- (3) $\omega_m + \omega_c$
- (4) $\omega_c - \omega_m$

7. 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 channel requires a bandwidth of 5 kHz?

[JEE (Main)-2018]

- (1) 2×10^3
- (2) 2×10^4
- (3) 2×10^5
- (4) 2×10^6

8. In a communication system operating at wavelength 800 nm, only one percent of source frequency is available as signal bandwidth. The number of channels accomodated for transmitting TV signals of band width 6 MHz are (take velocity of light $c = 3 \times 10^8$ m/s, $h = 6.6 \times 10^{-34}$ J-s)

[JEE (Main)-2019]

- (1) 3.75×10^6
- (2) 3.86×10^6
- (3) 6.25×10^5
- (4) 4.87×10^5

9. A TV transmission tower has a height of 140 m and the height of the receiving antenna is 40 m. What is the maximum distance upto which signals can be broadcasted from this tower in LOS (Line of Sight) mode? [JEE (Main)-2019]

(Given : radius of earth = 6.4×10^6 m)

- (1) 65 km (2) 80 km
 (3) 40 km (4) 48 km
10. The modulation frequency of an AM radio station is 250 kHz, which is 10% of the carrier wave. If another AM station approaches you for license what broadcast frequency will you allot?

[JEE (Main)-2019]

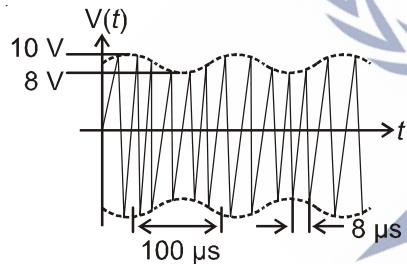
- (1) 2750 kHz (2) 2900 kHz
 (3) 2000 kHz (4) 2250 kHz

11. An amplitude modulated signal is given by $V(t) = 10 [1 + 0.3\cos(2.2 \times 10^4 t)] \sin(5.5 \times 10^5 t)$. Here t is in seconds. The sideband frequencies (in kHz) are, [Given $\pi = 22/7$] [JEE (Main)-2019]

- (1) 1785 and 1715 (2) 178.5 and 171.5
 (3) 89.25 and 85.75 (4) 892.5 and 857.5

12. An amplitude modulated signal is plotted below:

[JEE (Main)-2019]



Which one of the following best describes the above signal?

- (1) $(9 + \sin(2\pi \times 10^4 t))\sin(2.5\pi \times 10^5 t)$ V
 (2) $(9 + \sin(4\pi \times 10^4 t))\sin(5\pi \times 10^5 t)$ V
 (3) $(1 + 9\sin(2\pi \times 10^4 t))\sin(2.5\pi \times 10^5 t)$ V
 (4) $(9 + \sin(2.5\pi \times 10^5 t))\sin(2\pi \times 10^4 t)$ V
13. A 100 V carrier wave is made to vary between 160 V and 40 V by a modulating signal. What is the modulation index? [JEE (Main)-2019]

- (1) 0.5 (2) 0.4
 (3) 0.6 (4) 0.3

14. To double the covering range of a TV transmission tower, its height should be multiplied by

[JEE (Main)-2019]

- (1) $\sqrt{2}$ (2) 2

- (3) $\frac{1}{\sqrt{2}}$ (4) 4

15. The wavelength of the carrier waves in a modern optical fiber communication network is close to

[JEE (Main)-2019]

- (1) 600 nm (2) 900 nm
 (3) 1500 nm (4) 2400 nm

16. In a line of sight radio communication, a distance of about 50 km is kept between the transmitting and receiving antennas. If the height of the receiving antenna is 70 m, then the minimum height of the transmitting antenna should be :

[JEE (Main)-2019]

(Radius of the Earth = 6.4×10^6 m).

- (1) 20 m (2) 51 m
 (3) 32 m (4) 40 m

17. A signal $A\cos\omega t$ is transmitted using $v_0\sin\omega_0 t$ as carrier wave. The correct amplitude modulated (AM) signal is [JEE (Main)-2019]

- (1) $v_0\sin\omega_0 t + \frac{A}{2}\sin(\omega_0 - \omega)t + \frac{A}{2}\sin(\omega_0 + \omega)t$
 (2) $(v_0 + A)\cos\omega t \sin\omega_0 t$
 (3) $v_0\sin\omega_0 t + A\cos\omega t$
 (4) $v_0\sin[\omega_0(1 + 0.01 A\sin\omega t)t]$

18. The physical sizes of the transmitter and receiver antenna in a communication system are

[JEE (Main)-2019]

- (1) Inversely proportional to modulation frequency
 (2) Inversely proportional to carrier frequency
 (3) Proportional to carrier frequency
 (4) Independent of both carrier and modulation frequency

19. A message signal of frequency 100 MHz and peak voltage 100 V is used to execute amplitude modulation on a carrier wave of frequency 300 GHz and peak voltage 400 V. The modulation index and difference between the two side band frequencies are : [JEE (Main)-2019]

- (1) 4 ; 2×10^8 Hz
 (2) 4 ; 1×10^8 Hz
 (3) 0.25 ; 1×10^8 Hz
 (4) 0.25 ; 2×10^8 Hz

20. Given below in the left column are different modes of communication using the kinds of waves given in the right column.

[JEE (Main)-2019]

- | | |
|------------------|-------------------|
| A. Optical Fibre | P. Ultrasound |
| Communication | |
| B. Radar | Q. Infrared Light |
| C. Sonar | R. Microwaves |
| D. Mobile Phones | S. Radio Waves |

From the options given below, find the most appropriate match between entries in the left and the right column.

[JEE (Main)-2019]

- (1) A-Q, B-S, C-P, D-R
- (2) A-Q, B-S, C-R, D-P
- (3) A-S, B-Q, C-R, D-P
- (4) A-R, B-P, C-S, D-Q

21. In an amplitude modulator circuit, the carrier wave is given by, $C(t) = 4 \sin(20000\pi t)$ while modulating signal is given by, $m(t) = 2 \sin(2000\pi t)$. The values of modulation index and lower side band frequency are

[JEE (Main)-2019]

- (1) 0.5 and 10 kHz
- (2) 0.3 and 9 kHz
- (3) 0.4 and 10 kHz
- (4) 0.5 and 9 kHz

22. An amplitude modulated wave is represented by the expression

$$v_m = 5(1 + 0.6 \cos 6280t) \sin(211 \times 10^4 t) \text{ volts}$$

The minimum and maximum amplitudes of the amplitude modulated wave are, respectively

[JEE (Main)-2020]

- | | |
|--------------|--------------------------|
| (1) 5 V, 8 V | (2) $\frac{3}{2}$ V, 5 V |
| (3) 3 V, 5 V | (4) $\frac{5}{2}$ V, 8 V |

