CHAPTER 29

# Communication Systems

**1.** This question has Statement – 1 and Statement – 2. Of the four choices given after the statements, choose the one that best describes the two statements. **[2011]**

**Statement – 1 :** Sky wave signals are used for long distance radio communication. These signals are in general, less stable than ground wave signals.

**Statement – 2 :** The state of ionosphere varies from hour to hour, day to day and season to season.

(a) Statement–1 is true, Statement–2 is true, Statement–2 is the correct explanation of Statement–1.

(b) Statement–1 is true, Statement–2 is true, Statement–2 is not the correct explanation of Statement – 1.

(c) Statement – 1 is false, Statement – 2 is true.

(d) Statement – 1 is true, Statement – 2 is false.

**2.** Which of the following four alternatives is not correct ? We need modulation : **[2011 RS]**

(a) to reduce the time lag between transmission and reception of the information signal

(b) to reduce the size of antenna

(c) to reduce the fractional band width, that is the ratio of the signal band width to the centre frequency

(d) to increase the selectivity

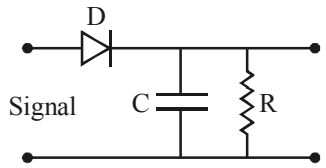
**3.** A radar has a power of 1kW and is operating at a frequency of 10 GHz. It is located on a mountain top of height 500 m. The maximum distance upto which it can detect object located on the surface of the earth

(Radius of earth = $6.4 \times 10^6$m) is : **[2012]**

(a) 80km (b) 16km

(c) 40km (d) 64km

**4.** A diode detector is used to detect an amplitudemodulated wave of 60% modulation by using a condenser of capacity 250 picofarad in parallel with a load resistance 100 kilo ohm. Find the maximum modulated frequency which could be detected by it. **[2013]**




(a) 10.62 MHz (b) 10.62 kHz

(c) 5.31 MHz (d) 5.31 kHz

**5.** 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 : **[2015]**

(a) 2005 kHz, 2000 kHz and 1995 kHz

(b) 2000 kHz and 1995 kHz

(c) 2 MHz only

(d) 2005 kHz and 1995 kHz

**6.** Choose the correct statement :

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

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

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

(d) In amplitude modulation the frequency of the high frequency carrier wave is made to vary in proportion to the amplitude of the audio signal. **[2016]**

**7.** In amplitude modulation, sinusoidal carrier frequency used is denoted by $\omega_c$ and the signal frequency is denoted by $\omega_m$. 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 ? **[2017]**

(a) $\omega_m + \omega_c$ (b) $\omega_c - \omega_m$

(c) $\omega_m$ (d) $\omega_c$

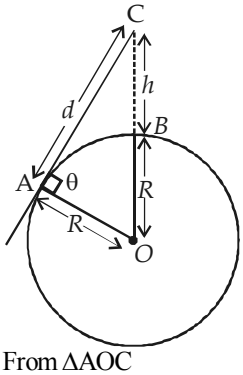
| Answer Key | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | | | | | | | | |
| (b) | (a) | (a) | (b) | (a) | (c) | (c) | | | | | | | | |

## SOLUTIONS

**1.** **(b)** For long distance communication, sky wave signals are used.
Also, the state of ionosphere varies every time.
So, both statements are correct.

**2.** **(a)** Low frequencies cannot be transmitted to long distances. Therefore, they are super imposed on a high frequency carrier signal by a process known as modulation.
Speed of electro-magnetic waves will not change due to modulation. So there will be time lag between transmission and reception of the information signal.

**3.** **(a)** Let $d$ is the maximum distance, upto which it can detect the objects




From $\Delta AOC$

$$OC^2 = AC^2 + AO^2$$

$$(h+R)^2 = d^2 + R^2$$

$$\Rightarrow \quad d^2 = (h+R)^2 - R^2$$

$$d = \sqrt{(h+R)^2 - R^2} \; ; \; d = \sqrt{h^2 + 2hR}$$

$$d = \sqrt{500^2 + 2\times 6.4\times 10^6} = 80\,\text{km}$$

**4.** **(b)** **Given :** Resistance R = 100 kilo ohm
$= 100 \times 10^3\,\Omega$
Capacitance C = 250 picofarad
$= 250 \times 10^{-12}$F
$\tau = RC = 100 \times 10^3 \times 250 \times 10^{-12}$ sec
$= 2.5 \times 10^7 \times 10^{-12}$ sec
$= 2.5 \times 10^{-5}$ sec
The higher frequency whcih can be detected with tolerable distortion is

$$f = \frac{1}{2\pi m_a RC} = \frac{1}{2\pi \times 0.6 \times 2.5 \times 10^{-5}}\,Hz$$

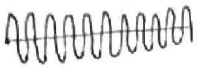
$$= \frac{100\times 10^4}{25\times 1.2\pi}\,Hz = \frac{4}{1.2\pi}\times 10^4\,Hz$$

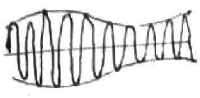
$= 10.61$ KHz
This condition is obtained by applying the condition that rate of decay of capacitor voltage must be equal or less than the rate of decay modulated singnal voltage for proper detection of mdoulated signal.

**5.** **(a)** Amplitude modulated wave consists of three frequencies are $\omega_c + \omega_m$, $\omega$,$\omega_c - \omega_m$ i.e. 2005 KHz, 2000KHz, 1995 KHz

**6.** **(c)** In amplitude modulation, the amplitude of the high frequency carrier wave made to vary in proportional to the amplitude of audio signal.


Audio signal


Carrier wave


Amplitude modulated wave

**7.** **(c)** Modulated carrier wave contains frequency $w_{c \text{ and }}\ w_c \pm w_m$