SOLVED NCERT QUESTIONS

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

Sol. (b)

(10 kHz cannot be radiated, size of antenna would be large, 1GHz and 1000 GHz will penetrate the atmosphere).

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

(a) Ground waves (b) Sky waves

(c) Surface waves (d) Space waves

Sol. (d) Space waves (Refer to table)

3. Digital signals

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

(ii) represent values as discrete steps,

(iii) can utilise binary system, and

(iv) can utilise 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).

Sol. (c) (Digital means discrete values = binary, decimal means continuous values so it cannot be a digital signal.)

4. Is it necessary for a transmitting 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?

Sol. No.

Height of antenna = 81 m

service are = πd_T^2 where

$d_T = \sqrt{2Rh} = \sqrt{2 \times 6.4 \times 10^6 \times 81}$

$\pi d_T^2 = 3.14 \times 2 \times 6.4 \times 10^6 \times 81 \text{ m}^2$

$= 3258 \times 10^6 \text{ m}^2 = 3258 \text{ km}^2$ $\left(\begin{array}{l} \because 10^3 m = 1 \text{ km} \\ 10^6 m^2 = 1 \text{ km}^2 \end{array}\right)$

SOLVED NCERT QUESTIONS

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%?

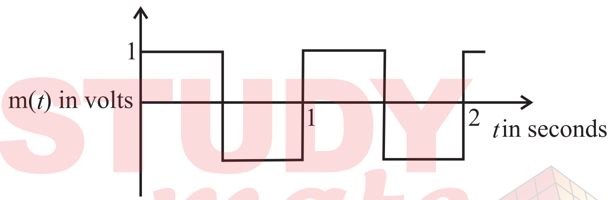
Sol. Modulation index $\mu = \frac{A_m}{A_c}$

$$\Rightarrow \quad \mu = \frac{A_m}{A_c} = \frac{75}{100}$$

Peak voltage = A_c = 12

$$\Rightarrow \quad A_m = \frac{75}{100} \times 12 = 9 \text{ V}.$$

6. A modulating signal is a square wave, as shown in figure.

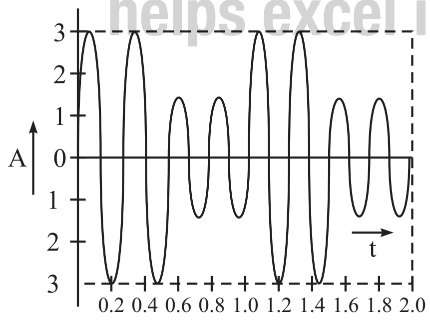


The carrier wave is given by $c(t) = 2 \sin (8\pi t)$ volts.

(i) Sketch the amplitude modulated waveform

(ii) What is the modulation index?

Sol. (i)



Comparing the given carrier wave equation with

$C(t) = A_c \sin (\omega_c t)$

We get, $A_c = 2\text{V}, \omega_c = 8\pi$ or $\frac{2\pi}{T_c} = 8\pi$

or $T_c = 0.25$ s

Time period of modulating signal

STUDY mate helps excel in boards

$T_m = 1$ s and $\omega_m = \dfrac{2\pi}{T_m} = 2\pi$

Amplitude of modulating signal, $A_m = 1$ V

(ii) Modulation index, $\mu = \dfrac{A_m}{A_c} = \dfrac{1\text{V}}{2\text{V}} = 0.5$

7. For an amplitude modulated wave, the maximum amplitude is found to be 10 V while the 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 volt?

Sol. Maximum amplitude = $m_1 = A_c + A_m$

Minimum amplitude = $m_2 = A_c - A_m$

Now $m_1 + m_2 = 2A_c$

$m_1 - m_2 = 2A_m \Rightarrow \mu = \dfrac{A_m}{A_c} = \dfrac{m_1 - m_2}{m_1 + m_2} = \dfrac{8}{12} = \dfrac{2}{3}$

$\mu = 0.66$

When minimum amplitude $m_2 = 0$ then $\mu = \dfrac{m_1}{m_1} = 1$ irrespective of m_1

8. Due to economic reasons, only the upper sideband of an AM wave is transmitted, but at the receiving station, there is a facility for generating the carrier. Show that if a device is available which can multiply two signals, then it is possible to recover the modulating signals at the receiver station.

Sol. Let the received signal be $A_1 \cos(\omega_c + \omega_n)t$ (upper side band)

The carrier wave $A_c \cos \omega_c t$ is available at receiving station then the device multiplies the two signals as $A_1 \cos(\omega_c + \omega_m)t . A_c \cos \omega_c t$

$= A_1 A_c \cos(\omega_c + \omega_m)t . \cos \omega_c t$

using $\cos A \cos B = \dfrac{1}{2}\cos(A+B) + \cos(A-B)$

We get $= \dfrac{A_1 A_c}{2}[\cos(\omega_c + \omega_m + \omega_c)t + \cos(\omega_c + \omega_m - \omega_c)t]$

$= \dfrac{A_1 A_c}{2}[\cos(2\omega_c + \omega_m)t + \cos \omega_c t]$

If we have a low pass filter which allows lower frequencies to pass through, then $(2\omega_c + \omega_m)$ wave would be blocked and $\dfrac{A_1 A_c}{2}\cos \omega_c t$ signal would be

STUDY mate helps excel in boards

allowed to pass through hence the message signal $\frac{A_1 A_c}{2}\cos\omega_m t$ would be recorded.

STUDY mate helps excel in boards