An amplitude modulated wave is represented by the expression $v_m = 5(1+0.6\cos 6280t)\sin(211\times10^4 t)$ volts The minimum and maximum amplitudes of the amplitude modulated wave are, respectively : **[Sep. 02, 2020 (I)]**

(a) $\frac{3}{2}$ V, 5 V

(b) $\frac{5}{2}$ V, 8 V

(c) 5 V, 8 V

(d) 3 V, 5 V

(b) From the given expression,

$V_m = 5\,(1 + 0.6\cos 6280t)\sin(211 \times 10^4 t)$

Modulation index, $\mu = 0.6$

$\because A_m = \mu A_c$

$$\frac{A_{max} + A_{min}}{2} = A_c = 5 \qquad \text{...(i)}$$

$$\frac{A_{max} - A_{min}}{2} = A_m = 3 \qquad \text{...(ii)}$$

From equation (i) + (ii),

Maximum amplitude, $A_{max} = 8$.

From equation (i) – (ii),

Minimum amplitude $A_{min} = 2$.

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 : **[12 April 2019 II]**

(a) 0.5 and 10 kHz
(b) 0.4 and 10 kHz
(c) 0.3 and 9 kHz
(d) 0.5 and 9 kHz

(d) Modulation index, $\mu = \frac{A_m}{A_c} = \frac{2}{4} = 0.5$

Given, $fe = \frac{20000\pi}{2\pi} = 10000$ Hz.

and $fm = \frac{2000\pi}{2\pi} = 1000$ Hz.

$\therefore$ LSB $= f_e - f_m = 10000 - 1000 = 9000$ Hz.

A 100 V carrier wave is made to vary between 160 V and 40 V by a modulating signal. What is the modulation index?

[12 Jan. 2019 I]

(a) 0.3 (b) 0.5 (c) 0.6 (d) 0.4

(c) Maximum amplitude $= E_m + E_c = 160$

$E_m + 100 = 160$

$E_m = 160 - 100 = 60$

Modulation index,

$$\mu = \frac{E_m}{E_c} = \frac{60}{100}$$

$\mu = 0.6$

To double the covering range of a TV transmittion tower, its height should be multiplied by: **[12 Jan 2019 II]**

(a) $\frac{1}{\sqrt{2}}$ (b) 2 (c) 4 (d) $\sqrt{2}$

(c) As we know, Range $= \sqrt{2hR}$

therefore to double the range height ‘h’ should be 4 times.

A message signal of frequency 100 MHz and peak voltage100 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 : **[10 April 2019 II]**

(a) 4 ; 1×10^{8} Hz (b) 4 ; 2×10^{8} Hz

(c) 0.25 ; 2×10^{8} Hz (d) 0.25 ; 1×10^{-8}T

(c) Equation given

$V(t) = 10[1 + 0.3\cos(2.2\times10^{4})]$

$\sin(5.5\times10^{5}t)$

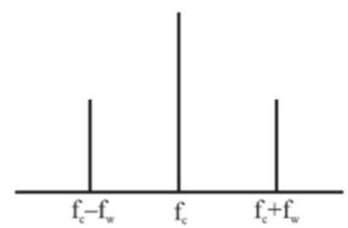
$= 10 + 1.5[\sin(57.2\times10^{4}t) + \sin(52.8\times10^{4}t)]$

$\omega_c + \omega_w = 57.2\times10^{4} = 2\pi f_1$

$$f_1 = \frac{57.2\times10^{4}}{2\times\left(\frac{22}{7}\right)} = 9.1\times10^{4} \simeq 91\,\text{KHz}$$

$\omega_c - \omega_w = 52.8\times10^{4}$

$$f_2 = \frac{52.8\times10^{4}}{2\times\left(\frac{22}{7}\right)} \simeq 84\,\text{KHz}$$



Upper side band frequency (f_1) is

$$f_1 = f_c - f_w = \frac{52.8\times10^{4}}{2\pi} \approx 85.00\,\text{kHz}$$

Lower side band frequency (f_2) is

$$f_2 = f_c + f_w = \frac{57.2\times10^{4}}{2\pi} \approx 90.00\,\text{kHz}$$