



Question 15.7:

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?

Answer

Maximum amplitude, $A_{\max} = 10$ V

Minimum amplitude, $A_{\min} = 2$ V

Modulation index μ , is given by the relation:

$$\mu = \frac{A_{\max} - A_{\min}}{A_{\max} + A_{\min}}$$

$$= \frac{10 - 2}{10 + 2} = \frac{8}{12} = 0.67$$

If $A_{\min} = 0$,

$$\text{Then } \mu = \frac{A_{\max}}{A_{\max}} = \frac{10}{10} = 1$$

Question 15.8:

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 signal at the receiver station.

Answer

Let ω_c and ω_s be the respective frequencies of the carrier and signal waves.

Signal received at the receiving station, $V = V_1 \cos (\omega_c + \omega_s)t$

Instantaneous voltage of the carrier wave, $V_{in} = V_c \cos \omega_c t$

$$\therefore V V_{in} = V_1 \cos (\omega_c + \omega_s)t (V_c \cos \omega_c t)$$

$$= V_1 V_c [\cos (\omega_c + \omega_s)t \cdot \cos \omega_c t]$$

$$= \frac{V_1 V_c}{2} [2 \cos (\omega_c + \omega_s)t \cdot \cos \omega_c t]$$

$$= \frac{V_1 V_c}{2} [\cos \{(\omega_c + \omega_s)t + \omega_c t\} + \cos \{(\omega_c + \omega_s)t - \omega_c t\}]$$

$$= \frac{V_1 V_c}{2} [\cos \{(2\omega_c + \omega_s)t + \cos \omega_s t\}]$$

At the receiving station, the low-pass filter allows only high frequency signals to pass through it. It obstructs the low frequency signal ω_s . Thus, at the receiving station, one

can record the modulating signal $\frac{V_1 V_c}{2} \cos \omega_s t$, which is the signal frequency.

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