

Question Bank for Open Book Exam

Communication System

Amplitude Modulation

1. The antenna current of an AM transmitter is 8A when only the carrier is sent, but increases to 8.93A when the carrier is modulated by the single sine wave. Find the percentage modulation. Determine the antenna current when the percentage of modulation changes to 0.8.
2. The antenna current of AM broadcast transmitter, modulated to a depth of 40% by an audio sine wave, is 11A. It increases to 12A as a result of simultaneous modulation by another audio sine wave. What is the modulation index due to second wave?
3. When the modulation percentage is 75, an AM transmitter produces 10kW. How much of this is carrier power. What would be the percentage power saving if the carrier and one of the side bands were suppressed before transmission took place.
4. A 360W carrier is simultaneously modulated by two sine waves with modulation percentage of 55 and 65 respectively. What is the total side band power radiated?
5. Derive the relation between the output power of an AM transmitter and depth of modulation, and plot it as a graph for values of the modulation index from zero to maximum.
6. From the expression for the instantaneous voltage of an AM wave, derive the formula for the RMS value of this wave.
7. In a phase shift SSB system, the phase shift at the audio frequency of 500 Hz is only 88° . To what extent will this frequency be present in the unwanted lower side band?
8. Prove that the balanced modulator produces an output consisting of sidebands only, with carrier removed. Other than in SSB generation, what application can this circuit have?
9. Draw the block diagram of a SSB transmitter using filter system. Why must the filter have such sharp cut-off outside the passband? In a transmitter, must this cut-off be equally sharp on each side of filter's passband?
10. What are linear amplifiers? Why are they used in SSB transmitters?
11. Draw the block diagram of phase cancellation SSB generator and explain how the carrier and the unwanted sideband are suppressed? What change is necessary to suppress the other sideband?
12. Compare the three main systems of SSB generation by drawing up table of the outstanding characteristics of each system.
13. What are the main disadvantages of SSB?
14. What is the most critical component value in a diode detector circuit? Explain.
15. What is the most commonly used filter in a filter-type SSB generator?
16. The message signal $m(t) = 2\cos 400t + 4\sin(500t + \frac{\pi}{3})$ modulates the carrier signal $c(t) = A\cos(8000\pi t)$, using DSB amplitude modulation. Find the time domain and frequency domain representation of the modulated signal and plot the spectrum (Fourier transform) of the modulated signal. What is the power content of the modulated signal?
17. An AM signal has the form
$$u(t) = [20 + 2\cos 3000\pi t + 10\cos 6000\pi t] \cos(2\pi f_c t)$$

where $f_c = 10^5$ Hz.

1. Sketch the (voltage) spectrum of $u(t)$.
2. Determine the power in each of the frequency components.
3. Determine the modulation index.

4. Determine the power in the sidebands, the total power, and the ratio of the sidebands power to the total power.
18. The amplitude modulated waveform $S(t) = [1 + m \cos(2\pi f_m t)] \cos(2\pi f_c t)$ is to be demodulated by an envelope detector. Find the maximum permissible value of the modulation index m for which such demodulation is possible. Also sketch the output of the envelope for $m=2$.