EE 302 PS 07 - SOLUTIONS

Chapter 3

Questions: 1, 13, 14
Problems: None
Critical Thinking: None

Additional Problems: 1-4

Question 1

Modulation is the process of modifying the characteristics of a signal called a *carrier* with another information signal for the purpose of transmitting the information signal more efficiently or effectively.

Question 13

For an overmodulated signal, the carrier signal's amplitude is to small to support modulating the information signal. Thus, *clipping* occurs, and the signal is *distorted*.

Question 14

"Sidebands."

Additional Problem 1

$$f_c = 800 \text{ kHz}$$

$$f_{\text{USB}} = f_c + f_i = 800.5 \text{ kHz}$$

$$f_{\text{LSB}} = f_c - f_i = 799.5 \text{ kHz}$$

$$m = \frac{V_i}{V_c} = \frac{80}{100} = 0.80 \longrightarrow 80\%$$

Additional Problem 2

$$m = \frac{V_i}{V_c} = \frac{120}{100} = 1.20 \longrightarrow 120\%$$

This is *overmodulation*.

Additional Problem 3

{1280 kHz, [1280 kHz ± 853 Hz], and [1280 kHz ± 960 Hz] }, or {1279040 Hz, 1279147 Hz, 1280000 Hz, 1280853 Hz, and 1280960 Hz}

The tone that is higher in frequency determines BW (i.e., the 960 Hz tonal) because it causes sideband frequencies further from the carrier frequency.

10 kHz.

Additional Problem 4

The frequency of any given tone after demodulation can be determined by finding the distance from any one of the corresponding AM sidebands to the AM carrier frequency. I use f_{carrier} in conjunction with upper side-band frequencies:

$$f_G = f_{\text{USB-G}} - f_{\text{carrier}} = 392 \text{ Hz}$$

$$f_E = f_{\text{USB-E}} - f_{\text{carrier}} = 330 \text{ Hz}$$

$$f_C = f_{\text{USB-C}} - f_{\text{carrier}} = 262 \text{ Hz}$$

The note G determines the bandwidth, as it is the highest in frequency. It creates sidebands that are the farthest from the carrier frequency. Since G causes sidebands 392 Hz away from the carrier on either side, the bandwidth required for this tone is 2×392 Hz $= 784$ Hz.