

EE 567

Homework 4

Due Tuesday, September 25, 2018

Work all 5 problems.

Problem 1. Over the interval $0 \leq t \leq 1$ a PM signal is given by

$$s_{PM}(t) = 10 \cos 2\pi f_0 t$$

where $f_0 = 100$ kHz. It is known that the carrier frequency is 75 kHz. If $k_p = 1250$ determine $m(t)$ over the interval $0 \leq t \leq 1$.

Problem 2. Over the interval $0 \leq t \leq 1$ an FM signal is given by

$$s_{FM}(t) = 10 \cos 2\pi f_0 t$$

where $f_0 = 100$ kHz. It is known that the carrier frequency is 75 kHz. If $k_f = 1250$ determine $m(t)$ over the interval $0 \leq t \leq 1$.

Problem 3. An angle modulated signal is described by

$$s(t) = 10 \cos (2\pi f_c t + 0.1 \sin(2\pi f_1 t))$$

where $f_c = 1$ MHz and $f_1 = 1$ kHz.

- Find the power of the modulated signal $s(t)$.
- Find the frequency deviation, Δf .

Problem 4. A carrier wave of frequency 40 MHz is frequency-modulated by a sine-wave of amplitude 8 volts and frequency 15 kHz. The frequency sensitivity of the modulator is 10 kHz per volt.

- Determine the approximate bandwidth of the FM wave using Carson's rule.
- Repeat part (a) assuming that the amplitude of the modulating wave is doubled.

- c. Repeat part (a) assuming that the modulation frequency is doubled.

Problem 5. A certain AM signal is given as

$$s_{AM}(t) = [2 + \cos(2\pi f_m t)] \cos(2\pi f_c t).$$

The value of f_c is much greater than the bandwidth of the signal.

- a. What is the modulating signal, $m(t)$?
- b. What is the modulation index?
- c. Determine the average message power in $m(t)$.