

# EE 567

## Homework 4

Due Monday, September 25, 2017

**Problem 1.** Lathi and Ding 5.1-4 (modified). Over the interval  $0 \leq t \leq 1$  a PM signal is given by

$$s_{PM}(t) = 10 \cos(13,000\pi t).$$

It is known that the carrier frequency is 5000 Hz. If  $k_p = 1000$  rad/volt determine  $m(t)$  over the interval  $0 \leq t \leq 1$ .

**Problem 2.** Lathi and Ding 5.1-4 (modified). Over the interval  $0 \leq t \leq 1$  an FM signal is given by

$$s_{FM}(t) = 10 \cos(13,000\pi t).$$

It is known that the carrier frequency is 5000 Hz. If  $k_f = 1000$  Hz/volt determine  $m(t)$  over the interval  $0 \leq t \leq 1$ .

**Problem 3.** An angle modulated signal is described by

$$s(t) = 20 \cos(2\pi f_c t + 0.2 \sin(2\pi f_1 t))$$

where  $f_c = 1$  MHz and  $f_1 = 2$  kHz.

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

**Problem 4.** A carrier wave of frequency 25 MHz is frequency-modulated by a sine-wave of amplitude 5 volts and frequency 10 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.
- Repeat part (a) assuming that the modulation frequency is doubled.