

# EE 567

## Homework 2

Due Tuesday, September 11, 2018 at 6:40 p.m.

**Work all 5 problems.**

**Problem 1.** Let

$$g(t) = c_1 \cos(2\pi f_c t + \theta_1) + c_2 \cos(2\pi f_c t + \theta_2), \quad c_1, c_2, t \text{ real numbers, } \theta_1 = \theta_2.$$

Compute the time average message power in  $g(t)$ .

**Problem 2.** Determine the time average message power and the rms value for each of the following signals:

- $A \sin\left(5t + \frac{\pi}{4}\right)$
- $A \sin\left(5t + \frac{\pi}{4}\right) + B \sin\left(50t + \frac{\pi}{6}\right)$
- $A \sin(3t) \cos(6t)$

**Problem 3.** Compute

- $\int_{-2}^2 (t^2 + 1) \delta(t - 1) dt.$
- $\int_{-\infty}^{\infty} \cos\left(\frac{\pi}{2}(x - 5)\right) \delta(3x - 3) dx.$

**Problem 4.** Pulse Coded Modulation (PCM) is to be used to encode a signal. The signal ranges between the values -3 and +3. There are 4 bits or 16 levels (hence 16 code numbers) available. The levels assigned have symmetry like we demonstrated in class. The first three sample values obtained (before quantization) are 1.1, 2.7, and -2.7, respectively.

- Find the quantized values for the three sample values.
- Find the corresponding PCM sequences for the quantized values.

**Problem 5.** Let  $s(t) = 10 \cos(2\pi ft + \pi/8)$  where  $f = 15$  Hz. Let us sample  $s(t)$  at the sampling rate of  $f_s = 60$  Hz to obtain the discrete time signal  $s(nT_s) = 10 \cos(2\pi fnT_s + \pi/8)$  where  $T_s = 1/f_s$ , for  $n = 0, 1, 2, \dots, 40$ . Using the PCM example in class as a guide compute the quantized PAM signal and

the corresponding PCM codeword assuming you have 9 bits or 512 levels to represent the quantized signal.

Note: In this problem you are to use Matlab. You should include your Matlab code with your homework submission.