**EE451 Mobile Communication Systems**

**Homework 3**

**Due Date: Dec 21, 2023 (in Class)**

**All assignments received after deadline will not be marked. This is the hard deadline.**

**Problem 1 (CLO-1):**

Consider a linearly modulated signal of the form s(t) = Re{sl(t)ej2πfct}, where

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and where all pairs of symbols bn and bm are independent for n ≠m and each bn ε {-3, -1,1,3}, taking the values with equal probability. Furthermore, assume the pulse p(t) is rectangular with unit height and width Ts. Sketch the power spectral density (PSD), including labeling its peak height.

**Problem 2:**

Suppose the constellation of 8 signals for a communication system is given below

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1. Find the energy of each symbol and the average symbol energy of this constellation
2. Give a complete union bound for the probability of symbol error.
3. If the basis functions are the usual ones for QPSK, give the expression of the symbol waveform as a function of time for the symbol that is indicated by the arrow.

Chart, box and whisker chart

Description automatically generated**Problem 3:**

Two signal points Sa and Sb are shown below

1. Suppose the noise spectral height is N0/2=25/16. Evaluate the BER if these two signals are used in a wireless communication link.

Text, letter

Description automatically generated

Construct an expression of signal labeled Sa in terms of t and Ts.

**Problem 4:**

Let the carrier frequency be 100 MHz and let the symbol period be 1 microsecond. Consider a transmitted BPSK signal that uses the 25% excess bandwidth **Root** **Raised Cosine pulses** (you can use the definition in Wikipedia, where beta=0.25). Using MATLAB or your favorite programming language, plot the RF modulated BPSK signal,

assuming the symbol sequence 1, -1, -1, 1, -1, -1, -1, 1.

**Problem 5:**

Using the same parameters as in Problem 1, plot the RF modulated QPSK waveform

Use the same sequence as in Problem 1, and let the quadrature symbols of the signal, , be -1, -1, 1, 1, 1, -1, 1, -1.

**Problem 6:**

Consider the pulse below, plotted versus time in microseconds. Could this pulse be a Nyquist pulse for a binary transmission with a 10MHz data rate? Why or why not?

