PCS QAM Project 2025

Use two pulse shapes for baseband modulation p(t) and $p_s(t)$. p(t) is a square pulse of duration T and height A and $p_s(t)$ is a sinc function whose main lobe width is 2T and height is A. T is the symbol time. Use a carrier tone of frequency f_c = 5Hz for up-conversion and down-conversion.

Build a 16-QAM transmitter and receiver.

For both I and Q use a matched filter, sample and threshold detector for 4-PAM decoding.

In the following assume T = 2 seconds and A = 1 Volt. Also, assume the sampling time T_s = 0.05 seconds for MATLAB emulation.

Note that 2-8 below may be different for the two pulses.

1. Write your RUID
2. Draw a complete block diagram of a transmitter and receiver starting with binary bits sent and binary bits received.
3. Set random seed in MATLAB using your RUID (using **rng(RUID)** function) and generate a random sequence of N=100000 bits using a rand function and denote with **bb**. List the first 10 bits of your sequence.
4. Before I/Q demodulation, add white Gaussian noise (0-mean) whose variances $\mathbf{v_i}$ are selected so that detection $\mathbf{SNR_i}$ is in the range **[0:7] dB.** (Note that this variance may be different for the two pulse shapes).
5. Plot EYE diagram for the I-branch based on the first 20 bits for both pulse shapes and SNRs in [0, 3, 7, infinity] dB.
6. Plot the constellations for the first 1000 bits for both pulse shapes and SNRs in [0, 3, 7, infinity] dB.
7. Estimate the bit error rate (BER) for all SNRs via simulation using your detector. Plot the BER vs SNR in dB using semilogy() function and compare with the curve that you get with the theoretical analysis (draw on the same graph).
8. What is the bit rate of your system?

Report submission/output:

Your report including the MATLAB should be given in a single pdf file as usual.

MATLAB code via copy and paste from pdf should generate all the plots in that single run together with the labels