Assignment #6

Due: Wed. Dec. 5, 13:00 am at FSS 1006 (beginning of the lecture). Hard copy only, no email submissions. Late entries will not be accepted!

Before doing the assignment, please read appropriate sections of Chapter 6 and 7 of the course textbook (by Rappaport, 2nd edition) or any other relevant book (e.g. from the reference list).

1) Find the average SNR per bit $\gamma_b = E_b / N_0$ required to detect a DPSK signal in a flat-fading channel so that the average BER does not exceed $10^{-2}$. Assume that the fading process is slow (quasi-static) and its distribution is (a) Rayleigh, (b) Ricean, with $K = 0$ dB and 10 dB. Compare your answers and make conclusions. Which is the best case scenario?

2) Repeat Problem 1 with BPSK modulation. Compare the answers, make conclusions.

3) Problem 6.37 in the textbook.

4) Problem 7.7.

5) Problem 7.11. Note: in our terminology, $y = $ outage probability, $P(\gamma) =$ instantaneous BER (i.e. for a given channel realization of SNR = $\gamma$), and $x =$ target BER. In questions (c) and (d), you have to assume that the BER = the outage probability = $10^{-3}$ is desired. In general, the BER and the outage probability do not have to be equal.

6) Consider a BPSK receiver operating in a Rayleigh (slow and frequency-flat) fading channel with the average BER = $10^{-1}$. Find % of time (or users) when instantaneous error rate exceeds $10^{-1}$.

Please read appropriate chapters of the textbook first, study all the examples, attempt to do them with the closed book. Remember the learning efficiency pyramid!

![Learning Pyramid](image.png)

Please include in your solutions all the intermediate results and their numerical values (if applicable). Detailed solutions are required, not just the final answers.

Plagiarism (i.e. “cut-and-paste” from a student to a student, other forms of “borrowing” the material for the assignment) is absolutely unacceptable and will be penalized. Each student is expected to submit his own solutions. If two (or more) identical or almost identical sets of solutions are found, each student involved receives 0 (zero) for that particular assignment. If this happens twice, the students involved receive 0 (zero) for the entire assignment component of the course in the marking scheme and the case will be send to the Dean’s office for further investigation.