Digital Communication Systems
Assignment 2019/2020

1- Explore the modulators and demodulators of MatLab/Simulink and estimate the probabilities of error for the various binary digital modulations that we have studied. Show in the same plot the simulation results and the theoretical curves for the bit error probability (see slide 113). Use again MatLab/Simulink to compare the bit error rate performance of the modulations MPSK (considering M = 4, 8, 16 and 32) and MQAM (taking M = 4, 16 and 64). Present your results in a plot analogous to the case before and draw your conclusions.

MPSK
MQAM
MFSK

2- Test the Cyclic and convolutional error correction codes on MatLab. Apply these codes to the BER simulations performed on the previous question and compare the results.

3- Repeat question 2 for a multipath channel. Show that for multipath channels with a long Excess Delay (Time Spread) and due to the ISI, the error rate is too high. (Take into consideration the cyclic prefix used in the next point (4) of the assignment).

4- Change the modulation used on the previous question to an OFDM modulation adapted to the multipath channel parameters. Show the superior performance of this type of modulation for multipath channels. Use the parameters in the following table for the OFDM transmitter model design.

Key Parameters of the OFDM transmitter	
Modulation	Same as in point 1
Coding rates	Same as in point 2
Number of used sub-carriers	52
Ofdm symbol duration	4 µsec
Guard interval (cyclic prefix)	0.8 µsec
Subcarrier Spacing	312.5 kHz
Channel bandwidth	20 MHz

64 (6 +6 guards)
= 3.2 + 0.8 (gi)
How many samples is this?
16? I think so (0.8/3.2*64)
= 1/3.2e-6
= 64 * fspacing

The students should submit by email the MatLab/Simulink files with the simulations and a short report (10 pages maximum) two days before the presentation date. This work is individual and each student must submit its own code and report. The students should also prepare a presentation with no more than 15 slides to present on a date to be decided. Each student will have 15 minutes to present his work.