Spring 2023 - EE3082 Spring 2023, Project 1

Due: Monday 18.04.2023, 23:55.

Project submission policy:

1. You must present your own work. Collaboration is strictly prohibited. You must present your report in Microsoft Word only (using Equation Editor if needed). Screenshots, page photos or scanned pages will NOT be graded.
2. To get the maximum credit, discuss and comment on your results in detail.
3. You should submit a .docx document to UES with the source codes (.m) and other necessary files of each question. Do not include the source codes to your .docx report. Use separate .m files for each question. Submit your project in the form "Name_Lastname_EE3082_Project1.zip".
4. Before submitting your project, on a piece of paper hand write the following honor code and sign it. You can then take its photo and add it to the beginning of your .docx report.

"I neither lie, cheat, steal nor attempt to deceive. On all my work, my name affirms my Honor."

Please note that I am NOT going to grade the reports without the honor code.

Question 1 (35 pts)

a) In Matlab, read the following sentence and record your own voice for 4 seconds at a rate 40 kHz and generate a "message.wav" file.

"*Use a pencil to write the first draft*."

b) Downsample your message signal at a sampling rate 8 kHz, show the original signal and its discrete time samples for a very short period of time.
c) Using Spectrum Analyzer, show the two sided spectrum of the original signal and the sampled signal.
d) Define a low pass filter with suitable cutoff frequencies to recover the original low pass filter from its discrete time samples. Listen the original message signal and recovered message signal at 40 kHz and comment on your results.
e) Repeat the above steps for the new sampling rate 4 kHz. What happens at 4 kHz? Comment on your results.

Question 2 (35 pts)

a) In Matlab, read the following sentences and record your own voice for 4 seconds at a rate 40 kHz and generate "message1.wav" and "message2.wav" files.

"The two met while playing on the sand."

"This is a grand season for hikes on the road."

b) In Matlab, implement an analog QAM modulator with carrier frequency 8 kHz. Show the two sided QAM spectrum using Spectrum Analyzer.
c) Add Gaussian channel noise whose power is 1 micro Watts.
d) Implement QAM demodulator and recover message 1 and message 2. Listen the original message signals and recovered message signals and comment on your results.

e) Repeat the above steps with channel noise whose power is 1 milliWatts. Comment on your results.

Question 3 (30 pts)

In this question, you are NOT allowed to use "ssbmod" and "ssbdemod" functions.

a) In Matlab, read the following sentence and record your own voice for 4 seconds at a rate 40 kHz and generate "message.wav" file,

"We find joy in the simplest things. "

b) In Matlab, implement an USB modulator with carrier frequency 8 kHz. Show the two sided USB spectrum and DSB spectrum using Spectrum Analyzer.
c) Add Gaussian channel noise whose power is 1 micro Watts.
d) Implement USB/LSB demodulators and recover the message. Listen the original message signals and recovered message signals and comment on your results.
e) Repeat the above steps with channel noise whose power is 1 milliWatts. Comment on your results.