

EE 470 DIGITAL COMMUNICATION SYSTEMS
Fall 2013

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Instructor's office hours: Mon 11am-12pm, and by appointment.

Class Website: Announcements regarding the course and any supplementary material will be posted on the instructor's website www.isikun.edu.tr/~onurkaya, and Course Online. You are strongly encouraged to check the class website frequently to get updated information such as new problem sets, exam dates etc.

Class hours: Mon 2pm-3pm, Thu 1pm-3pm

Course Synopsis:

Digital Communication Systems is a senior level treatment of communication systems, with emphasis on digital communications. Communication is a process taking place between two or more parties, in which a message generated at one of the participating parties is represented by a signal which is transmitted through an imperfect medium to a receiver, where an estimate of the message is reconstructed. The goals of this course are

- To develop an understanding of how digital modulators and demodulators work,
- To learn how to represent various modulation techniques mathematically, in time and frequency domains, and more generally, in the signal space,
- To obtain some insight into the role of random processes in communication system analysis, both as a means of modeling noise, and also as a model for message generation,
- To address several key issues such as noise, bandwidth, interference; and to investigate their effects on the performance of communication systems,
- To explore fundamental limits of communication systems such as channel capacity.
- To introduce practical means of avoiding errors in the channel, such as error correcting codes.

Required Textbook: S. Haykin. Digital Communication Systems, Wiley, 2014.

(Highly) Suggested Reading: J. G. Proakis and M. Salehi. *Fundamentals of Communication Systems*, Pearson Prentice Hall, 2005.

CLASS POLICIES

Attendance: Attendance to lectures is automatically assumed, and will not be recorded. However, be advised that your attendance to the class will be indirectly assessed by frequent pop-quizzes.

Homeworks: There will be quasi-weekly homework sets consisting of problems which target the timely practice of the covered course material. Solutions to homework problems will be provided for feedback, but the homeworks will not directly contribute to the final grade. However, each student's attempt on homework problems will be tested by frequent quizzes on homework problems.

Quizzes: There will be several unannounced short bonus quizzes throughout the semester. These will total 20 bonus points, and the weight of each quiz will depend on the total number of quizzes. These quizzes will test either the topics recently covered in class (even on the very same day!), or your work on the homework problems.

Exams: There will be one written midterm (30%), one oral midterm (30%), one final (40%) exam. The exams will be closed book and notes. In the oral exam, you will be asked to explain concepts, derive formulas, or solve problems on a whiteboard. The language of examination will be English, and this rule will be strictly enforced. (The questions will be asked only in English, and your answers in any other language will not be taken into account in grading.) The schedule and venue of the exam will be determined in class. No cell phone use will be allowed during the exams.

Make-up Policy:

There will not be any make-ups for the quizzes and the written midterm. In the event of failure to attend at most one of the quizzes due to an emergency, formally documented medical excuses or other exceptional circumstances may be accepted, in which case your final grade will be determined by suitably projecting of remaining quiz grades. If you miss the written midterm with a valid excuse, its percentage will be added to the final.

The make-up for the midterm oral exam will be scheduled immediately upon receiving your excuse documents.

Cases which will not be accepted as valid excuses include, but are not limited to,

- Conflict in class hours.
- Working part/full time somewhere.
- Missing the shuttle, urgently having to go to the city for business.
- Bringing medical reports from unaccredited private hospitals.
- Accidents, illness in family, loss of relatives; unless proper legal documents are supplied.

Make-up policy for the final exam will follow the university rules and regulations.

Academic Dishonesty: Cheating, attempting to cheat, facilitation of cheating, fabrication of information, plagiarism and illegal use of copyrighted material are considered acts of academic dishonesty. Students conducting any of these acts will receive an automatic F from this course, and will face suspension/expulsion from the program, according to university rules and regulations.

Exam Dates and Grading Policy:

Bonus Quizzes	20%	: Pop-quizzes, dates will not be announced.
Midterm I	30%	: Nov. 6th, in class
Midterm II	30%	: Oral Exam, week of Dec 23rd. Date and time to be announced.
Final	40%	: To be announced.

The letter grades will be determined according to the following grade table, which is firm. No exceptions will be made, therefore please adjust your course-load accordingly, if you intend to take this course.

Overall Semester Total	Letter Grade
[85,100]	AA
[70,85)	BA
[60,70)	BB
[50,60)	CB
[40,50)	CC
[35,40)	DC
[30,35)	DD
[0,30)	F

Topics:

Below is the list of topics that will be covered in the course, along with a tentative schedule.

Week 1	Conversion of Analog Waveforms into pulses. Baseband PAM.
Week 2	PCM, DPCM, DM
Week 3	Vector spaces, geometric representation of signals.
Week 4	Conversion of continuous time channels into vector channels.
Week 5	Binary signaling. Optimum detector design for binary signals.
Week 6	Probability of error analysis for binary signals. Matched filter implementation of optimum detectors.
Week 7	M-ary signaling, detection, and probability of error.
Week 8	Passband modulation techniques (BPSK,QPSK, M-ary PSK), probability of error analysis
Week 9	Passband modulation techniques (QAM, FSK, MSK), probability of error analysis
Week 10	Band limited channels, Intersymbol Interference (ISI), signal design for no ISI, spectral shaping
Week 11	Fundamental limits in communication: introduction to information theory (Entropy, mutual information, source coding).
Week 12	Channel capacity, channel coding
Week 13	Error control coding
Week 14	Error control coding