Communication and Information Theory

ECE 460

Fall 2018

Instructor Dr. B.-Peter Paris
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Time and Place Monday and Wednesday, 3:00pm-4:15pm, Music and Theater Building, room 1005.

Office Hours Tuesdays 5:00–6:00pm and Mondays 10:00am–11:00am. or by appointment.

Course Goals This course introduces students to key concepts in the design and analysis of modern communications systems. Throughout, theory is illustrated by examples from wireless communication systems. Students will learn how modulation is used to shift signals to radio carrier frequencies and back; this forms the basis af analog modulation. Students will understand how digital information is transmitted in modern communication systems. Students will learn how to recover this digital information from a received signal.

Required Textbook 1. U. Madhow, *Introduction to Communication Systems*, Cambridge Press, 2014.

Recommended Further Reading

1. C. R. Johnson, Jr., W. A. Sethares, and A. Klein, *Software Receiver Design: Build Your Own Digital Communications System in Five Easy Steps*, Cambridge Press, 2011.
2. J.G. Proakis and M. Salehi, *Communication Systems Engineering*, Second Edition, Prentice Hall, Englewood Cliffs, NJ, 2002.
3. J.G. Proakis and M. Salehi, *Contemporary Communication Systems using MATLAB*, Brooks/Cole, 2000.
4. R.E.Ziemer and W.H.Tranter, *Principles of Communications*, Fourth Edition, Houghton Mifflin, Boston, MA, 1995.
5. MATLAB Student Edition, The Mathworks, Inc.

Homework will be assigned every week and is due the following week.

You are encouraged to work on the assignments in small groups. Do not refer to existing homework solutions; this constitutes plagiarism and will be handled in accordance with the Honor Code. Homework solutions will be made available. Homework will be collected and graded by the teaching assistant.

Multiple Quizzes, one Midterm Exam and a Final Exam will be given during the semester. Quizzes will not be announced and may be given at any time during the class. Make-up exams are rarely given. In case of an emergency, contact the instructor as soon as possible and always *before* the exam. Failure to take an exam, will result in no credit for the exam.

All exams are conducted under the rules and regulations of the **Honor Code** (see University Catalog).

Teaching Assistant Haotian Zhai
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On-line Class Material Class material will be distributed electronically via the World-Wide Web. Use a browser to find the ECE 460 homepage at URL: `http://www.spec.gmu.edu/~pparis/classes/ece460.html`. I will also correspond with you through your Mason e-mail account — check your e-mail regularly. The BlackBoard page for this course will contain homework assignments, syllabus, and your grades.

Final Grades are determined by a weighted average of homework, the two exams, and the final exam in the following manner:

Homework	20%
Quizzes	20%
Exam 1	20%
Final	40%

Tentative Course Schedule

Part I: Signals & System and Analog Signal Transmission and Reception
Book Chapters: 2 and 3.

Week 1 Signals and Systems Foundations for Communications

Week 2 Signals and Systems Foundations for Communications (cont'd)

Week 3 Baseband equivalent signals

Week 4 Analog Modulation techniques.

Week 5 Analog Modulation techniques (cont.).

Week 6 *Midterm Exam* (1.5 hrs).

Part II: Digital Signal Transmission and Reception
Book Chapters: 4, 5, and 6.

Week 7 Digital Modulation Concepts

Week 8 Digital Modulation Concepts — signal spaces

Week 9 Just enough on Random Processes

Week 10 Optimum Digital Receivers: The Matched Filter.

Week 11 Performance of Digital Receivers.

Week 12 Performance of Digital Receivers (cont.).

Week 13 Advanced Topics: Synchronization

Week 14 Putting it all together

Monday Dec. 17 *Final Exam* (1:30pm — 4:15pm).