

# Statistical Communication Theory

ECE 630

Spring 2017

**Instructor** Dr. B.-Peter Paris

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**Time and Place** Thursday 7:20pm — 10:00pm, Innovation Hall, Room 330

**Office Hours** Thursday 5:30pm — 6:30pm and Tuesday 3:00 — 4:00pm.

**Required Textbook** Upamanyu Madhow, *Fundamentals of Digital Communication*, Cambridge University Press, 2012.

## Recommended Further Reading

1. J.M. Wozencraft and I.M. Jacobs, *Principles of Communication Engineering*, New York: Wiley & Sons, 1965. (reissued by Waveland Press, Prospect Heights, IL, 1990.)
2. H.L. van Trees, *Detection, Estimation, and Modulation Theory, vol. I*, New York: Wiley & Sons, 1968.
3. J.G. Proakis, *Digital Communications*, 5th ed., New York: McGraw-Hill, 2007.

**Homework** will be assigned every week except when an exam is scheduled the following week. A set of solutions will be made available. You are encouraged to work on the assignments in small groups.

**Two Exams** will be given: one midterm exam and a comprehensive final exam. All exams are conducted under the rules and regulations of the Honor Code (see University Catalog).

**On-line Class Material** Class material will be distributed electronically via the World-Wide Web. Use a browser to find the ECE 630 homepage at URL <http://www.spec.gmu.edu/~pparis/classes/ece630.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 as a weighted average of homeworks and exams in the following way:

Homework	30%
Midterm	35%
Final	35%

## Tentative Course Schedule

### Background Material

**Week 1:** Random variables with emphasis on the Gaussian distribution

**Week 2:** Random processes.

**Week 3:** Signal space concepts.

### Optimal Receiver in White Gaussian Noise

**Week 4:** Binary hypothesis testing

**Week 5:** The matched filter.

**Week 6:**  $M$ -ary signal sets and the union bound.

**Week 7:** Midterm Exam.

**Week 8:** Message sequences.

### Digital Modulation

**Week 9:** Complex baseband representation of signals and random processes.

**Week 10:** Linear, digital modulation methods and their bandwidth.

**Week 11:** Orthogonal, bi-orthogonal, and differential modulation.

**Advanced Topics:** The final third of the class will consider advanced topics, options include:

- Introduction to error correction coding.
- Dispersive channels and equalization.
- Fading channels and diversity.

**Final Exam:** May 11, 7:30–10:15pm