

AUBURN UNIVERSITY
Department of Electrical and Computer Engineering

ELEC 3800
Random Signals & Systems
Fall 2011

Course Information

Professor: Stanley J. Reeves
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Class Hours: TR 11:00 - 12:15

Office Hours: T 2:00–3:00 p.m., W 9:00–9:30 a.m., virtual office hours W 3:30–4:00 p.m., and other hours by appointment. I also encourage email contact at any time.

Text: George R. Cooper and Clare D. McGillem, *Probabilistic Methods of Signal and System Analysis*, 3rd edition, Oxford University Press, 1999.

Recommended Supplement: *Schaum's Outline of Probability, Random Variables, and Random Processes*, McGraw-Hill, 1997.

Web Site: I will link from Blackboard to an external class web site at <http://www.eng.auburn.edu/~reevesj/Classes/ELEC3800>

Online material will be accessible via Instructure Canvas. (This is the Blackboard replacement that is being rolled out. You can access it via the big blue “C” icon at the top of AU Access or from the web site above.)

Prerequisites: ELEC 2120

All students will be expected to be competent in the basic concepts of linear signals & systems and its prerequisites (especially calculus). You will be required to review the material independently if a pre-test reveals areas of significant weakness. A prerequisite test will be given to motivate review of prerequisites.

Course Objective:

1. To gain an understanding of fundamentals of basic probability.
2. To gain an understanding of fundamentals of one and two random variables.
3. To gain an understanding of random processes and their second-order characterization.
4. To gain an understanding of fundamentals of basic statistics.
5. To be able to apply the above concepts to analyze electrical engineering problems.
6. To be able to approach and communicate the subject verbally, analytically, graphically, and numerically and to understand the connections among these approaches.

Teaching Philosophy:

A statement of my teaching philosophy can be found at <http://www.eng.auburn.edu/~reevesj>.

Grading Policy:

Test 1:	20%
Test 2:	20%
Homework:	5%
Quizzes:	15%
Computer exercises/projects:	10%
Final exam:	25%
Professionalism:	5%

Tests:

September 29
November 3

Homework: Homework will be assigned regularly and graded primarily based on effort. Solutions will be made available.

Quizzes:

Ten-minute quizzes will ordinarily be given at the end of class on Thursdays. These quizzes will be based closely on homework problems assigned prior to the quiz as well as projects. Quizzes will be graded on a 10-point scale. **Grade appeals on quizzes will only be allowed within one week of the class following the quiz, so please check the web regularly to make sure your grades are posted accurately.**

Occasionally, the professor may post an online lecture instead of a class meeting. In that case, a simple assessment quiz may be given to make sure students have watched the online lecture. These quizzes will be averaged with the regular quizzes as a 6-point quiz.

Computer Exercises and Projects:

Computer exercises in MATLAB and other projects will be assigned occasionally to help you develop your intuition for concepts covered in lectures. The weight given to each exercise will depend on the level of work required.

Reference for Computer Exercises:

Beginning MATLAB for Engineers, S. J. Reeves. (available at Engineering Duplicating Services)
Kermit Sigmon, *MATLAB Primer*, 3rd edition, 1993. Note: An online version can be found on the Engineering Sun Network under the ELEC 3800 Web Site. The primer is 39 pages.
Other online help is also available through this site.

Final Exam:

The final will be cumulative with about 1/2 weight on the material after the second test. The final is Friday, December 9, 12:00–2:30 p.m.

Professionalism:

Students are professionals in training and should make every effort to take a professional approach to learning and classroom behavior. The following are specific areas of concern:

1. **Attendance:** Attendance is important and expected but not required. However, in-class work will be given regularly. Also, it is unprofessional behavior for a student to miss class without a valid excuse and then expect individual help or consideration from the instructor.
2. **Punctuality:** Professionals show respect to others in a meeting by being on time. Walking in late distracts the instructor and other students. Tardiness should be a rare event.
3. **Retrieving graded assignments:** Be sure to get your graded assignments when they are returned. If you miss a class in which assignments were returned, please see the instructor as soon as possible to pick yours up, either after class or in his office.
4. **Restroom:** The restroom is for use before and after class and for medical emergencies. Plan ahead!
5. **Talking in class:** Avoid obscene and profane speech. Exchanges with classmates during class should be quiet and related to the lecture. Stop talking when the instructor begins the class.
6. **End of class:** Do not rustle papers, slam books shut, snap three-ring binders, or shuffle around near the end of class. The instructor will work hard to end class on time, but the last few statements may be the most important of the entire class period. Do not distract yourself or others from hearing these.
7. **Laptops:** Laptops are to be used only for class purposes. Do not display anything that will distract others. Laptops are to be closed during quizzes and tests.
8. **Cell phones:** Cell phones should be in silent or vibrate mode and not answered during class apart from an emergency. Headsets should be removed. Do not text or surf the web in class.
9. **Personal audio devices:** These should be turned off and earphones removed during class.
10. **Other electronic gizmos:** No Wiis, Xboxes, Playstations, handheld games, Pong, Van de Graaff generators, or other electronic gizmos should be visible in class.
11. **Spitballs:** Do not throw spitballs or put tacks in the instructor's chair. This is generally considered unprofessional behavior, except in Elbonia.

In-Class Exercises

In-class exercises will be given at the end of most classes to assess and reinforce learning during that class period. These exercises are crucial to your learning experience and may be taken up randomly at the instructor's discretion and graded as a quiz.

Students with Disabilities:

Students who need special accommodations are encouraged to see me after class or in my office as soon as possible so we can discuss your situation confidentially. You can contact me by phone or email if my office hours conflict with your schedule. Please bring your memo from The Program for Students with Disabilities (PSD) to me as soon as possible; we can discuss it during your appointment. **Exam accommodations must be arranged at least one week in advance.** If at any time during the quarter you feel that the accommodations we have put in place are not working, please consult with me and/or the professional staff in the PSD office. If you do not have a memo from the PSD office that tells me about your accommodations, please make an appointment to see them in 1232 Haley Center (844-2096).

Contingency:

If normal class activities or computer lab availability are disrupted due to many students or the instructor experiencing illness or an emergency or crisis situation, the syllabus and other course plans and assignments may be modified to allow completion of the course. If this occurs, an addendum to your syllabus and/or course assignments will replace the original materials.

Topical Outline

1. Introduction to probability
 - (a) Applications
 - (b) History
 - (c) Definitions
 - (d) Axiomatic approach
 - (e) Conditional probability and independence
2. Random variables
 - (a) Distribution and density functions
 - (b) Mean values and moments
 - (c) Gaussian and other probability density functions
3. Reliability analysis
 - (a) Mean time to failure
 - (b) Parallel and series connections
4. Several random variables
 - (a) Independence and correlation
 - (b) Characteristic function
5. Random processes
 - (a) Discrete/continuous
 - (b) Deterministic/nondeterministic
 - (c) Stationary/nonstationary
 - (d) Ergodic/nonergodic
6. Spectral density
 - (a) Properties
 - (b) Relation to other functions
7. Linear systems with random input
 - (a) Correlation measures
 - (b) Spectral measures
 - (c) Time- and frequency-domain analysis
8. Elements of statistics
 - (a) Sample mean and variance
 - (b) Confidence intervals & hypothesis testing
 - (c) Curve fitting
 - (d) Correlation between data sets