

AUBURN UNIVERSITY
Department of Electrical and Computer Engineering

ELEC 3800
Random Signals & Systems
Summer 2011

Course Information

Professor: Stanley J. Reeves
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Class Hours: MWF 1:15-2:30 p.m. Instructor will announce adjustments to these times.

Office Hours: MW 2:30-3, and online hours W 11-11:30, F 2-3. 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 Canvas to an external class web site at <http://www.eng.auburn.edu/~reevesj/Classes/ELEC3800/>

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 Objectives:

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%
Quizzes:	20%
Computer exercises/projects:	10%
Final exam:	25%
Professionalism:	5%

Online Discussion:

An important portion of the learning experience in this class will be online interaction about the material. At the end of each lecture module, you will be asked to provide some feedback about the material. You are encouraged to follow up other student comments if you think you have some insight that might help the material click with others.

Tests:

June 15

July 18

Quizzes

Ten-minute quizzes will ordinarily be given at the end of class on Wednesdays. 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.**

Lectures will be delivered online instead of in class. A simple assessment quiz may be given to make sure students have watched the online lecture material. These quizzes will be averaged with the regular quizzes, generally 2 points per question.

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. These exercises and projects cannot be dropped!

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 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 1/3 weight on the material after the second test. The final is Tuesday, July 31, 4:00-6:30 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 will allow you to get specific help and exposure to some in-class exercises and homework problem review. However, attendance is not required. (Note that graded quizzes will be given every Wed., so attendance is required on Wed.) *Students who miss two or more in-class quizzes before mid-semester will be force-dropped from the class.* 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.

Homework: Homework will be assigned regularly but not graded. Solutions will be made available.

In-Class Exercises:

In-class exercises will be given in most classes to assess and reinforce learning during that class period. These exercises will be very helpful to your learning experience.

Online Classes:

This course will be treated as a blended course, with some material taught live in class and some material delivered online by recorded lecture. Ordinarily, an online class experience will substitute for Friday classes as well as a few others. The online class experience will consist of 1) video lecture material, 2) reading, 3) homework problems, 4) an online quiz, and 5) some interaction with classmates. None of these are optional in terms of an effective learning experience. The instructor will be available for questions in the office and online at posted times. Please make full use of this

opportunity.

Academic Honesty Policy:

All portions of the Auburn University student academic honesty code (Title XII) found in the Tiger Cub will apply to this class. At the discretion of the instructor, academic honesty violations or alleged violations of the SGA Code of Laws will be reported to the Office of the Provost, which will then refer the case to the Academic Honesty Committee.

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

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