

**Math 7800-110: PROBABILITY I**  
**Fall Semester, 2010**

<b>Time:</b>	M W F 11:00–11:50am
<b>Place:</b>	318 Parker Hall
<b>Instructor:</b>	Dr. Erkan Nane
<b>Office:</b>	340 Parker Hall
<b>Telephone:</b>	844-6595
<b>E-Mail:</b>	nane@auburn.edu
<b>Office Hours:</b>	M W F 10:00–11:00am, and by appointment
<b>Text:</b>	<i>Probability: Theory and Examples</i> , Third Edition, by Rick Durrett
<b>Prerequisite:</b>	A full year of undergraduate mathematical analysis at a level commensurate with MATH 5200/5210.
<b>Other references:</b>	<i>Foundation of Modern Probability</i> , Second Edition, By Olav Kallenberg. <i>Introduction to Stochastic Process</i> , by Hoel, Port and Stone.

**Course description:**

This is the first semester of a two-semester graduate-level introduction to probability theory (Math 7800-7810) and it also serves as a stand-alone introduction to the subject.

Math 7800: Probability I: Fall 2010. Discrete-time probability and stochastic processes, including topics such as conditioning and independence, laws of large numbers, central limit theorem, martingales, Markov chains, Poisson and renewal processes.

Math 7810: Probability II: Spring 2011. Continuous-time probability and stochastic processes, including topics such as continuous-time martingales and Markov processes, Brownian motion, stochastic integrals and differential equations, with relations to partial differential equations, stationary processes, ergodic theorems, Lévy processes, and large deviations.

Some applications of probabilistic techniques in other areas will be mentioned. The stochastic processes of various types have many applications in physics, finance, engineering and related areas. The course will be suitable for students who want to specialize in the area of probability. It will also be suitable for students from other areas of the sciences to broaden their view of mathematics. The course will cover many beautiful applications in physics, economics, particle systems, biological populations and mathematical finance. One of the most well known use of probability is solving partial differential equations and modeling stock market data. We will focus on these applications throughout the course.

As a prerequisite, strong background in undergraduate analysis is required at a level commensurate with MATH 5200/5210. In particular, the graduate analysis is not required, and the necessary background material will be developed as part of the course.

**Homework:** Homework (40%) will be regularly assigned. It is expected that students will do all the homework assigned. The due date will be announced in class.

**Exams:** There will be two midterm exams (15% each) on **October 1 and November 10**

Make-up exams will only be allowed in extreme circumstances.

**Final exam:** A **comprehensive** final (30%) will be given on Wednesday, Dec 8, 12:00

**Grading:** The grading scale will be as follows:

80–100%	A
65–79%	B
55–64%	C
40–54%	D
39% or below	F

Math 7800 will cover:

- 1. Review of measures and integration. Convergence theorems,  $L_p$  spaces and inequalities, the Lebesgue decomposition theorem, the Radon-Nikodym theorem, product measures and Fubini's theorem, Kolmogorov's extension theorem.
- 2. Independence and conditioning. Constructing independent random variables, Kolmogorov's zero-one law, the Borel-Cantelli lemma and its extensions, conditional expectations.
- 3. Law of large numbers. Convergence of random series, Cramer's large deviation theorem, law of the iterated logarithm.
- 4. Central limit theorems. Weak convergence, characteristic functions, the Lindeberg-Feller theorem, the Berry-Esseen theorem, stable laws, Poisson convergence.
- 5\*. Martingales. Martingale convergence theorem, Doob's inequality, optional stopping theorem, applications.

The instructor reserves the right to make any changes he deems academically advisable.

#### **Important Dates for Fall Semester 2010**

Aug. 18 Classes Begin (Wed)  
Sept. 6 Labor Day (Mon)  
Oct. 7 Mid Semester (36th Class Day)\*\* (Thu)  
Nov. 22-26 Thanksgiving Break (Mon-Fri)  
Dec. 3 Classes End (Fri)  
Dec. 4, 5 Study/Reading Day (Sat, Sun)  
Dec. 6-10 Final Exam Period (Mon-Fri)  
Dec. 13 Commencement (Mon)

\* Last day to withdraw from a course with no grade assignment

\*\* Last day to withdraw from a course with no grade penalty

**Tips:** This course is demanding and requires a great deal of work. Students are responsible for all material covered in class. Students are expected to attend each class period and to bring text. Read the textbook as assigned. Study the examples solved in class and in the textbook. Then do the homework problems. Try to study every day even if it has to be a few minutes only. It takes time and frequent practice to become comfortable with the material. Do not fall behind!

**Policies:** Academic Honesty (DISHONESTY): Suspicion of academic dishonesty and/or cheating will result in action by the University Honesty Committee. Refer to the Tiger Cub for more specific details. Student who plagiarize will receive a grade 0.0 on the assignment.

**Special needs:** To arrange for accommodation a student should contact the office of the Program with Disabilities, located in 1244 Haley center