MTH 664: Probability Theory 3 credits  Section 001, Winter 2014

Catalog Description: General theory of probability measures and random variables, including weak convergence, characteristic functions, central limit theory, conditional expectations, martingales.

Prerequisites: MTH 411 or MTH 511 or an equivalent class in real analysis.

Meets: Three 50 minute lectures weekly.

Instructor: Professor Ossiander, Kidder 298B

Office Hours: Wednesday: 11-12:30; Friday: 10:30-noon; additional hours by appointment

Course Content: This class is the first in a two term sequence in probability theory. It is intended for graduate students who have had at least one term of real analysis. The goal of the course is to give a rigorous and systematic introduction to basic probability theory using measure-theoretic tools. Some minimal previous exposure to probability calculations is assumed. The following topics will be covered during the first term.

- Probability spaces
- Existence and extension of probability measures
- Independence
- The Borel-Cantelli Lemmas
- Random variables and distributions
- Expected values
- Sequences and sums of random variables
- Modes of convergence of random variables
- A law of the iterated logarithm
- Convergence of distributions

Learning Resources: The required text for the course is ‘Probability and Measure’, by Patrick Billingsley, Anniversary Edition, published by Wiley, 2012. This is a very nice text book that covers the foundational concepts and results of probability theory. It will be followed selectively. (There are some differences between this ‘Anniversary Edition’ and the earlier first, second, and third editions.) Jeffrey S. Rosenthal’s ‘A First Look at Rigorous Probability Theory’ maybe helpful as an auxiliary text, but it is not required.

Course Plan: This course is lecture based. Homework will be assigned weekly. Students are expected to write up homework solutions independently. Late homework is strongly discouraged and may be penalized. There will be one in-class midterm examination in addition to a final examination. (The final examination will not be in-class.) No make-up examinations will be given.
Learning Outcomes: Upon completing MTH 664 a successful student is expected to be able to do the following.

1. Demonstrate a command of the basics of measure theoretic probability including applications of continuity properties of probability measures.

2. State and apply the Borel-Cantelli Lemmas and Kolmogorov’s 0-1 Law.

3. Utilize Lebesgue integration to calculate expectations of functions of random variables.

4. Distinguish and apply different types of convergence of real-valued random variables including convergence in probability, convergence a.s. and convergence in p-th mean.

5. Evaluate convergence properties of sums of independent random variables.

Evaluation of Student Learning: (Approximate percentages given.)

- Homework problems 50 %
- Midterm 25 %
- Final Exam: 25 %

Students with Disabilities: Accommodations for students with disabilities are determined and approved by Disability Access Services (DAS). If you, as a student, believe you are eligible for accommodations but have not obtained approval please contact DAS immediately at 541-737-4098 or at http://ds.oregonstate.edu. DAS notifies students and faculty members of approved academic accommodations and coordinates implementation of those accommodations. While not required, students and faculty members are encouraged to discuss details of the implementation of individual accommodations.

Student Conduct: All students are expected to obey OSU’s student conduct regulations. Here is the link to OSU’s Statement of Expectations for Student Conduct: http://studentlife.oregonstate.edu/studentconduct/offenses-0