

COURSE SYLLABUS

Course number:	2301661
Course title:	Probability Theory
Course credit:	3 credits
Academic year:	Second semester 2008
Program:	M.S., Ph.D. (Mathematics)
Course type:	Optional course
Instructor:	Kittipat Wong, Ph.D.
Prerequisite:	C.F.
Course description:	

Probability spaces; random variables; weak and strong convergence; distribution functions; characteristic functions; uniqueness and continuity theorem; solution of the central limit problem; introduction to weak convergence of probability measures on metric spaces.

Objectives

The goal of this course is to understand the basic tools and language of modern probability theory. We will start with the basic concepts of probability theory; random variables, distribution, expectations, variances, independence and convergence of random variables. Then, we will cover

- (1) Basic limit theorem (the law of large numbers, large deviations and central limit theorem)
- (2) Martingales and applications
- (3) Weak convergence
- (4) Brownian motion and the construction of Wiener measure.

Course Outline

1. Introduction and probabilistic framework
 - 1.1 Connections with measure theory
 - 1.2 Random variables, Expected values, Independence
 - 1.3 Law of large numbers
 - 1.4 Borel-Cantelli lemmas
2. Central limit theorem

- 2.1 Weak convergence
- 2.2 Characteristic functions
- 2.3 Central limit theorem
- 3. Random walks
 - 3.1 Stopping times
 - 3.2 Recurrence
- 4. Martingales
 - 4.1 Conditional expectations
 - 4.2 Martingales, almost sure convergence
 - 4.3 Doob's inequality, L^p convergence
 - 4.4 Uniform integrability
 - 4.5 Construction of Wiener measure

Course evaluation

Homework	20%
Midterm exam	40%
Final exam	40%

References

1. P. Billingsley, *Probability and Measure*, 3rd Edition, John-Wiley & Sons, 1995.
2. R. Durrett, *Probability: Theory and Examples*, 2nd Edition, Duxbury Press, 1996.
3. H.L. Royden, *Real Analysis*, 3rd Edition, Macmillan, 1989.