

Syllabus: MA 529 Stochastic Processes, Spring 2016

Instructor: Zhongqiang Zhang

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Office hours: Monday 2:00-4:00pm and by appointment

Teaching assistant: Yuchen Dong

Office: 204 Stratton Hall Email: ydong@wpi.edu

Office hours: 11-11:50 am (Monday and Tuesday) and by appointment

Class meetings: Tuesday 5:30 - 8:20pm SH 304

Conferences: Wednesday 2 - 4 pm SH 304

Textbook

Hui-Hsiung Kuo, *Introduction to Stochastic Integration*. Springer Universitext, Springer-Verlag, Berlin. 2006

Fima Klebaner, *Introduction to Stochastic Calculus with Applications*, Imperial College Press, 2nd edition, 2006.

Other References

Jean Jacod and Philip Protter, *Probability Essentials*. Springer-Verlag, Berlin. 2nd edition, 2004

David Williams, *Probability with Martingales*. Cambridge University Press, Cambridge. 1991

Bernt Øksendal, *Stochastic Differential Equations*. Springer-Verlag, Berlin. 6th edition 2010

Dieter Sondermann, *Introduction to Stochastic Calculus for Finance*, Springer, 2006

Course description

This course is designed to introduce students to continuous-time stochastic processes. Stochastic processes play a central role in a wide range of applications from signal processing to finance and also offer an alternative novel viewpoint to several areas of mathematical analysis, such as partial differential equations and potential theory. The main topics for this course are martingales, maximal inequalities and applications, optimal stopping and martingale convergence theorems, the strong Markov property, stochastic integration, Ito's formula and applications, martingale representation theorems, Girsanov's theorem and applications, and an introduction to stochastic differential equations, the Feynman-Kac formula, and connections to partial differential equations. Optional topics (at the instructor's discretion) include Markov processes and Poisson-and jump-processes.

(Prerequisite: MA 528. Measure-Theoretic Probability Theory, which can be taken concurrently (or, with special permission by the instructor, MA 540)).

Course outline:

Topic 1: Martingales

Topic 2: Markov processes

Topic 3: Brownian motion

Topic 4: Stochastic integration, Itô's formula

Topic 5: Stochastic differential equations and numerical methods

Topic 6: Change of measure: Radon-Nikodým and Girsanov theorems

Topic 7: Feynman-Kac formula and connection to PDEs

Conferences

You will meet with the Teaching Assistant for the class. You will be able to ask the TA questions on the material covered and homework.

The TA may also review course materials.

Grading

Homework = 40% (weekly)

Midterm Exam = 30% (on March 1st, 5:30pm-8:20pm)

Final Exam = 30% (on April 26th, 5:30pm-8:20pm)

Grades are given as follows: A (≥ 85), B (≥ 75 , & ≤ 84), C (≥ 60 , & ≤ 74), and NR otherwise.

Grading policy

Make sure that your work is legible and done neatly; otherwise you will receive no credits for it.

No credits will be given if you have only answers to assignments and exams. You need to show both your answer and the work leading to it with proper wording or expressions. A detailed rubric has been uploaded at the course web page at myWPI.

Homework

Problems will be assigned weekly and be posted on myWPI. Make sure that you turn in your homework on time as late homework will not be accepted and will be graded as zero. If you have to miss a class, you may email me and the TA your scanned homework.

You are encouraged to discuss homework problems. But you are expected to write your own homework in your own words.

Homework will be due in class.

Exams

All the exams are close book ones but you can have a (simple) calculator and a “cheat sheet” (1 letter-sized, 2-sided paper).

Some statements

You are encouraged to attend all the lectures. Though lecture attendance will not be monitored, you will be responsible for knowing everything delivered in class.

Cell phones and all electric devices should be turned off or muted.

Academic Dishonesty is not tolerated. Please be aware of WPI’s Academic Honesty Policy <http://www.wpi.edu/offices/policies/honesty/policy.html>.

Disability services

If you are eligible for course adaptations or accommodations because of a disability or if you have medical information to share with me, about please make an appointment with me as soon as possible. If you are not sure about the eligibility for course adaptations or accommodations, please contact the Disability Services Office (DSO), which is located in the Student Development and Counseling Center, 124 Daniels Hall and the phone number is 508-831-4908, e-mail is DisabilityServices@wpi.edu.

Academic honesty

Each student is expected to familiarize him/herself with WPI’s Academic Honesty policies which can be found at <http://www.wpi.edu/offices/policies/honesty>. All acts of fabrication, plagiarism, cheating, and facilitation will be prosecuted according to the university’s policy. If you are ever unsure as to whether your intended actions are considered academically honest or not, please contact me.