Math 546 Continuous Time Stochastic Processes; Term I 2019.

Instructor: Ed Perkins, Math Annex 1207
Contact: perkins@math.ubc.ca
Lectures: TTh 9:30-11:00 in Math Annex 1118.
Course webpage: `http://www.math.ubc.ca/~perkins/teaching.html`
Office hours: TBA
Textbook: Diffusions, Markov Processes and Martingales 2nd Edition, VOLUME 2 Itô Calculus, by L.C.G. Rogers and D. Williams, Cambridge University Press, 2000.

PLEASE NOTE IT IS VOLUME 2, NOT VOLUME 1, BUT SEE OTHER REFERENCES BELOW ABOUT THE LATTER.

Outline:

This is a rigorous course on finite dimensional continuous Markov processes. Most topics covered will be included in Chapters IV and V of Rogers and Williams' text. We will study stochastic integration with respect to continuous semimartingales, and Itô's stochastic calculus. The focus of the course will be on finite-dimensional stochastic differential equations. After a brief review of Brownian motion we will study Itô's pathwise uniqueness results and then introduce the weak solutions, martingale problems and the relationship with strong or pathwise solutions. Change of measure (Girsanov) formulae will be derived and applied to the well-posedness of the martingale problem for finite dimensional sde's. Depending on the interest of the students and energy level of the instructor we will then study local times and one-dimensional diffusion theory or Stroock-Varadhan martingale problems.

The course will assume familiarity with measure theoretic probability theory* including discrete parameter martingale theory and Brownian motion although there will be a brief review of these last two topics. The text is self-contained for the most part but does refer to Volume 1 (cited below) on occasion.

Prerequisites: Math 545 or consent of the instructor.
*Students from other Departments interested in learning about stochastic differential equations from a mathematical perspective are encouraged–Measure theoretic prerequisites may be treated as "black boxes".

Evaluation: This will be based on homework assignments which will be given every 2-3 weeks.

Other References: The first two are good basic references for measure-theoretic probability. [W1] is a good reference for discrete parameter martingales.

[B] Breiman, Probability.

[D] Durrett, Probability: Theory and Examples.

[EK] Ethier and Kurtz, Markov Processes: Characterization and Convergence.

[RY] Revuz and Yor, Continuous Martingales and Brownian Motion.

[P] Protter, Stochastic Integration and Differential Equations.

[W1] D. Williams, Probability with Martingales.

[W] D. Williams, Diffusions, Markov Processes and Martingales Vol. 1. (If you bought this volume due to my error, it is somewhat useful at the start of the course and also is a good reference in general. But it is NOT required.)