

Tentative* Course Outline for AMCS-8105-367

Title: Applied Stochastic Analysis

Professor: Joshua McGinnis* (Email: jam887@sas.upenn.edu)

Time: 8:30-10:00 a.m. Monday and Wednesday

Location: TBD (Class will be in-person. The location on campus is yet to be specified.)

Main Book: Applied Stochastic Analysis by Miranda Holmes-Cerfon

Additional Resources*: An Introduction to the Numerical Simulation of Stochastic Differential Equations by Higham & Kloeden, Stochastic Analysis of Biochemical Systems by Anderson & Kurtz

A List of **Tentative Topics**

- Discrete time Markov chains
- Markov chain Monte Carlo (MCMC) methods
- Continuous time Markov chains (forward & backward equations, generators etc.)
- Stochastic Simulation Algorithms (Gillespie, Tau Leaping, Thinning)
- Brownian motion and stochastic differential equations (SDEs)
- PDE counterparts of SDEs (forward & backward equations, Feynman-Kac)
- Numerical methods and analysis for SPDEs (Euler-Maruyama, Milstein)
- Mean first passage times

Student Responsibilities: Students will be expected to complete assigned reading each week and therefore be able ask questions during lecture that may have arisen while reading. Students will be assigned homework exercises from the “Main Book” (see above) each week. Some exercises may involve coding (in any preferred language e.g. MATLAB and Python are acceptable).

*A detailed syllabus (with dates, a full list of topics, and detailed grading scheme) will be given to students before classes begin.

*Feel free to email me if you have questions about the course

*It is not necessary for students to acquire any of the additional material. Class notes will be adequately thorough for any topics deviating from the “main book”.