MIE1605H: Stochastic Processes (Fall 2020)

- **Instructor:** Prof. Vahid Sarhangian, Office: BA8108, Email: sarhangian@mie.utoronto.ca
- **Office hours:** TBD in class.
- **Lectures:** Thursdays (9:00-12:00AM) online on Bb Collaborate.

Course description and prerequisites

This course is an introduction to fundamental probabilistic models with emphasis on applications to queueing theory and service Engineering. Tentative topics include discrete Markov chains, The Poisson process, Markov processes, Martingales, and Brownian motion.

The course is designed for graduate research students. MEng students require permission from the instructor to enroll in the course. Students are expected to have a strong undergraduate (non-measure theoretic) level background in probability at the level of MIE231 or STA347, or equivalent. It is recommended that the students take MIE1613 (Stochastic Simulation) before this course.

Textbook and additional references

Notes will be provided in class. The main reference for the course is:

- J. S. Rosenthal (2019) A first look at stochastic processes. World Scientific Publishing Company, Singapore,

which can be purchased from the publisher's website or Amazon.ca.

Some of the topics and applications will be based on the following texts, which are also useful sources for supplementary readings.

- R. Durrett (2012) Essentials of stochastic processes. Springer, New York.
- J. S. Rosenthal (2006), A first look at rigorous probability theory. World Scientific Publishing Company, Singapore.
- C. Hong, and D. Yao (2013) Fundamentals of queueing networks: Performance, asymptotics, and optimization. Springer Science & Business Media.

Durrett (2012) is available online on the publisher's website and here. Additional resources and papers will be posted on the course webpage on Quercus.

Evaluation

- 30% Homework (To be assigned after covering each major topic)
- 25% Midterm (October 29th)
- 45% Final test (Date to be announced)

Tentative Course Plan

- Introduction and probability review (1 lecture)
- Discrete Markov Chains (4-5 lectures)
- Random walks and Martingales (2 lectures)
- Brownian Motion and diffusion processes (1-2 lectures)
- The Poisson process (1 lecture)
- Continuous-time Markov processes (2 lectures)
- Exact and approximate analysis of queueing networks (1-2 lectures)

Video Privacy Considerations

This course, including your participation, will be recorded on video and will be available to students in the course for viewing remotely and after each session. Course videos and materials belong to your instructor, the University, and/or other sources depending on the specific facts of each situation, and are protected by copyright. Do not download, copy, or share any course or student materials or videos without the explicit permission of the instructor. For questions about recording and use of videos in which you appear please contact the instructor.