ACT460/STA2502/STA2501

Stochastic Methods for Finance & Actuarial Science

Fall 2025 Syllabus

Course Meetings

ACT460H1 F

Section	Day & Time	Delivery Mode & Location
LEC0101	Tuesday, 1:00 PM - 3:00 PM Thursday, 3:00 PM - 4:00 PM	In Person: GB 120 In Person: NL 6

Refer to ACORN for the most up-to-date information about the location of the course meetings.

Course Contacts

Course Website: https://q.utoronto.ca/courses/394585

Instructor: Dr. Dena Firoozi
Email: dena.firoozi@utoronto.ca
Office Hours and Location: Flexible office hours are available in person or online, but only by appointment through Piazza. Location for in-person meetings is Room 9080, 700 University Ave.

Piazza: We will be using Piazza for the class discussions. The system is highly catered to getting you help fast and efficiently from classmates, the TA and myself. Rather than emailing questions, I encourage you to post your questions on Piazza. The TA and I will check and answer your questions on a regular basis. There you have an option for sending private questions to me, or post questions to the class anonymously (only I will be able to see your identity). You can post questions and answers on Piazza at any time; please allow 2 to 3 days for responses.
Here is the information you may need to activate your account:
Signup link
Access Code: 460-2502-F25
Short introduction video

Communication: Students are expected to check Quercus regularly to keep up with the course updates. It is recommended to set up immediate email notifications for Quercus announcements to facilitate this process. It is also strongly recommend posting your technical questions and other inquiries about the course material and assessments publicly on Piazza. For private matters, please send a private message on Piazza instead of an email.

Teaching Assistant: Zhe Zhou

Course Overview

This course offers an introduction to the mathematical theories and probabilistic methods used for continuous-time modeling in actuarial science and financial engineering. Covered topics include continuous-time stochastic processes, martingales, Brownian motion, Itô's Lemma, stochastic calculus, Monte Carlo methods, and variance reduction techniques, all with practical applications to finance problems.

Prerequisites: (ACT240H1, ACT245H1, ACT247H1, ACT350H1/ STA347H1) OR (ACT350H1/ STA347H1, MAT237Y1/ MAT257Y1)
Corequisites: None
Exclusions: None
Recommended Preparation: ACT370H1 strongly recommended
Credit Value: 0.5

Course Materials

Lecture notes, which will be uploaded after each session, serve as the main reference for the course. You are also encouraged to consult the two following textbooks, upon which the course is mostly based, to gain a deeper understanding of the topics. The first textbook addresses theoretical concepts, and the second focuses on numerical methods relevant to our subjects.

- Arbitrage Theory in Continuous Time, Tomas Björk, 4th edition. Available online through the library: Link
- Monte Carlo Methods in Financial Engineering, Paul Glasserman. Available online through the library: Link

Another useful reference is

- Stochastic Calculus for Finance I & II, Steven Shreve, 2004. Errata

For in-class simulation runs, we will use Python, and familiarity with it will be assumed. If you do not know Python, I recommend completing chapters 1, 2, 3 and 4 of the Introduction to Python course on DataCamp. For free access to DataCamp courses, sign in using the link shared with you and using your @mail.utoronto.ca email address.

Marking Scheme

Assessment	Percent	Details	Due Date
Quiz 1*	10%	All topics covered from Week 1 to Week 2, inclusive.	2025-09-18
Quiz 2*	10%	All topics covered from Week 3 to Week 5, inclusive.	2025-10-09

Quiz 3*	10%	All topics covered from Week 5 to Week 8, inclusive.	2025-11-06
Term Project	30%	Conducted in groups of four for undergraduate students. Conducted individually by master's level students. 19% for group/individual report, 1% for individual contribution statement, 10% for presentation (more details to come).	2025-11-27
In-Person Final Exam	40%		Final Exam Period

*Lowest quiz mark dropped.

Late Assessment Submissions Policy

Late projects will be penalized 10% of the maximum grade for every day (24-hour period from the deadline) that it is late. Note that this penalty applies equally, whether the project is, for example, 2 hours late or 5 hours late.

Course Schedule

Here is a tentative schedule of course topics and assessments for the term, which may be modified as the term progresses.

Week	Description	Reference	Deliverable
Week 1 Sep 1-7	Probability theory	Björk: Appendices A & B	
Week 2 Sep 8-14	Probability theory Simulating RVs	Björk: Appendices A & B Glasserman: Chapters 1.1 & 2.2	
Week 3 Sep 15-21	Stochastic processes, Brownian motions, Martingales	Björk: Chapters 4.1-4.2, 4.4 & appendix C.1 Glasserman: Chapter 3.1	Quiz 1 Covering material from weeks 1-2
Week 4 Sep 22-28	Itô integrals	Björk: Chapter 4.3	
Week 5 Sep 29-Oct 5	Itô's lemma and SDEs	Björk: Chapters 4.5-4.8 & 5.1-5.2	

Week 6 Oct 6-12	Itô's lemma and SDEs Simulating sample	Björk: Chapters 4.6-4.8 & 5.1-5.2 Glasserman: Chapters 3.1-3.2	Quiz 2 Covering material from weeks 3-5
Week 7 Oct 13-19	Discretization methods	Björk: Chapters 6.3, 7.1, 7.3 Glasserman: Chapters 6.1-6.2	
Week 8 Oct 20-26	Discrete-time market models	Björk: Chapter 2	
Week 9 Nov 3-9	Continuous-time market models	Björk: Chapters 7, 10	Quiz 3 Covering material from weeks 5-8
Week 10 Nov 10-16	Continuous-time market models	Björk: Chapters 7, 10	
Week 11 Nov 17-23	Variance reduction (if time allows)	Glasserman: Chapters 4.1, 4.6	
Week 12 Nov 24-Dec 30	Group presentations		Project group report Project individual report Presentation slides Group presentation

Policies & Statements

Missed Term Works

If you miss an assessment for a valid reason, you must notify the instructor via email within one week of the missed assessment. In addition, you must declare your absence to the University using the Absence Declaration area in ACORN. The following policies will be followed if you miss an assessment for a valid reason.

Quizzes: If you miss a quiz, the weight of that quiz will be shifted to the other quizzes (i.e., your quiz mark will be from the best two out of three quizzes).

Final Project Presentation: A one-on-one make-up presentation will be scheduled if you miss the group presentation.

Re-marking Policy - Timeline and Protocol

You may submit regrade requests to the instructor by email as soon as possible, at latest within one week of receiving the marked term work. The course regrade policy exists to correct mistakes, and any request should clearly identify the error (for example, a question that was not marked, or a total incorrectly calculated). You must include a concise reason for a regrade request, referring to a possible error or omission by the marker.

Students with Disabilities or Accommodation Requirements

Students with diverse learning styles and needs are welcome in this course. If you have an acute or ongoing disability issue or accommodation need, you should register with Accessibility Services (AS) at the beginning of the academic year by visiting https://studentlife.utoronto.ca/department/accessibility-services/. Without registration, you will not be able to verify your situation with your instructors, and instructors will not be advised about your accommodation needs. AS will assess your situation, develop an accommodation plan with you, and support you in requesting accommodation for your course work. Remember that the process of accommodation is private: AS will not share details of your needs or condition with any instructor, and your instructors will not reveal that you are registered with AS.

Academic Integrity

All suspected cases of academic dishonesty will be investigated following procedures outlined in the Code of Behaviour on Academic Matters (https://governingcouncil.utoronto.ca/secretariat/policies/code-behaviour-academic-matters-july-1-2019). If you have questions or concerns about what constitutes appropriate academic behaviour or appropriate research and citation methods, please reach out to me. Note that you are expected to seek out additional information on academic integrity from me or from other institutional resources. For example, to learn more about how to cite and use source material appropriately and for other writing support, see the U of T writing support website at http://www.writing.utoronto.ca. Consult the Code of Behaviour on Academic Matters for a complete outline of the University's policy and expectations. For more information, please see A&S Student Academic Integrity (https://www.artsci.utoronto.ca/current/academic-advising-and-support/student-academic-integrity) and the University of Toronto Website on Academic Integrity (https://www.academicintegrity.utoronto.ca).

Mental Health and Well-Being

Your mental health is important. Throughout university life, there are many experiences that can impact your mental health and well-being. As a University of Toronto student, you can access free mental health and wellbeing services at Health & Wellness (https://studentlife.utoronto.ca/department/health-wellness/) such as same day counselling, brief counselling, medical care, skill-building workshops, and drop-in peer support. You can also meet with a Wellness Navigation Advisor who can connect you with other campus and community services and support. Call the mental health clinic at 416-978-8030 ext. 5 to book an appointment or visit **https://uoft.me/mentalhealthcare** to learn about the services available to you.

You can also visit your College Registrar to learn about the resources and supports available: https://www.artsci.utoronto.ca/current/academic-advising-and-support/college-registrars-offices

If you're in distress, you can access immediate support: https://uoft.me/feelingdistressed

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Additional Content

Acknowledgement

I thank Emma Kroell and Anthony Coache for sharing their course materials with me. The current course is based on the previous editions that were designed and taught by them.