Stochastic Processes with Applications in Finance and Actuarial Science
2018/2019
Financial Modelling 9590A Section 001

Course Outline

Instructor Information:
Instructor: Marcos Escobar-Anel,
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Office Hours: Wednesday 12-2pm.

Course Information:
Course Description: The aim of this course is to provide stochastic tools for financial modelling and pricing. It covers the basis theories of stochastic processes and stochastic calculus, with examples coming from finance.
Prerequisites: SS 2858A/B or equivalent and consent of instructor if you are not enrolled in the DSAS graduate programmes.
Pre, Co-requisites Warning: Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. You can be deregistered at any time even after writing the final exam. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.
Lecture Hours: Wednesdays 8:30-9:30am (NCB114), Fridays 8:30-10:30am (NCB114).

Book Information:
Textbook(s):
Note that these textbook will only be used as a guide. The instructor will use his own set of course notes during lectures.

Course Objectives:
After completing this course, students will be able to:
- understand essential elements of stochastic processes such as filtrations, conditional expectation, martingales;
- work with multidimensional Brownian motion;
- understand Ito's processes and the Ito's differentiation rule;
- show existence and uniqueness of solutions of Stochastic Differential Equations;
- understand Feynman-Kac formula and applications;
- understand Girsanov theorem and numeraire processes;
• replicate the payoff of various securities using self-financing portfolios;
• construct continuous-time models for security prices;
• price securities by risk-neutral valuation and by no-arbitrage;
• understand implied volatility, surface and various volatility models;
• price and hedge equity options using Black-Scholes in a continuous-time framework;
• simulate stochastic processes using Euler discretization;
• generate Monte Carlo simulation for option pricing;
• explore stochastic interest rate models and Bond pricing.

Assessment

Assignments and/or Quizzes: There will be 2 assignments of equal weight. Due dates: 5-Oct, and 16-Nov.
Midterms or Tests: There will be one midterm (combining Multiple Choice with open-Ended questions), 2 hours long on 26-October.
Final Exam: One final exam, 3 hours long, date to be determined.

Evaluation: Students will be evaluated on the basis of assignments, one mid-term test, and a final examination. The final mark will be based on a weight of 30% for assignments, 25% for the mid-term test, and 45% for the final exam.

Course Website Information

on Owl

Computing and/or Calculator Requirement:

You may use a non-programmable calculator that does not make any sound when writing the final exam. Laptops and other electronic devices are not allowed during the exam.

Course work evaluation prior to course dropping deadline:
NB: This policy applies to all UWO undergraduate courses, but this will be adopted in this graduate course.
Effective September 2016, a new Senate regulation has come into effect. It states that students must receive an evaluation of course work totalling 15% of their final grade at least one week prior to the deadline for withdrawal without academic penalty. The "drop" deadline is Monday, 06 November. Course work (i.e., assignment) results returned in class or elsewhere by 30 October meets this requirement. There is no obligation for an electronic posting on OWL or other site. A student's failure to collect such items by 30 October does not constitute grounds for any appeal.

Department Policy on Missed Course Requirements and Student Health and Wellness

If you are unable to meet a course requirement due to illness or other serious circumstances, you must provide valid medical or other supporting documentation to your Dean's office as soon as possible, and contact your instructor immediately. If accommodation is approved by your Dean's office, your instructor will be notified, then it
is your responsibility to make alternative arrangements with your instructor. In the event of a missed final exam, a "Recommendation of Special Examination" form must be obtained from the Dean's Office immediately. For further information please see: http://www.stats.uwo.ca/accommodation_medical.pdf. A student requiring academic accommodation due to illness, should use the Student Medical Certificate when visiting an off-campus medical facility. The form can be found at: http://www.stats.uwo.ca/medicalform.pdf. Or, request a Record's Release Form (located in the Dean's Office) for visits to Student Health Services.

**Missed Midterm or Test:** The policy of the department of Statistical and Actuarial Sciences is that there will be no make-up exams for a missed midterm. For those that do legitimately miss a midterm and provide the required supporting documentation, the standard practice will be that the weight of the midterm will be reassigned to the final exam. If your reason is not deemed valid, then you will receive a mark of 0.

**Student Health and Wellness:** As part of a successful student experience at Western, we encourage students to make their health and wellness a priority. Western provides several on-campus health-related services to help you achieve optimum health and engage in healthy living while pursuing your degree. For example, to support physical activity, all students, as part of their registration, receive membership in Western’s Campus Recreation Centre. Numerous cultural events are offered throughout the year. Please check out the Faculty of Music web page http://www.music.uwo.ca/, and our own McIntosh Gallery http://www.mcintoshgallery.ca. Information regarding health- and wellness-related services available to students may be found at http://www.health.uwo.ca/. Students seeking help regarding mental health concerns are advised to speak to someone they feel comfortable confiding in, such as their faculty supervisor, their program director (graduate chair), or other relevant administrators in their unit. Campus mental health resources may be found at http://www.health.uwo.ca/mental_health/resources.html. To help you learn more about mental health, Western has developed an interactive mental health learning module, found here: http://www.health.uwo.ca/mental_health/module.html. This module is 30 minutes in length and provides participants with a basic understanding of mental health issues and of available campus and community resources. Topics include stress, anxiety, depression, suicide and eating disorders. After successful completion of the module, participants receive a certificate confirming their participation.

**Accessibility:** Please contact the course instructor if you require lecture or printed material in an alternate form at or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 ext. 82147 if you have questions regarding accommodation.

**Support Services:** Learning-skills counsellors at the Student Development Centre (SDC) (http://www.sdc.uwo.ca) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through
individual counselling. Additional student-run support services are offered by the USC, [http://westernusc.ca/services](http://westernusc.ca/services). The website for Registrarial Services is [http://www.registrar.uwo.ca](http://www.registrar.uwo.ca).

**Email Communication:**

You are welcome to communicate with your instructor by email, but email communication should only be used to provide them with information or to ask a question that requires a brief response. For more lengthy discussions and for discussions on lectures/course material please see your instructor during their scheduled office hours or by appointment. If you do email them, please use your UWO account, as these are often the only emails read (as emails sent from other addresses often get spammed).

**Attendance**

Classroom attendance is viewed as an important part of the learning process. Students are advised that excessive absenteeism may result in the student being disbarred from the final exam (see Western Academic Calendar).

**Classroom Environment**

The Department has adopted a "Mutual Expectations" policy governing the classroom environment and all work submitted by students. The full text of the policy can be found at: [http://www.stats.uwo.ca/mutual_expectations.pdf](http://www.stats.uwo.ca/mutual_expectations.pdf). In summary, the policy was developed under the premise that all interactions between students and faculty should be governed by the principles of courtesy, respect and honesty. Students who are in emotional/mental distress should refer to MentalHealth@Western [http://www.uwo.ca/uwocom/mentalhealth/](http://www.uwo.ca/uwocom/mentalhealth/) for a complete list of options about how to obtain help.