DALHOUSIE UNIVERSITY

Faculty of Science Course Syllabus (Section A)
Department of Mathematics & Statistics
Financial Mathematics, MATH 3900 / ECON 3900
Winter Term 2023

Dalhousie University is located in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq. We are all Treaty people

We acknowledge the histories, contributions, and legacies of the African Nova Scotian people and communities who have been here for over 400 years.

Instructor: John Rumsey, johndrumsey@gmail.com Email "office hours" preferred. In person office hours by appointment

Lectures: Tuesdays Thursdays 1:05pm - 2:25pm
Course delivery: In-person and not recorded

Course Description

This course is an introduction to derivative pricing. Topics include: binomial tree model, stochastic calculus, Itô calculus, Black-Scholes model, market price of risk, log-normal models.

Course Prerequisites

MATH 2060.03 and (MATH 2120.03 or MATH 2135.03), or permission of the instructor

Learning Objectives

A student who is successful in this course should be able to:

- Derive the process for the price of a derivative security, given the process for the price of the underlying.
- Derive the non-stochastic PDE for the price of a derivative security.
- Create an algorithm for pricing a derivative security using a binomial model.
- Compute an approximate price for a derivative security using "Delta Hedging" at discrete time intervals.
- Compute the "market price of risk" of the underlying.

Course Materials

Lecture notes will be available on the MATH3900 BrightSpace site for the course. The text, *The Mathematics of Financial Derivatives* by P. Wilmott, S. Howison & J. Dewynne; Cambridge University Press, 15th printing, 2009, is a suitable reference.

DALHOUSIE UNIVERSITY

Course Assessment

Component	Weight	Date
Assignments	20%	
Midterm	35%	**16 Feb 2023**
Final Exam	45%	

There will be eight assignments sets. Each problem set will have the same weight, 2.5% of the total 20%. The time interval between assignment due dates will be approximately one week. The Midterm will be held during regular class time on **Thursday, 16 February, 1:00 pm to 2:30 pm**. The date of the final exam will be set by the registrar and will take place during the regular April examination period.

Assignments must be done individually and submitted electronically before or on the due date. ".pdf" format is preferred.

Conversion of numerical grades to Final Letter Grades

$(89.5, 100] \to \mathsf{A}^+$	$(84.5, 89.5] \to \mathsf{A}$	$(79.5, 84.5] \to \mathsf{A}^-$	$(76.5, 79.5] \to \mathsf{B}^+$
$(72.5, 76.5] \to \mathsf{B}$	$(69.5, 72.5] \to \mathsf{B}^-$	$(64.5, 69.5] \to \mathsf{C}^+$	$(59.5, 64.5] \to \mathsf{C}$
$(54.5, 59.5] \to \mathsf{C}^-$	$(49.5, 54.5] \to \mathsf{D}$	$[0, 49.5] \to \mathsf{F}$	

Course Policies

Late assignments will not be accepted. Missed assignments will be given a score of zero. There is no make-up midterm. If a class is cancelled (due to weather, for example) on the day when the in-class tests is scheduled, the test will be rescheduled. If a class is cancelled on a non-test day, the decision to make up the class will depend on circumstances.

Approximate Schedule / List of Topics

Week	*Topic*	*Notes*
1,2	Wiener processes – Itô's Lemma	Notes §1,2; WHD 2.1, 2.2, 2.3
3	The Black-Scholes-Merton PDE	Notes §3; WHD 3.5, 3.6, 3.7, 3.8
4	Derivative Securities	Notes §4;WHD 1.1 - 1.6
5	The Diffusion Equation	Notes §5.1-§5.3; WHD 4.1, 4.2, 4.3
6	The Black-Scholes Formula	Notes §5.4-§5.6; WHD 3.8, 5.3, 5.4, 5.6
7	Variations on the Black-Scholes Formula	Notes §6; WHD 6
8	American Options	Notes §7; WHD 7
9	Binomial Pricing	Notes §8; WHD 10
10	Exotic Options	Notes §9; WHD 11, 12, 14
11	Option Replication	Notes §10; WHD 16
12	Interest-Rate Derivatives	Notes §11; WHD 17

"Notes" refers the the Lecture Notes posted on *BrightSpace*
"WHD" refers the the text by Wilmott, Howison & Dewynne