

Faculty of Science Course Syllabus Winter 2021 (revised October 2020)**Department of Mathematics and Statistics**Financial Mathematics, MATH 3900 / ECON 3900 (*online*)*Winter 2021***Instructor(s):** *Amjad Khan* amjadkhan@dal.caOffice hours (*online*) will be posted regularly on Brightspace. You can also seek help by email at any time.**Lectures:** *Tuesdays, and Thursdays 1:00-2:30, synchronous.*

Course Description

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

Course Prerequisites

MATH 2060.03 and (MATH 2120.03 or MATH 2135.03)

Learning Objectives

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

- Derive the process for the price of derivative security, given the process for the price of the underlying.
- Derive the non-stochastic PDE for the price of derivative security.
- Create an algorithm for pricing derivative security using a binomial model.
- Compute an approximate price for 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.

MATLAB will be used for computational purpose

Course Delivery (online)

Lectures will be delivered Tuesdays, and Thursdays 1-2:30, *synchronously*, using Brightspace. Lecture notes and assignments will be posted on Brightspace (<https://dal.brightspace.com/>).

Course Assessment

The course grade will be based on assignments, a midterm, and a final exam.

Component	Weight (% of final grade)	Date
Assignment	70%	The detail is given below in the table*

Midterm	10%	11 February 2021
Final exam	20%	<i>(Scheduled exam period)</i>

*

Assignment #	Post date	Due date
1	14/01/2021	21/01/2021
2	21/01/2021	28/01/2021
3	28/01/2021	04/02/2021
4	04/02/2021	11/02/2021
5	25/02/2021	04/03/2021
6	04/03/2021	11/03/2021
7	11/03/2021	18/03/2021
8	18/03/2021	25/03/2021
9	25/03/2021	06/04/2021

Assignments must be submitted by the due date, through Brightspace, and as a single pdf file. The midterm examination will last one hour and will take place in class on February 11, 2021. The final examination will last three hours, will take place during the exam period, and will be scheduled by the registrar.

Conversion of numerical grades to Final Letter Grades follows the Dalhousie Common Grade Scale

A+ (90-100)	B+ (77-79)	C+ (65-69)	D	(50-54)
A (85-89)	B (73-76)	C (60-64)	F	(<50)
A- (80-84)	B- (70-72)	C- (55-59)		

Course Policies on Missed or Late Academic Requirement

Late assignments will not be accepted unless a prior arrangement was made. Missed assignments will be given a score of zero. Assignments must be done individually and handed in before or on the due date. There are no make-up tests for missed tests. If a class is canceled (due to weather, for example) on the day when the in-class test is scheduled, the test will be rescheduled. If a class is canceled on a non-test day, the decision to make up the class will depend on circumstances. Senate has approved a new policy for missed or late academic requirements due to student absence, which came into effect Jan 1, 2018 (winter term). The link to the policy is:

[Missed or Late Academic Requirements due to Student Absence - University Secretariat - Dalhousie University](#)

Students are not permitted to record the lectures.

Course Content

Week	Date	Topic
1	07/01/2021	Overview
2	12/01/2021 14/01/2021	Stochastic processes (Wiener processes)
3	19/01/2021 21/01/2021	Ito calculus
4	26/01/2021 28/01/2021	Derivative Securities
5	02/02/2021 04/02/2021	The Black-Scholes-Merton PDE
6	09/02/2021 11/02/2021	The Diffusion Equation Midterm exam
7	16/02/2021 18/02/2021	No class (Winter Study Break)
8	23/02/2021 25/02/2021	The Black-Scholes Formula
9	02/03/2021 04/03/2021	Variations of the Black-Scholes Formula
10	09/03/2021 11/03/2021	American Options
11	16/03/2021 18/03/2021	Binomial Pricing
12	23/03/2021 25/03/2021	Exotic Options
13	30/03/2021 01/04/2021	Option Replication
14	06/04/2021	Interest-Rate Derivatives

The schedule is subject to change. Detailed recommendations for reading to complement the lecture notes will be given throughout the term.