# Faculty of Science Course Syllabus
# Department of Mathematics and Statistics
# Financial Mathematics, MATH 3900 / ECON 3900
# Winter Term 2019

**Instructor:** John Rumsey, John.Rumsey@Dal.ca A13 6206 University Ave (Economics)
**Office Hours:** Tuesdays 2:30 - 3:30
**Lectures:** Tuesdays Thursdays 1:00 - 2:30

---

## 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)

## Course Objectives / Learning Outcomes

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.

## Course Assessment

| Component | Weight | Date |
|---|---|---|
| Assignments | 20% | |
| Midterm | 35% | **14 Feb 2019** |
| Final Exam | 45% | |

There will be four assignments sets. Each problem set will have the same weight, 5% of the total 20%. The assignments will be due approximately every two weeks. The Midterm be held during regular class time on **Thursday, 14 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 handed in before or on the due date. Only hard copy is acceptable.

**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 are no make-up tests for missed tests. 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. 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:
http://www.dal.ca/dept/university_secretariat/policies/academic/missed-or-late-academic-requirements-due-to-student-absence.html

**Approximate Schedule / List of Topics**

| *Week* | *Topic* | *References* |
|---|---|---|
| 1,2 | Wiener processes – Itô's Lemma | Notes §1,2; WHD 2.1, 2.2, 2.3 |
| 3 | Derivative Securities | Notes §3; WHD 1.1 - 1.6 |
| 4 | The Black-Scholes-Merton PDE | Notes §4; WHD 3.5, 3.6, 3.7, 3.8 |
| 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 of 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