

# ACT370H1S: Financial Principles for Actuarial Science II

Winter 2022

<b>Instructor:</b> Alex Shipilov	<b>Time:</b> M: 11:00am – 12:00pm ET (Tutorials)
<b>TAs:</b> Sophia Chan, Sebastian Calcetero Vanegas	W: 12:00pm – 2:00pm ET (Lectures)
<b>Emails:</b> <a href="mailto:alex.shipilov@utoronto.ca">alex.shipilov@utoronto.ca</a> ; <a href="mailto:ianweng.chan@mail.utoronto.ca">ianweng.chan@mail.utoronto.ca</a> ; <a href="mailto:sebastian.calcetero@mail.utoronto.ca">sebastian.calcetero@mail.utoronto.ca</a>	<b>Place:</b> <a href="#">MS Teams Meeting</a> till January 31, 2022 M: AH100 / W: MS3153

Welcome to ACT370! In this course, you will be learning about basic theory behind financial derivatives. Such products form an integral part of today's financial markets, and impact anyone working in fields such as actuarial science, financial engineering, economics, or financial regulation. For that reason, it is important that you understand how they work, why they are important and why they are so widely used today. This course is designed to answer these questions, and provide you with the tools you need to enter into more advanced course work.

There are four major themes in this course:

1. Understanding derivative products, including their payoffs, which should mostly be a review from previous actuarial science courses;
2. Understanding derivative characteristics and relationships, including put-call parity and correlation with the underlying variables and parameters;
3. Pricing derivative products under two separate models: the binomial pricing model and the Black-Scholes pricing model, which form the foundation for more advanced financial modeling and pricing theory; and
4. Option Greeks, delta hedging and exotic options.

By the end of this course, you should feel comfortable applying the techniques you learnt to price basic financial derivative products. Actuarial exam writers should be prepared to write roughly the first half of Exam IFM, which is revised and renamed version of Exam MFE (Models for Financial Economics).

**Objectives:** This course is essentially designed to help you prepare for the Society of Actuaries Exam IFM: *Investment and Financial Markets*. As such, term and final exams will to a large extent follow the format of the SOA exams. This course, combined with ACT245 and ACT460, gives you most of the background necessary to write Exam IFM (though some self-study is still required).

**Prerequisites:** A basic understanding of financial instruments, a solid understanding of the time value of money, an introductory course in probability and statistics (including probability distributions, pdfs, expectations, etc.), and some mathematical maturity: ACT240H1 (minimum 63%); ACT245H1 (minimum 63%); ACT247H1 (minimum 63%); (STA257H1, STA261H1); MAT237Y1/MAT257Y1. Exclusion: RSM435H1.

## Tentative Course Outline:

The course will aim to cover the following topics:

- Introduction to Pricing, Financial Instruments, and Derivatives

- General ideas behind pricing financial products (Arbitrage, Law of One Price, Risk-Neutral Pricing, Utility Theory, Equilibrium Pricing)
- Review/Overview of basic financial instruments (Forwards, Futures, Bonds, Options)
- Comparing Call and Put Options, Put-Call Parity Binomial Asset Pricing Model
  - Replicating Portfolios and Risk-Neutral Pricing
  - Multiperiod Trees and American Options
  - Assets other than stocks
  - Utility Theory
- Lognormal Stock Price Model and the Black-Scholes Formula
  - Properties of the Lognormal Distribution and its relation to stock prices
  - Black-Scholes Formula for options on stocks and other assets
  - Option Greeks and Delta-Hedging
- Other topics (Exotic Options, Interest Rate Derivatives)

**Recommended Textbook:** The recommended textbook for this course is:

- [Robert L. McDonald, \*Derivatives Markets\*](#), 3rd Ed., Pearson, 2013.

This textbook is also useful if you are writing the Society of Actuaries' Exam *IFM: Investment and Financial Markets*. There is no required textbook for the course, but problems from the book will be referenced for practice.

**Grading Scheme:** Homework Assignments (20%), Two Term Exams (20% each), and Final (40%). There will be three homework assignments throughout the term. The lowest mark will be dropped.

**Important Dates:**

Problem Set #1.....	February 8, 2022
Problem Set #2.....	March 1, 2022
Problem Set #3.....	April 5, 2022
Term Exam 1 .....	February 16, 2022
Term Exam 2 .....	March 23, 2022
Final Exam .....	TBD

**Lectures and Tutorials:** Before January 31<sup>st</sup> : All sessions will be delivered online (per the meeting schedule) or pre-recorded. All livestreamed lectures will also be recorded for viewing. It is strongly recommended that students have a computer with a microphone and camera in order to participate in online lectures and tutorials.

After January 31<sup>st</sup>: Lectures and tutorials and tests will be in-person. Details about the course meeting schedule, as well as other course activities and assessments, will be communicated in the course syllabus and/or on Quercus.

**Office Hours** with Alex Shipilov and TAs will be held online (timing will be determined in January).

**Late Policy and Make-up Exams:** If one of the Term Exams is missed due to illness or any other circumstances, the weight from the Term Exam will be carried over to the final exam. If two of the Term Exams are missed, the student will be considered as failed. Homework assignments should be submitted via Quercus with a single PDF file by 11:59 PM ET on the day of the deadline. A late penalty with 20% deduction per day after missing the assignment deadline will be applied. If you have any questions about this, please feel free to ask me.

**Academic Honesty:** Academic integrity is essential to the pursuit of learning and scholarship in a university, and to ensuring that a degree from the University of Toronto is a strong signal of each student's individual academic achievement. As a result, the University treats cases of cheating and plagiarism very seriously. The University of Toronto [Code of Behavior on Academic Matters](#) outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offences.

All suspected cases of academic dishonesty will be investigated following procedures outlined in the Code of Behaviour on Academic Matters. If students have questions or concerns about what constitutes appropriate academic behaviour or appropriate research and citation methods, they are expected to seek out additional information on academic integrity from their instructors or from other institutional resources.

In addition to the specific university's internal policies on conduct, including academic misconduct, candidates pursuing credits for writing professional examinations shall also be subject to the Code of Conduct and Ethics for Candidates in the CIA Education System and the associated Policy on Conduct and Ethics for Candidates in the CIA Education System. For more information, please visit information for candidates on [obtaining UAP credits](#).

**Canadian Institute of Actuaries (CIA)s University Accreditation Program (UAP):** ACT370 is an accredited under the Canadian Institute of Actuaries (CIA) [University Accreditation Program](#) (UAP). Achievement of the minimum required grades in accredited courses may provide credit for preliminary exams. Please note that a combination of courses may be required to achieve exam credit. Details on the required courses and grades for the University of Toronto can be found [here](#).