

FALL 2018 - ACMA 440 D100

**MODELS FOR FINANCIAL ECONOMICS (3)**

Class Number: 4678 Delivery Method: In Person

**COURSE TIMES + LOCATION:**Mo 8:30 AM – 10:20 AM  
WMC 3510, BurnabyWe 8:30 AM – 9:20 AM  
WMC 3510, Burnaby**EXAM TIMES + LOCATION:**Oct 3, 2018  
4:30 PM – 6:20 PM  
AQ 5008, BurnabyNov 7, 2018  
4:30 PM – 6:20 PM  
AQ 5008, BurnabyDec 7, 2018  
3:30 PM – 6:30 PM  
AQ 5005, Burnaby**INSTRUCTOR:**

Jean-Francois Begin

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Office: SC-K10548

**PREREQUISITES:**

ACMA 320 and ACMA 340.

## Description

**CALENDAR DESCRIPTION:**

Advanced actuarial models and their application to insurance and financial risks. Exotic options. Market-making, hedging and option greeks. Introduction to stochastic calculus: Ito's lemma, risk neutrality, fundamental theorems of asset pricing. Interest rate modelling and derivatives. Advanced option pricing models. Implied volatility and empirical issues. Actuarial applications: variable annuities. Quantitative.

**COURSE DETAILS:**

**Some classes will take place in lieu of the tutorial session. These will be announced during the first lecture of the semester.**

**Lectures on Oct 3rd and Oct 24th will be held in Computing Lab AQ 3148.1.**

**Outline:**

This course covers financial and actuarial models and their applications to insurance and financial risks. The topics covered include:

The Black-Scholes-Merton Model : The Lognormal Distribution, Assumptions of the Black-Scholes-Merton Model, The Black-Scholes-Merton Formula, Option Greeks.  
Elementary Stochastic Calculus : Probability Theory, Stochastic Process, Martingale, Markov Process, Brownian Motion, Stochastic Differential Equations, Ito's Lemma.

The Black-Scholes-Merton Equation : Differential Equation and Valuation Under Certainty, The Black-Scholes-Merton Equation, Finite Difference Approximation, The Explicit Finite Difference Method, The Implicit Finite Difference Method, The Crank-Nicolson Method

Risk Neutrality and Fundamental Theorems of Asset Pricing : Intuition Behind Risk-Neutral Pricing, Risk-Neutral Pricing and the Binomial Model, Risk-Aversion and Marginal Utility, First-Order Condition for Portfolio Selection, Change of Measure and Change of Numéraire, The Girsanov Theorem, Fundamental Theorems of Asset Pricing

More on Exotic Options: Asian Options, All-or-Nothing Options, Barrier Options, Monte Carlo Simulation.

Interest Rate Modelling and Derivatives : Introduction to Interest Rate Derivatives, Interest Rate Derivatives and the BSM Approach, Continuous-Time Short-Rate Models (Rendelman-Bartter Model, Vasicek Model, Cox, Ingersoll and Ross Model), Interest-Rate Trees (Black, Derman and Toy Model, Hull and White Model)

Advanced Option Pricing Models : Measurement and Behaviour of Volatility, Autoregressive Conditional Heteroskedasticity, Generalized ARCH, The Cox Model, The Merton (1976) Model, The Heston (1993) Model, The Bates (1996) Model, The Heston and Nandi (2000) Model

Implied Volatility and Empirical Issues : Implied Volatility, Volatility Smiles, Hedging in the Presence of Volatility Smiles, Empirical Facts on Equity Volatility Smiles, Model Calibration

Actuarial Applications : Guaranteed Minimum Death Benefit, Guaranteed Minimum Maturity Benefit, Guaranteed Minimum Withdrawal Benefit, Guaranteed Minimum Income Benefit, Guaranteed Minimum Accumulation Benefit, Key Risks of Variable Annuities, Hedging and Risk Management of Variable Annuities, Lapse

Behaviour, Pros and Cons of Variable Annuities

This course is accredited under the Canadian Institute of Actuaries (CIA) University Accreditation Program (UAP) for the 2018-2019 academic year. Achievement of the established exemption grade in this course may qualify a student for exemptions from writing certain preliminary exams. Please note, a combination of courses may be required to achieve a single exemption. Please see <http://www.cia-ica.ca/membership/uap> for full details.

## Grading

Assignments	10%
In-Class Activities	5%
Term Project	5%
Midterm 1	20%
Midterm 2	20%
Final Exam	40%

### NOTES:

The pass mark is 50%. The final grade will be allocated according to the student's achievement in the course. Under no circumstances will late assignments be accepted.

**All above grading is subject to change.**

## Materials

### REQUIRED READING:

**Derivatives Markets, 3rd ed.** Author: McDonald, R.L. (2013). Publisher: Pearson. Chapters 12-14, 18-25, Appendices B and C.

eBook ISBN: 9780134234960

Book ISBN: 9780321543080

### RECOMMENDED READING:

**Options, Futures, and Other Derivatives.** Hull, J. C. (2006). Pearson. Chapters 14, 15, 19, 20, 28, 31.

eBook ISBN: 9780134234939

Book ISBN: 9780133456318

**Stochastic Calculus for Finance II: Continuous-Time Models.** Shreve, S. E. (2004). Springer. Chapters 3-5, 11

Hardcover ISBN: 978-0-387-40101-0

Softcover ISBN: 978-1-4419-2311-0

**Volatility and Correlation: The Perfect Hedger and the Fox, 2nd ed.** Rebonato, R. (2005). Wiley. Chapters 6-9, 13, 14

Book available [on-line](#) through the SFU Library

eBook ISBN: 978-0-470-09140-1

Hardcover ISBN: 978-0-470-09139-5

**Interest Rate Models - Theory and Practice: With Smile, Inflation and Credit.** Brigo, D. & Mercurio, F. (2007). Springer. Chapters 1, 3.

**Investment Guarantees: Modeling and Risk Management for Equity-linked Life Insurance.** Hardy, M. (2003). Wiley. Chapters 1, 8, 13.

### DEPARTMENT UNDERGRADUATE NOTES:

#### Students with Disabilities:

Students requiring accommodations as a result of disability must contact the Centre for Accessible Learning 778-782-3112 or [csdo@sfu.ca](mailto:csdo@sfu.ca)

#### Tutor Requests:

Students looking for a Tutor should visit <http://www.stat.sfu.ca/teaching/need-a-tutor-.html>. We accept no responsibility for the consequences of any actions taken related to tutors.

**REGISTRAR NOTES:**

SFU's Academic Integrity web site <http://students.sfu.ca/academicintegrity.html> is filled with information on what is meant by academic dishonesty, where you can find resources to help with your studies and the consequences of cheating. Check out the site for more information and videos that help explain the issues in plain English.

Each student is responsible for his or her conduct as it affects the University community. Academic dishonesty, in whatever form, is ultimately destructive of the values of the University. Furthermore, it is unfair and discouraging to the majority of students who pursue their studies honestly. Scholarly integrity is required of all members of the University. <http://www.sfu.ca/policies/gazette/student/s10-01.html>

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