



BUSINESS SCHOOL
Te Kura Pakihi

COURSE OUTLINE

FINC299 Special Topic: Fundamentals of Quantitative Finance

Semester Two, 2022
Final Version

This course outline contains information specific to this paper. For more general information common to your papers, please refer to the COMMERCE_UG_2022: Commerce Undergraduate Students site on Blackboard.

Paper Description and Aims

Quantitative finance focuses on solving finance problems by using quantitative methods including mathematical and numerical techniques, where mathematical finance formulae are published and widely used in financial engineering and computational finance algorithms are very useful in solving practical problems. During the past decade, many sophisticated mathematical and computational techniques have been developed for analysing financial markets. Students intending to work in quantitative analysis (e.g., derivative structuring or pricing and risk management) must have a comprehensive knowledge of quantitative finance. This paper offers students a skill set widely sought-after by prospective employers, such as Barclays, JPMorgan Chase, Morgan Stanley, Merrill Lynch, Federal Reserve Board and Reserve Bank of New Zealand.

This course covers two major components of quantitative finance: mathematical finance and computational finance. The aim of this paper is to provide a knowledge in quantitative finance. Topics covered: probability theory, Monte Carlo simulation, and exotic options pricing.

Prerequisite: FINC 102

Note: MATH170 or MATH140 is accepted as an alternative to FINC102.

Learning Outcomes

Upon successful completion of this paper, you should be able to:

1. Demonstrate the knowledge of probability theory
2. Acquire the knowledge of the Black–Scholes model
3. Understand how to model and simulate stock prices
4. Acquire the knowledge of exotic options and its pricing
5. Apply the knowledge on Monto Carlo simulation

Teaching Staff

Paper Coordinator and Lecturer

Name: **Dr Edwin Ruan**

Office: OBS 5.09

Email: xinfeng.ruan@otago.ac.nz

Office Hours: Wednesday 14:00 – 16:00 and Thursday 15:00-16:00 or email for an appointment

You should contact **Dr Edwin Ruan** with any administrative enquiries about the paper, e.g. requests for late submission of assignments.

Class Representatives

Class representatives are an important means of communication between students and staff. Contact details for your student class representatives can be found on the Blackboard page for this paper.

Course Delivery

Lecture Day/Time/ Room:

Tuesday	13:00-14:50	OBS228
Thursday	13:00-14:50	OBS229

Lectures present the key conceptual material. Lectures are supported by independent readings. Lectures should be treated as a sign-post for wider independent study.

The Course Calendar (at the end of this document) details scheduling information. Note that this calendar may change as the course proceeds. Any changes will be announced at lectures and be detailed on Blackboard.

Course Learning Resources

Textbook Required

There are no textbooks required. But a list of recommended textbooks in quantitative finance for reading is provided as follows.

- *Options, Futures, and Other Derivatives*, by John Hull , 10th Edition, Pearson, 2017
- *Derivatives Markets*, by Robert L. McDonald, L., 3rd edition, Pearson, 2013
- *Monte Carlo Simulation with Applications to Finance*, by Hui Wang, CRC Press, 2012
- *Paul Wilmott on Quantitative Finance*, by Paul Wilmott, 2nd Edition, John Wiley & Sons, 2006

Blackboard

<https://blackboard.otago.ac.nz/> provides you with access to course materials, class notices, and resources. Blackboard is used to email the whole class so it is important that you check your student email and *Blackboard* regularly.

Further information about student support, learning support and information, academic integrity and other University resources for students is available on the COMMERCE_UG_2017: Commerce Undergraduate Students site on Blackboard.

Student Webmail

We will use your student email account to email you information relevant to your programme. To forward your University email address to an email address that you use regularly:

1. Log into your StudentMail account (<http://www.otago.ac.nz/smlanding/>) using your student username and password.
2. Click the **Cog** button (top right corner).
3. Click on **Mail** under **Your App Settings**.
4. Under **Accounts** on left hand side, select **Forwarding**.
5. Under the Forwarding heading, type in the email address you want your email to be forwarded to. You can also choose to have a copy of these emails kept on your StudentMail account, so please check the box if you would like this.
6. Click the **Save** button.

When emailing me, please use your University email address only.

Assessment

All material presented is examinable (except where stated otherwise) by assignments and the final examination. All-important assessment information such as due dates and times, content, guidelines and so on will be discussed at lectures and, where appropriate, detailed on Blackboard. *Students are responsible for ensuring that they are aware of this information, keeping track of their own progress, and catching up on any missed classes.*

Assessment	% of final grade
Assignment 1	10
Assignment 2	10
Midterm Exam	30
Final exam	50
Total	100

Course Requirements

Attendance

The material of this paper is highly sequential. To ensure that students gain the maximum benefit from classes, students are required to attend each lecture in person and no lecture recordings will be provided. However, I recognise illness, Covid and other significant unforeseen events do occur. For these students, please email me at least an hour before the lecture, and then a live Zoom meeting link will be sent to you.

Assignments

You are required to work on them individually. Discussion among classmates is allowed. Please turn in your solutions on the due date. Late turn-in will be heavily discounted (i.e., final marks = original marks * $\exp\{-0.05 * \text{number of late days}\}$). *Remember to put your name and student ID on the signed Declaration Sheet for Individual Assignment as the first page of your manuscripts. The assignment without the signed Declaration Sheet for Individual Assignment will not be marked.* Assignment 1 covers Lectures 1-5 and Assignment 2 covers Lectures 6-10.

Midterm Exam

The main purpose of the midterm is to test your understanding of the fundamental concepts and your ability of demonstrating the knowledge on mathematical finance. The midterm exam covers materials of Lectures 1-5. You are required to bring along a university approved calculator (CASIO FX82, CASIO FX100, CASIO FX95, CASIO FX570, or SHARP EL531) to the exam.

The Comprehensive Final Examination

A three-hour final examination will be comprehensive of all course topics and materials. You are required to bring along a university approved calculator (CASIO FX82, CASIO FX100, CASIO FX95, CASIO FX570, or SHARP EL531) to the exam. *In order to pass this paper, you must pass the final examination with a minimum mark of 45%.*

Terms Requirements

To gain Terms in FINC299, you must **either** obtain a mark of at least 45% on the Midterm Exam **or** attend at least 70% of classes in person or via Zoom.

Learning Outcomes

Learning Outcome	Assessment	Assessment	Exam	Total
Demonstrate the knowledge of probability theory	Assignment 1	Midterm exam	Final exam	30%
Acquire the knowledge of the Black–Scholes model	Assignment 1	Midterm exam	Final exam	20%
Understand how to model and simulate stock prices	Assignment 2		Final exam	20%
Acquire the knowledge of exotic options and its pricing	Assignment 2		Final exam	15%
Apply the knowledge on Monte Carlo simulation	Assignment 2		Final exam	15%
Total	20%	30%	50%	100%

Course Calendar

The following schedule of topics covered is subject to modification as the course progresses. We will not be following the textbook exactly. *Chapters are provided for reference. Class notes are key!*

No.	Week Commencing	Topic	Notes
1	11 July 2022	Lecture 1: Quantitative Finance: An Introduction	
		Pre-Lecture: Calculus and Algebra Review (Optional)	
2	18 July 2022	Lecture 2: Introduction to Probability Theory I - Discrete Random Variables	Assignment 1 available
3	25 July 2022	Lecture 3: Introduction to Probability Theory II - Continuous Random Variables	
4	1 August 2022	Lecture 4: Introduction to Probability Theory III - Play with A Normally Distributed Random Variable	
5	8 August 2022	Lecture 5: The Black-Scholes Model	
6	15 August 2022	Lecture 6: Introduction to Probability Theory IV - Joint Distributions, Covariance and Correlation	Assignment 1 due
7	22 August 2022	Review	
		Midterm Exam on 25 August 2022, 1-3 pm	
Mid-Semester Break 29 August to 2 September			
8	5 September 2022	Lecture 7: Stock Price Models	
9	12 September 2022	Lecture 8: Exotic options	Assignment 2 available
10	19 September 2022	Lecture 9: Monte Carlo Simulation	
11	26 September 2022	Lecture 10: Monte Carlo Simulation in MATLAB	
12	3 October 2022	Research Seminars in Quantitative Finance	Assignment 2 due
13	10 October 2022	Review	

Lectures end Friday 14 October 2022
University Exam Period 19 October - 12 November 2022

Disclaimer

While every effort is made to ensure that the information contained in this document is accurate, it is subject to change. Changes will be notified in class and via Blackboard. Students are encouraged to check Blackboard regularly. It is the student's responsibility to be informed.