



## DEPARTMENT OF ACCOUNTING AND FINANCE

### ADVANCED DERIVATIVES CLASS CODE: AG426 2023/24 SEMESTER 2

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#### CLASS DESCRIPTION

This class covers advanced material in derivatives pricing, such as stochastic calculus and its implication in finance under financial market frictions. The course particularly focuses on applying option valuation techniques to capital investment decisions of firms, which is referred to as real option valuation. The new approach dramatically departs from the orthodox theory and "it has shown that the traditional 'net present value' rule, which is taught to virtually every business school student and student of economics, can give very wrong answers" (Dixit and Pindyck, 1994). By the end of this course, students will have a good understanding of how derivative contracts work, how they are priced using modern financial language. Students will also learn how to employ numerical methods to price complex financial derivatives with the help of MATLAB software. Most importantly, students will better understand how investment decisions to be made with the ongoing uncertainty of economic environments.

#### CLASS AIM

This class covers advanced material in derivatives pricing. We will cover stochastic calculus and its implication in finance. In addition, numerical methods, such as Monte Carlo Simulation, Binomial tree model, Finite Difference methods (FDM), will be introduced to price basic options. Finally, this course explores portfolio risk management and real option pricing framework. By the end of this course, students will have a good understanding of how derivative contracts work, how they are used and how they are priced. Students will learn how traditional option pricing framework could be used to analyse real investment projects,

i.e. real option analysis.

## **LEARNING OUTCOMES**

The following learning outcomes will contribute to your self-analysis and reflection in your Student's Personal Development Planning (SPDP). These learning outcomes will be assessed using the methods explained in the "Assessment" section in this Outline.

### **Subject-specific knowledge and skills**

On completing this class you will be able to:

- A.1 Understand a model for the random behaviour of share prices.
- A.2 Understand stochastic calculus and Wiener process.
- A.3 Understand in detail futures and options.
- A.4 Understand the theoretical principles which sustain option pricing models.
- A.5 Understand advanced techniques to price derivatives.
- A.6 Understand numerical option pricing methods, i.e. Monte Carlo simulation, FDM, ect.
- A.7 Understand empirical volatility models: such as Garch models.
- A.8 Estimate different measures of the risk of a portfolio of derivatives.
- A.9 Estimate the Value at Risk of a portfolio of financial assets.
- A.10 Understand how option-pricing techniques can be used to assess the investment decision in real assets.

### **Cognitive abilities and non-subject specific skills**

During the class you will

- B.1 Develop academic skills in reading and understanding academic writing.
- B.2 Develop numerical skills while understanding the pricing of complex derivative instruments.
- B.3 Develop your team work and your computational skills through a group assignment.
- B.4 Develop the ability to explain and discuss complex issues.

## **TEACHING AND LEARNING**

Teaching methods will include formal lecturing but there will also be an emphasis in the learning process on student participation through group work and debate. There will be 10 two-hour lectures plus 10 one-hour seminars/labs. This will prepare you for the modes of Assessment (explained below). Active participation in workshops is important and this will be encouraged by the tutor to the extent of occasionally requiring short presentations/discussions by the students. At all times students are expected to supplement their learning by reading the

prescribed textbook(s), newspaper (such as Financial Times and Wall Street Journals) and web articles from services such as Bloomberg, Yahoo Finance, CNBC etc.

## ASSESSMENT

There will be one **group** project (to be submitted by Friday of Week 9) which will account 30% towards the final mark and a final in person exam which will account 70% towards the final mark. Students are requested to answer 4 out of 5 questions in the final exam with each counts 25 marks.

The Department of Accounting and Finance is returning to on campus, **in person examinations** in all modules. To support you in your exam preparation in this module we will offer a **mock exam** (45 minutes) with 2 past exam questions under exam conditions in week 10's tutorial. An outline answer will be provided in the next tutorial together with information on the marking framework.

Details of the group project and submission guidelines will be distributed at the lecture (by Week 3).

**It is a requirement for course completion to submit all parts of the class assessment. Non-submission of any part will result in an overall mark of zero being awarded for the class.**

**Reassessment** Not applicable

## PRE-REQUISITES

None

## READING

Hull, J. (2017). *Options, Futures and Other Derivatives*, 10th Edition. Prentice Hall. New Jersey.

Avinash K. Dixit & Robert S. Pindyck (1994). *Investment under Uncertainty*, Princeton University Press, Princeton, New Jersey.

## CLASS STRUCTURE

Week Number	Topic	Lecture pre-reading chapters
WEEK 1	Introduction; Wiener Processes	Hull Chapter 14

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WEEK 2	Ito's Lemma	Hull Chapter 14
WEEK 3	The Black-Scholes differential equation	Hull Chapter 15
WEEK 4	Numerical Procedures: Binomial trees	Hull Chapter 21
WEEK 5	Monte Carlo simulation	Hull Chapter 21
WEEK 6	Finite difference methods	Hull Chapter 21
WEEK 7	Value at Risk and Expected Shortfall	Hull Chapter 22
WEEK 8	Estimating Volatilities and Correlations	Hull Chapter 23
WEEK9	Real Options	Hull Chapter 36
WEEK 10	Real Option and Its applications	Hull Chapter 36
WEEK 11	Revision session.	

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## **PENALTIES FOR LATE SUBMISSION**

The Business School follows the University's policy for the late submission of assessed work:  
[POLICY and procedure for LATE SUBMISSION OF COURSEWORK \(strath.ac.uk\)](#)

## **FEEDBACK**

The standard turnaround time for all feedback and marking within SBS is 15 working days from assessment submission.

The University policy on Assessment and Feedback is available here:

[Assessment and Feedback Policy \(strath.ac.uk\)](#)

## **COMPENSATION SCHEME**

The Business School follows the university's policy:

[POLICY ON  
Compensation  
Scheme  
\(strath.ac.uk\)](#)

## **RESIT POLICY**

1. No resit for honours classes.

### **Marking**

The following marking guide is consistent with the Universal Marking Guide for Undergraduate Courses contained in the University's Teaching and Learning Guide (December 2003)

%	Descriptor
90 -100 A*	<u>Truly Exceptional/Outstanding</u> demonstration of learning outcomes: <ul style="list-style-type: none"><li>• wide, appropriate knowledge and understanding (and where appropriate effective project work) including insight and/or originality</li></ul>
80 - 89 A	<ul style="list-style-type: none"><li>• evidence of reading and thought beyond course/assignment materials</li><li>• appropriate use of references and exemplars</li><li>• a high standard of writing and communication</li></ul>

70 - 79 B	<p><u>Excellent</u> demonstration of learning outcomes:</p> <ul style="list-style-type: none"> <li>• wide, appropriate knowledge and understanding (and where appropriate effective project work) including insight and/or originality</li> <li>• evidence of reading and thought beyond course/assignment materials</li> <li>• appropriate use of references and exemplars</li> <li>• a high standard of writing and communication</li> </ul>
60 - 69 C	<p><u>Comprehensively Good</u> demonstration of learning outcomes:</p> <ul style="list-style-type: none"> <li>• wide appropriate knowledge and understanding (and where appropriate effective project work) with only occasional lapses in detail</li> <li>• evidence of reading and thought beyond course/assignment materials</li> <li>• a high standard of writing and communication</li> </ul>
50 - 59 D	<p><u>Generally Good</u> demonstration of learning outcomes:</p> <ul style="list-style-type: none"> <li>• sound knowledge and understanding of essential material (and where appropriate essential project skills)</li> <li>• general accuracy with occasional mistakes and/or uncoordinated use of information</li> </ul>
40 - 49 E	<p><u>Satisfactory</u> demonstration of learning outcomes:</p> <ul style="list-style-type: none"> <li>• basic knowledge and understanding (and where appropriate basic project skills)</li> <li>• omissions and/or weaknesses of presentation and/or logic and/or evidence</li> </ul>
30 - 39 F	<p><u>Poor</u> performance in learning outcomes:</p> <ul style="list-style-type: none"> <li>• some relevant information and limited understanding (and where appropriate some project work completed under supervision)</li> <li>• omissions and/or weaknesses of presentation and/or logic and/or evidence</li> <li>• lack of familiarity with the subject of assessment and/or assessment vehicle</li> </ul>
20 - 29 G	<p><u>Weak</u> performance in learning outcomes:</p> <ul style="list-style-type: none"> <li>• a few key words or phrases</li> <li>• serious errors</li> </ul>
1 – 19 H	<ul style="list-style-type: none"> <li>• little evidence that learning or project work was seriously attempted</li> </ul>
0	No relevant work submitted for assessment