Department of Accounting and Finance
AG426 Advanced Derivatives

2024/25 Semester 2
20 Module Credits

Module Details

Module Description

This module 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.

Teaching Hours

Lectures: Weeks 1, 2, 9 and 10. Friday 10am-12pm, Weeks 3, 4, 5, 6,7 and 8, Friday 10:00am-13:00pm.

Lab: Weeks 3, 4, 5, 6,7 and 8, 12-1pm.

Prerequisites

None.

Contact Details

Lecturer: Dr Hai Zhang

Room number: Stenhouse 3.26

Telephone: 0141 548 4983

E-mail: hai.zhang@strath.ac.uk

Office Hours: Tuesday 13:00-14:00

Module Learning

Module Aims

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.

Learning Objectives and Outcomes

Subject-specific knowledge and skills

On completing this module 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 module 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.

Module Structure

Timetable

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

Assessment and Feedback Details

1. Group project worth 30%. Due: Wednesday 19th of March 2025. Marks/Feedback will be released on or before Wednesday 9th of April 2025.

2. Final exam worth 70%. Date: During semester 2 exam diet.

An overall weighted average mark of 40% is required to pass the module.

It is a requirement for course completion to submit all assessed coursework. Non-submission of any part will result in an overall mark of zero being awarded for the module.
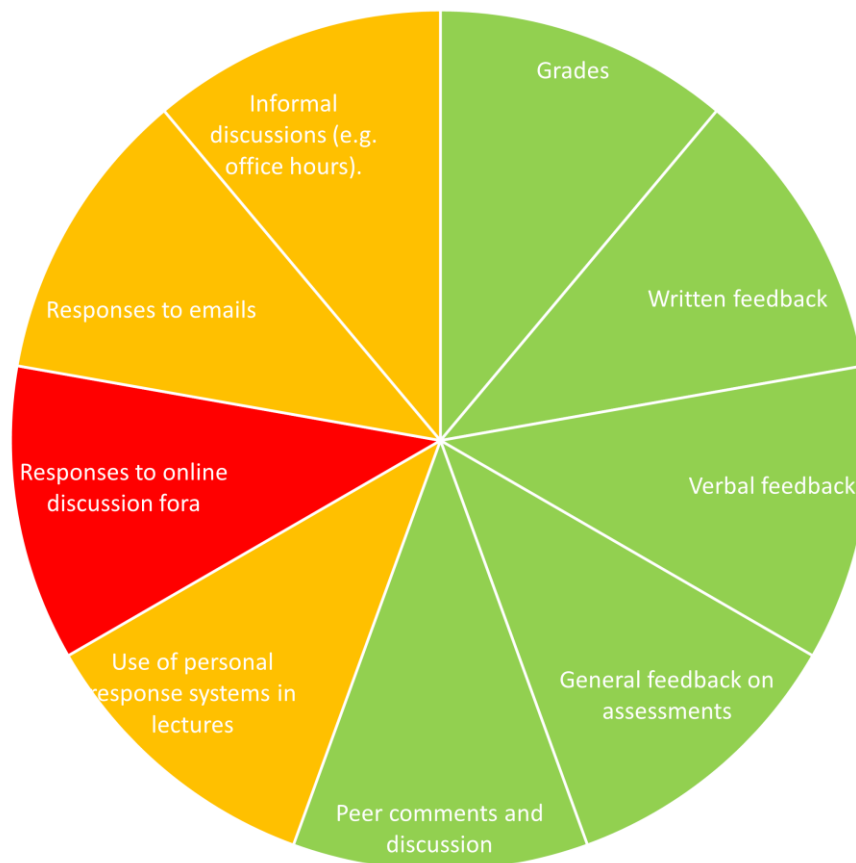
Artificial Intelligence

You are not permitted to use Gen-AI tools for this module unless you are a student with an adjustment report on Pegasus where this is explicitly specified as a 'reasonable adjustment'. Any student suspected of using such tools will be subject to investigation outlined in the Student_Discipline_Procedure_-_Academic_Misconduct.pdf (strath.ac.uk) process.

Reading List

Please refer to the AG426 Myplace page to access the Reading List.

UG Module Manual (Honours)

Please refer to the accounting and finance UG manual module for the following ([Honours Module Manual.docx](#)):

- Tutorial Attendance
- Useful Contacts
- Penalties for Late Submission
- Feedback
- Compensation Scheme
- Resit Policy – no resits in honours year
- Universal Marking Guide
- Useful Links