ST401-15 Stochastic Methods in Finance

23/24

Department
 Statistics
Level
 Undergraduate Level 4
Module leader
 Daniel Valesin
Credit value
 15
Module duration
 10 weeks
Assessment
 Multiple
Study location
 University of Warwick main campus, Coventry

Description

Introductory description

This module runs in Term 1 and is available only to students in the Department of Statistics.

Pre-requisites: ST318 Probability Theory and ST339 Introduction to Mathematical Finance.

Leads To: ST909 Continuous Time Finance for Interest Rate Models.

Results from this module may be partly used to determine exemption eligibility in the Institute and Faculty of Actuaries module CM2. (Independent application with the IFoA may be required to receive the exemption.)

[Module web page](#)

Module aims

To provide an introduction to continuous time stochastic models as applied in mathematical finance. To cover, in conjunction with parts of the Institute and Faculty of Actuaries syllabus. To gain an understanding of Brownian Motion and Stochastic Calculus. To be able to use this to model the evolution of financial markets in continuous time and price a variety of financial instruments.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

Content:
Introduction to Brownian Motion and Stochastic Calculus.
Introduction to SDEs (Stochastic Differential Equations) and Markov processes.
Continuous-time models of security prices.
Risk-neutral evaluation and equivalent martingale measures, Girsanov and martingale representation theorems.
Black-Scholes theory: PDE and SDE approaches.
Basic Greeks, delta-hedging.
Put-Call parity and Put-Call symmetry.
Introduction to optimal stopping and American Options.
Bond prices and term structure of interest rates: Hull-White, Vasicek and CIR models.

Learning outcomes

By the end of the module, students should be able to:

- Know how probability models are used in financial mathematics
- Understand the concept of Brownian motion

Indicative reading list

View reading list on Talis Aspire

Subject specific skills

- Demonstrate facility with rigorousstochasticmethods.

- Evaluate, select and apply appropriate mathematical and/or probabilist techniques.

- Demonstrate knowledge of and facility with formal probability concepts, both explicitly and by applying them to the solution of finance problems.

- Create structured and coherent arguments communicating them in written form.

- Construct logical mathematical arguments with clear identification of assumptions and conclusions.

- Reason critically, carefully, and logically and derive (prove) mathematical results.

Transferable skills

Problem solving: Use rational and logical reasoning to deduce appropriate and well-reasoned conclusions. Retain an open mind, optimistic of finding solutions, thinking laterally and creatively to look beyond the obvious. Know how to learn from failure.

- Self awareness: Reflect on learning, seeking feedback on and evaluating personal practices, strengths and opportunities for personal growth.

- Communication: Present arguments, knowledge and ideas, in a range of formats.

- Professionalism: Prepared to operate autonomously. Aware of how to be efficient and resilient. Manage priorities and time. Self-motivated, setting and achieving goals, prioritising tasks.

Study

Study time

Type	Required	Optional
Lectures	30 sessions of 1 hour (20%)	2 sessions of 1 hour
Tutorials	5 sessions of 1 hour (3%)	
Private study	115 hours (77%)	
Total	150 hours	

Private study description

Weekly revision of lecture notes and materials, wider reading, practice exercises and preparing for class tests and the examination.

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Students can register for this module without taking any assessment.

Assessment group B2

	Weighting	Study time
2 hour examination (April)	100%	
Answer all questions.		

	Weighting	Study time

- Answerbook Pink (12 page)

Assessment group R1

	Weighting	Study time
2 hour examination (September)	100%	

Answer all questions.

- Answerbook Pink (12 page)
- Graph paper
- Students may use a calculator

Feedback on assessment

Solutions and cohort level feedback will be provided for the examination.

[Past exam papers for ST401](#)

Availability

Courses

This module is Optional for:

- Year 1 of TMAA-G1PE Master of Advanced Study in Mathematical Sciences
- USTA-G300 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics
  - Year 3 of G300 Mathematics, Operational Research, Statistics and Economics
  - Year 4 of G300 Mathematics, Operational Research, Statistics and Economics

This module is Option list A for:

- Year 4 of USTA-G300 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics
- Year 5 of USTA-G301 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics (with Intercalated
- Year 4 of USTA-G1G3 Undergraduate Mathematics and Statistics (BSc MMathStat)
- Year 5 of USTA-G1G4 Undergraduate Mathematics and Statistics (BSc MMathStat) (with Intercalated Year)

This module is Option list D for:

- USTA-G300 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics
  - Year 4 of G30C Master of Maths, Op.Res, Stats & Economics (Operational Research and Statistics Stream)
  - Year 4 of G30C Master of Maths, Op.Res, Stats & Economics (Operational Research and Statistics Stream)
- Year 5 of USTA-G301 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics (with Intercalated

This module is Option list E for:

- Year 4 of USTA-G300 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics
- Year 5 of USTA-G301 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics (with Intercalated