MA482-15 Stochastic Analysis

26/27

Department
Warwick Mathematics Institute
Level
Undergraduate Level 4
Module leader
Oleg Zaboronski
Credit value
15
Module duration
10 weeks
Assessment
Multiple
Study location
University of Warwick main campus, Coventry

Description

Introductory description

We will introduce stochastic integration, and basic tools in stochastic analysis including Ito's formula. We will also introduce lots of examples of stochastic differential equations.

Module web page

Module aims

The module aims to help students to be confident in using stochastic calculus for Ito diffusions, with lots of practice in using Ito's formula to derive statistical information, and to describe path behaviour, on lots of examples. The module will emphasise examples over proofs, but will cover the basic constructions and theory, and it is an opportunity for students to see their knowledge of measure theory in action.

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.

- Construction of the Ito stochastic integral.

- Ito’s formula, stopping times, time changes.
- Existence and uniqueness for stochastic differential equations (SDEs).
- One dimensional examples: Brownian Bridges, Ornstein Uhlenbeck process, Geometric Brownian motion, Feller diffusion. Exit analysis for one dimensional diffusions.
- Links between SDEs and PDEs. Higher dimensional examples. Invariant measures.
- Topics from: conditioning diffusions; small noise asymptotics; ergodic theorems and central limit results for diffusions.

Learning outcomes

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

- Understanding of how to build a variety diffusions using Brownian motions, Ito’s stochastic integral and via stochastic differential equations.
- Ability to exploit Ito’s formula to extract statistical information about diffusions.
- Knowledge of a range of diffusions models that have been used in maths, physics and finance.

Subject specific skills

Stochastic calculus is now a standard tool in modelling randomness in both scientific modelling, and more recently in financial modelling. This module has been taken by mathematicians, statisticians, physicists and economists.

Transferable skills

Stochastic calculus is now a standard tool in modelling randomness in both scientific modelling, and more recently in financial modelling. This module has been taken by mathematicians, statisticians, physicists and economists.

Study

Study time

Type	Required
Lectures	30 sessions of 1 hour (20%)
Tutorials	9 sessions of 1 hour (6%)
Private study	111 hours (74%)
Total	150 hours

Private study description

Review lectured material and work on set exercises

Costs

No further costs have been identified for this module.

Assessment

You do not need to pass all assessment components to pass the module.

Students can register for this module without taking any assessment.

Assessment group B1

	Weighting	Study time	Eligible for self-certification
Centrally-timetabled examination (On-campus) 3 hour exam, no books allowed	100%		No

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- Answerbook Gold (24 page)

Assessment group R

	Weighting	Study time	Eligible for self-certification
In-person Examination - Resit	100%		No

- Answerbook Gold (24 page)

Feedback on assessment

Exam feedback

Past exam papers for MA482

Availability

Courses

This module is Optional for:

- TMAA-G1PE Master of Advanced Study in Mathematical Sciences
  - Year 1 of G1PE Master of Advanced Study in Mathematical Sciences
  - Year 1 of G1PE Master of Advanced Study in Mathematical Sciences
- Year 1 of TMAA-G1PD Postgraduate Taught Interdisciplinary Mathematics (Diploma plus MSc)
- Year 1 of TMAA-G1P0 Postgraduate Taught Mathematics
- TMAA-G1PC Postgraduate Taught Mathematics (Diploma plus MSc)
  - Year 1 of G1PC Mathematics (Diploma plus MSc)
  - Year 2 of G1PC Mathematics (Diploma plus MSc)
- Year 4 of USTA-G300 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics

This module is Core option list F for:

- Year 4 of UMAA-GV19 Undergraduate Mathematics and Philosophy with Specialism in Logic and Foundations

This module is Option list A for:

- TMAA-G1PD Postgraduate Taught Interdisciplinary Mathematics (Diploma plus MSc)
  - Year 1 of G1PD Interdisciplinary Mathematics (Diploma plus MSc)
  - Year 2 of G1PD Interdisciplinary Mathematics (Diploma plus MSc)
- Year 1 of TMAA-G1P0 Postgraduate Taught Mathematics
- Year 1 of TMAA-G1PC Postgraduate Taught Mathematics (Diploma plus MSc)
- Year 4 of UPXA-FG33 Undergraduate Mathematics and Physics (BSc MMathPhys)
- Year 4 of UPXA-FG31 Undergraduate Mathematics and Physics (MMathPhys)
- Year 4 of USTA-G1G3 Undergraduate Mathematics and Statistics (BSc MMathStat)

This module is Option list B for:

- TMAA-G1PD Postgraduate Taught Interdisciplinary Mathematics (Diploma plus MSc)
  - Year 1 of G1PD Interdisciplinary Mathematics (Diploma plus MSc)
  - Year 2 of G1PD Interdisciplinary Mathematics (Diploma plus MSc)
- Year 1 of TMAA-G1PC Postgraduate Taught Mathematics (Diploma plus MSc)
- TSTA-G4P1 Postgraduate Taught Statistics
  - Year 1 of G4P1 Statistics (Taught)
  - Year 1 of G40A Statistics with Probability (Taught)
- Year 4 of UCSA-G4G3 Undergraduate Discrete Mathematics
- Year 5 of UCSA-G4G4 Undergraduate Discrete Mathematics (with Intercalated Year)

This module is Option list C for:

- UMAA-G105 Undergraduate Master of Mathematics (with Intercalated Year)
  - Year 3 of G105 Mathematics (MMath) with Intercalated Year

    - Year 4 of G105 Mathematics (MMath) with Intercalated Year
    - Year 5 of G105 Mathematics (MMath) with Intercalated Year
- UMAA-G103 Undergraduate Mathematics (MMath)
    - Year 3 of G103 Mathematics (MMath)
    - Year 4 of G103 Mathematics (MMath)
- Year 4 of UMAA-G107 Undergraduate Mathematics (MMath) with Study Abroad
- UMAA-G106 Undergraduate Mathematics (MMath) with Study in Europe
    - Year 3 of G106 Mathematics (MMath) with Study in Europe
    - Year 4 of G106 Mathematics (MMath) with Study in Europe

This module is Option list E for:

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

This module is Option list F for:

- Year 4 of USTA-G300 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics