

MA390-15 Topics in Mathematical Biology

22/23

Department

Warwick Mathematics Institute

Level

Undergraduate Level 3

Module leader

Nigel Burroughs

Credit value

15

Module duration

10 weeks

Assessment

Multiple

Study location

University of Warwick main campus, Coventry

Description

Introductory description

Mathematical modelling of biological systems and processes is a growing field that uses multiple mathematical modelling and analysis techniques. This course will cover a range of these techniques.

[Module web page](#)

Module aims

To introduce ideas and techniques of mathematical modelling (deterministic and stochastic) in biology.

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.

This is a specialist course so the syllabus changes depending on the interests and expertise of lecturer.

Learning outcomes

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

- To gain an insight into modelling techniques and dynamic principles in biology through building and analysing a range of mathematical models;
- to consolidate basic mathematical techniques used in these approaches, such as ODEs, PDEs, probability theory, branching processes and Markov Chains.

Indicative reading list

A classic text (only deterministic modelling, I is predominantly ODEs, II is PDEs) is *Mathematical Biology I & II*. James Murray. Springer. See also *Methods and Models in Mathematical Biology*, Müller, Johannes, Kuttler, Christina, *Lecture Notes in Mathematical Modelling in the Life Sciences*, Springer. ISBN 978-3-642-27251-6, containing good examples. Specialist texts will also be indicated depending on module focus.

Subject specific skills

Students will primarily acquire skills on formulating and solving complex problems, turning a biology question into a mathematical question through construction of an appropriate mathematical model, either deterministic or stochastic. An ability to use a range of techniques will also be acquired to solve these problems, e.g. stability theory, bifurcation analysis, master equation approaches, including solving with the method of characteristics. Such skills are widely transferable to other problems in biology, and to other arenas, including engineering, financial modelling, population modelling etc.

Transferable skills

Students will acquire key reasoning and problem solving skills which will empower them to address new problems with confidence. Such skills are a major selling point of the Warwick mathematics degree, but with the biology underpinning that this course gives them, they will also have a background that will enable them to approach biotechnology and data science companies in addition to financial, engineering and management vocations.

Study

Study time

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

Type	Required
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
In-person Examination	100%	
<ul style="list-style-type: none">• Answerbook Gold (24 page)		

Assessment group R

	Weighting	Study time
In-person Examination - Resit	100%	
<ul style="list-style-type: none">• Answerbook Gold (24 page)		

Feedback on assessment

Marked coursework and exam feedback.

[Past exam papers for MA390](#)

Availability

Courses

This module is Optional for:

- Year 1 of TMAA-G1PD Postgraduate Taught Interdisciplinary Mathematics (Diploma plus MSc)
- Year 1 of TMAA-G1PC Postgraduate Taught Mathematics (Diploma plus MSc)
- UCSA-G4G1 Undergraduate Discrete Mathematics
 - Year 3 of G4G1 Discrete Mathematics
 - Year 3 of G4G1 Discrete Mathematics
- Year 3 of UCSA-G4G3 Undergraduate Discrete Mathematics
- Year 4 of UCSA-G4G4 Undergraduate Discrete Mathematics (with Intercalated Year)
- Year 4 of UCSA-G4G2 Undergraduate Discrete Mathematics with Intercalated Year
- 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
- Year 4 of UECA-GL12 Undergraduate Mathematics and Economics (with Intercalated Year)

This module is Core option list B for:

- UMAA-GV17 Undergraduate Mathematics and Philosophy
 - Year 3 of GV17 Mathematics and Philosophy
 - Year 3 of GV17 Mathematics and Philosophy
 - Year 3 of GV17 Mathematics and Philosophy
- Year 3 of UMAA-GV19 Undergraduate Mathematics and Philosophy with Specialism in Logic and Foundations

This module is Core option list D for:

- UMAA-GV18 Undergraduate Mathematics and Philosophy with Intercalated Year
 - Year 4 of GV18 Mathematics and Philosophy with Intercalated Year
 - Year 4 of GV18 Mathematics and Philosophy with Intercalated Year
- 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
- TMAA-G1PC Postgraduate Taught Mathematics (Diploma plus MSc)
 - Year 1 of G1PC Mathematics (Diploma plus MSc)
 - Year 2 of G1PC Mathematics (Diploma plus MSc)
- 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-G100 Undergraduate Mathematics (BSc)
 - Year 3 of G100 Mathematics

- Year 3 of G100 Mathematics
- Year 3 of G100 Mathematics
- UMAA-G103 Undergraduate Mathematics (MMath)
 - Year 3 of G100 Mathematics
 - Year 3 of G103 Mathematics (MMath)
 - Year 3 of G103 Mathematics (MMath)
 - Year 4 of G103 Mathematics (MMath)
 - Year 4 of G103 Mathematics (MMath)
- 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
- UPXA-FG33 Undergraduate Mathematics and Physics (BSc MMathPhys)
 - Year 3 of FG33 Mathematics and Physics (BSc MMathPhys)
 - Year 4 of FG33 Mathematics and Physics (BSc MMathPhys)
- UPXA-GF13 Undergraduate Mathematics and Physics (BSc)
 - Year 3 of GF13 Mathematics and Physics
 - Year 3 of GF13 Mathematics and Physics
- UPXA-FG31 Undergraduate Mathematics and Physics (MMathPhys)
 - Year 3 of FG31 Mathematics and Physics (MMathPhys)
 - Year 3 of FG31 Mathematics and Physics (MMathPhys)
 - Year 4 of FG31 Mathematics and Physics (MMathPhys)
 - Year 4 of FG31 Mathematics and Physics (MMathPhys)
- Year 4 of UPXA-GF14 Undergraduate Mathematics and Physics (with Intercalated Year)
- 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)
- USTA-GG14 Undergraduate Mathematics and Statistics (BSc)
 - Year 3 of GG14 Mathematics and Statistics
 - Year 3 of GG14 Mathematics and Statistics
- Year 4 of UMAA-G101 Undergraduate Mathematics with Intercalated Year
- USTA-Y602 Undergraduate Mathematics, Operational Research, Statistics and Economics
 - Year 3 of Y602 Mathematics, Operational Research, Stats, Economics
 - Year 3 of Y602 Mathematics, Operational Research, Stats, Economics
- Year 4 of USTA-Y603 Undergraduate Mathematics, Operational Research, Statistics, Economics (with Intercalated Year)

This module is Option list B for:

- Year 1 of TMAA-G1PE Master of Advanced Study in Mathematical Sciences
- Year 3 of USTA-G1G3 Undergraduate Mathematics and Statistics (BSc MMathStat)
- Year 4 of USTA-G1G4 Undergraduate Mathematics and Statistics (BSc MMathStat) (with Intercalated Year)
- Year 4 of USTA-GG17 Undergraduate Mathematics and Statistics (with Intercalated Year)

This module is Option list E for:

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

Economics

- Year 3 of G30D Master of Maths, Op.Res, Stats & Economics (Statistics with Mathematics Stream)
- Year 4 of G30D Master of Maths, Op.Res, Stats & Economics (Statistics with Mathematics Stream)
- USTA-G301 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics (with Intercalated
 - Year 3 of G30H Master of Maths, Op.Res, Stats & Economics (Statistics with Mathematics Stream)
 - Year 4 of G30H Master of Maths, Op.Res, Stats & Economics (Statistics with Mathematics Stream)
 - Year 5 of G30H Master of Maths, Op.Res, Stats & Economics (Statistics with Mathematics Stream)