MA256-10 Introduction to Mathematical Biology

23/24

Department
: Warwick Mathematics Institute

Level
: Undergraduate Level 2

Module leader
: Magnus Richardson

Credit value
: 10

Module duration
: 10 weeks

Assessment
: Multiple

Study location
: University of Warwick main campus, Coventry

Description

Introductory description

In this module, we will develop simple models of biological phenomena from basic principles. These models will then be analysed to investigate their stability in order to deduce biologically significant results. We will use applications from population dynamics, systems biology and epidemiology and derive differential equations to explore how biological systems evolve and the impact of model structure upon model stability. Finally, we will discuss the biological implications of our results.

[Module web page]

Module aims

Introduction to Mathematical Biology and Systems Biology. Modelling techniques (based on core module material).

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.

1. General introduction to mathematical biology, its uses and successes.
2. Population Dynamics and Epidemiology 2.1Simplemodelsofbiologicalpopulations 2.2Simplemodelsofinfectiondynamics 2.3Introducingmorecomplexity–risk structures 2.4Realworldexample:ZikavirusinBrazil. 3. Systems Biology 3.1Modellingregulatoryandsignallingsystems 3.2Modellingthecellcycles 3.3Realworldexample:optimaltreatmentofcancersusingchemotherapy.

Learning outcomes

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

- To develop simple models of biological phenomena from basic principles.
- To analyse simple models of biological phenomena using mathematics to deduce biologically significant results.
- To reproduce models and fundamental results for a range of biological systems.
- To have a basic understanding of the biology of the biological systems introduced.

Indicative reading list

H. van den Berg, Mathematical Models of Biological Systems, Oxford Biology, 2011
James D. Murray, Mathematical Biology: I. An Introduction. Springer 2007
Christopher Fall, Eric Marland, John Wagner, John Tyson, Computational Cell Biology, Springer 2002
L. Edelstein Keshet, Mathematical Models in Biology, SIAM Classics in Applied Mathematics 46, 2005.
Keeling, M.J. and Rohani, P. Modeling Infectious Diseases in Humans and Animals, Princeton University Press, 2007.
Anderson, R. and May, R. Infectious Diseases of Humans, Oxford University Press, 1992.
Glendinning, P. Stability, Instability and Chaos, Cambridge Texts in Applied Mathematics, 1994.

Subject specific skills

This is a 15 lecture taught model. Students will also complete three assignments that will be supported by a weekly examples class. The course will be assessed with a 1 hour exam.

Transferable skills

Students will learn about biological systems and the use of mathematical models to solve real world problems. This will be extremely valuable experience for those wishing to use mathematical models in the future in non-academic contexts.

Study

Study time

Type	Required
Lectures	30 sessions of 1 hour (30%)
Seminars	10 sessions of 1 hour (10%)
Private study	40 hours (40%)
Assessment	20 hours (20%)
Total	100 hours

Private study description

private study to master the material

Costs

No further costs have been identified for this module.

Assessment

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

Assessment group B

	Weighting	Study time
2 hour examination	100%	20 hours

- Answerbook Pink (12 page)

Assessment group R

	Weighting	Study time
In-person Examination - Resit	100%	

- Answerbook Pink (12 page)

Feedback on assessment

Exam Feedback

[Past exam papers for MA256]

Availability

Courses

This module is Core option list A for:

- UMAA-GV17 Undergraduate Mathematics and Philosophy
    - Year 2 of GV17 Mathematics and Philosophy
    - Year 2 of GV17 Mathematics and Philosophy
    - Year 2 of GV17 Mathematics and Philosophy
- Year 2 of UMAA-GV19 Undergraduate Mathematics and Philosophy with Specialism in Logic and Foundations

This module is Option list A for:

- Year 2 of UMAA-G105 Undergraduate Master of Mathematics (with Intercalated Year)
- UMAA-G100 Undergraduate Mathematics (BSc)
    - Year 2 of G100 Mathematics
    - Year 2 of G100 Mathematics
    - Year 2 of G100 Mathematics
- UMAA-G103 Undergraduate Mathematics (MMath)
    - Year 2 of G100 Mathematics
    - Year 2 of G103 Mathematics (MMath)
    - Year 2 of G103 Mathematics (MMath)
- Year 2 of UMAA-G1NC Undergraduate Mathematics and Business Studies
- Year 2 of UMAA-G1N2 Undergraduate Mathematics and Business Studies (with Intercalated Year)
- Year 2 of UMAA-GL11 Undergraduate Mathematics and Economics
- Year 2 of UECA-GL12 Undergraduate Mathematics and Economics (with Intercalated Year)
- USTA-GG14 Undergraduate Mathematics and Statistics (BSc)
    - Year 2 of GG14 Mathematics and Statistics
    - Year 2 of GG14 Mathematics and Statistics
- Year 2 of UMAA-G101 Undergraduate Mathematics with Intercalated Year

This module is Option list B for:

- UCSA-G4G1 Undergraduate Discrete Mathematics
    - Year 2 of G4G1 Discrete Mathematics
    - Year 2 of G4G1 Discrete Mathematics
- Year 2 of UCSA-G4G3 Undergraduate Discrete Mathematics
- UPXA-GF13 Undergraduate Mathematics and Physics (BSc)
    - Year 2 of GF13 Mathematics and Physics
    - Year 2 of GF13 Mathematics and Physics
- UPXA-FG31 Undergraduate Mathematics and Physics (MMathPhys)
    - Year 2 of FG31 Mathematics and Physics (MMathPhys)
    - Year 2 of FG31 Mathematics and Physics (MMathPhys)

- USTA-Y602 Undergraduate Mathematics,Operational Research,Statistics and Economics
    - Year 2 of Y602 Mathematics,Operational Research,Stats,Economics
    - Year 2 of Y602 Mathematics,Operational Research,Stats,Economics