Module Descriptor

Title	Mathematical Biology		
Session	2025/26	**Status**	Published
Code	MATH100010	**SCQF Level**	10
Credit Points	20	**ECTS (European Credit Transfer Scheme)**	10
School	**Computing, Engineering and Physical Sciences**		
Module Co-ordinator	Ryan P. Meeten		

Summary of Module

The module covers the mathematical modelling of biological phenomena.

Students will begin to understand why ordinary differential equations (ODEs) can arise in modelling biological phenomena. One-dimensional autonomous ODEs will be covered, including a treatment of equilibrium points, stability, phase plots, and linear stability analysis within the context of mathematical biology.

These ideas will be expanded to consider systems of two or more ODEs, paying attention to equilibria and the stability thereof, phase plane analysis, and linear stability analysis, within the context of interacting species and/or disease modelling.

Biological movement and pattern formation will be introduced, with mention made to chemical diffusion, chemotaxis, reaction-diffusion equations, Turing patterns and diffusion-driven instability.

Travelling waves will be touched upon, with regard to Fisher's equation, wound healing and epidemiology. Further, the modelling of infectious diseases will be covered, with an introduction to SIR models, the Kermack-McKenzie model, steady-states and linear stability.

Reaction kinetics will be studied, including the Law of Mass Action, enzyme reactions, the pseudo steady-state hypothesis, and singular perturbation techniques.

Finally, discrete time population models will be introduced, via difference equation models for seasonally reproducing organisms, harvesting, obtaining maximum sustainable yields, Leslie matrices and the Jury conditions for stability.

The Graduate Attributes relevant to this module are given below:

• Academic: Critical thinker; Analytical; Inquiring; Knowledgeable; Problem-solver; Digitally literate; Autonomous.

• Personal: Motivated, Creative; Resilient.

• Professional: Research-minded; Ambitious; Driven.

Module Delivery Method	On-Campus[1] ☒	Hybrid[2] ☐	Online[3] ☐	Work -Based Learning[4] ☐
Campuses for Module Delivery	☐ Ayr ☐ Dumfries	☐ Lanarkshire ☐ London ☒ Paisley	☐ Online / Distance Learning ☐ Other (specify)	

Terms for Module Delivery	Term 1	☐	Term 2	☒	Term 3	☐
Long-thin Delivery over more than one Term	Term 1 – Term 2	☐	Term 2 – Term 3	☐	Term 3 – Term 1	☐

Learning Outcomes	
L1	Demonstrate detailed knowledge and understanding of equilibria and stability in ODE models of biological phenomena.
L2	Demonstrate detailed knowledge and understanding of the mathematics involved in biological movement and pattern formation.
L3	Demonstrate detailed knowledge and understanding of mathematical modelling of reaction kinetics.
L4	Demonstrate detailed knowledge and understanding of discrete time population models.
L5	Using appropriate computational methods to investigate dynamical systems.

Employability Skills and Personal Development Planning (PDP) Skills	
SCQF Headings	**During completion of this module, there will be an opportunity to achieve core skills in:**
Knowledge and Understanding (K and U)	**SCQF 10** Demonstrating a detailed knowledge and understanding of important techniques used in creating and analysing models which arise in biological phenomena. Demonstrating critical awareness of established techniques of enquiry in common biological applications of differential equations and difference equations.

[1] Where contact hours are synchronous/ live and take place fully on campus. Campus-based learning is focused on providing an interactive learning experience supported by a range of digitally-enabled asynchronous learning opportunities including learning materials, resources, and opportunities provided via the virtual learning environment. On-campus contact hours will be clearly articulated to students.

[2] The module includes a combination of synchronous/ live on-campus and online learning events. These will be supported by a range of digitally-enabled asynchronous learning opportunities including learning materials, resources, and opportunities provided via the virtual learning environment. On-campus and online contact hours will be clearly articulated to students.

[3] Where all learning is solely delivered by web-based or internet-based technologies and the participants can engage in all learning activities through these means. All required contact hours will be clearly articulated to students.

[4] Learning activities where the main location for the learning experience is in the workplace. All required contact hours, whether online or on campus, will be clearly articulated to students

Practice: Applied Knowledge and Understanding	**SCQF 10** Using a range of standard techniques to analyse and solve problems at advanced levels, and sometimes in non-routine contexts. Carrying out defined investigative problems within a mathematically based subject.
Generic Cognitive skills	**SCQF 10** Conceptualising and analysing problems informed by professional and research issues.
Communication, ICT and Numeracy Skills	**SCQF 10** Making formal written presentation(s) based on the output from an investigative problem.
Autonomy, Accountability and Working with Others	**SCQF 10** Exercising independence and initiative in carrying out complex activities. Identifying learning needs through reflection based on self, tutor and peer evaluation of work.

Prerequisites	**Module Code** MATH09002	**Module Title** Differential Equations 2
	Other Or equivalent	
Co-requisites	**Module Code**	**Module Title**

Learning and Teaching	
In line with current learning and teaching principles, a 20-credit module includes 200 learning hours, normally including a minimum of 36 contact hours and maximum of 48 contact hours.	
Learning Activities During completion of this module, the learning activities undertaken to achieve the module learning outcomes are stated below:	**Student Learning Hours** (Note: Learning hours include both contact hours and hours spent on other learning activities)
Lecture / Core Content Delivery	24
Tutorial / Synchronous Support Activity	12
Laboratory / Practical Demonstration / Workshop	12
Independent Study	152
Please select	
Please select	
TOTAL	200

Indicative Resources

The following materials form essential underpinning for the module content and ultimately for the learning outcomes: Essential Mathematical Biology: 1st Edition, N Britton, 2003, Springer. "Mathematical Biology" class notes as published on the University VLE. Mathematical Biology: 3rd Edition, J D Murray, 2013, Springer. Mathematical Aspects of Reacting and Diffusing Systems: 1st Edition, P C Fife, 1979, Springer.
(N.B. Although reading lists should include current publications, students are advised (particularly for material marked with an asterisk*) to wait until the start of session for confirmation of the most up-to-date material)

Attendance and Engagement Requirements
In line with the Student Attendance and Engagement Procedure, Students are academically engaged if they are regularly attending and participating in timetabled on-campus and online teaching sessions, asynchronous online learning activities, course-related learning resources, and complete assessments and submit these on time. **For the purposes of this module, academic engagement equates to the following:** The School of Computing, Engineering and Physical Sciences considers attendance and engagement to mean a commitment to attending, and engaging in, timetabled sessions. You will scan your attendance via the scanners each time you are on-campus and you will log in to the VLE several times per week. Where you are unable to attend a timetabled learning session due to illness or other circumstance, you should notify that Programme Leader that you cannot attend. Across the School an 80% attendance threshold is set. If you fall below this, you will be referred to the Student Success Team to see how we can best support your studies.

Equality and Diversity
The University's Equality, Diversity and Human Rights Procedure can be accessed at the following link: UWS Equality, Diversity and Human Rights Code. Aligned with the University's commitment to equality and diversity, this module supports equality of opportunity for students from all backgrounds and learning needs. Using the VLE, material will be presented electronically in formats that allow flexible access and manipulation of content. This module complies with University regulations and guidance on inclusive learning and teaching practice. This module has lab-based teaching and as such you are advised to speak to the Module Co-ordinator to ensure that specialist assistive equipment, support provision and adjustment to assessment practice can be put in place, in accordance with the University's policies and regulations.
(N.B. Every effort will be made by the University to accommodate any equality and diversity issues brought to the attention of the School)

Supplemental Information

Divisional Programme Board	**Engineering Physical Sciences**
Overall Assessment Results	☐ **Pass / Fail** ☒ **Graded**
Module Eligible for Compensation	☐ **Yes** ☒ **No** **If this module is eligible for compensation, there may be cases where compensation is not permitted due to**

	programme accreditation requirements. Please check the associated programme specification for details.
School Assessment Board	Mathematics and Physics
Moderator	W. Mekwi
External Examiner	C. Guiver
Accreditation Details	
Module Appears in CPD catalogue	☐ **Yes** ☒ **No**
Changes / Version Number	1.05 Module coordinator changed for 25-26 to R. Meeten. Computational laboratory component added. Assessment changed to closed book test. Moved to term 2.

Assessment (also refer to Assessment Outcomes Grids below)
Assessment 1
Class Test (Unseen, closed book) (80%)
Assessment 2
Individual coursework task (20%)
Assessment 3
(N.B. (i) Assessment Outcomes Grids for the module (one for each component) can be found below which clearly demonstrate how the learning outcomes of the module will be assessed. (ii) An indicative schedule listing approximate times within the academic calendar when assessment is likely to feature will be provided within the Student Module Handbook.)

Component 1							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**
Class Test (unseen, closed book)	☒	☒	☒	☒	☐	80	2

Component 2							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**
Coursework	☒	☐	☐	☐	☒	20	0

Component 3

Assessment Type	LO1	LO2	LO3	LO4	LO5	Weighting of Assessment Element (%)	Timetabled Contact Hours
	☐	☐	☐	☐	☐		
Combined total for all components						100%	2 hours

Change Control

What	When	Who
Module coordinator changed and module moved to term 2	March 2025	R. Meeten
Computational lab added	March 2025	R. Meeten
Learning outcome added	March 2025	R. Meeten
Assessment updated: closed book test	March 2025	R. Meeten