MA133-10 Differential Equations

24/25

Department

Warwick Mathematics Institute

Level

Undergraduate Level 1

Module leader

Lukas Eigentler

Credit value

10

Module duration

10 weeks

Assessment

Multiple

Study location

University of Warwick main campus, Coventry

Description

Introductory description

It is a far stream version of the new M^3-1 and M^3-2 (MA144, MA145, MA146,MA147) module that allows students access to differential equations (ODEs and PDEs) in year 2. It covers the differential equations topics covered in these modules as well as foundations of differentiable calculus.

Module aims

To introduce simple differential and difference equations, methods for their solution, and foundations of differential calculus.

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. First order linear equations: first order linear equations, examples of existence and uniqueness, integration techniques (integrating factors, ...).
2. Second order equations: general homogeneous equations and linear second order equations with constant coefficients, reduction to 2x2 systems, sketching the flow under a

vector field (2d only, phase diagrams).
3. Nonlinear equations and 2x2 systems: linear stability such as predator and prey models.
4. Discretisation techniques: explicit and implicit Euler, stability (optional).
5. Differential calculus of scalar functions of several variables: partial derivative, chain rule, change of coordinates, gradient, directional derivative.
6. Differential calculus of vector functions of several variables: crossed product, vector fields, divergence, curl, nabla, algebraic identities, Laplace, expression in other coordinates (polar, cylindrical, spherical), parametrisation of surfaces, tangent planes, normal
7. Integration: 2D-divergence theorem.

Learning outcomes

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

- You should be able to solve various simple differential equations (first order, linear second order and coupled systems of first order equations) and to interpret their qualitative behaviour;
- and to do the same for simple difference equations.

Indicative reading list

The primary text will be:
J. C. Robinson An Introduction to Ordinary Differential Equations, Cambridge University Press 2003.
Additional references are:
W. Boyce and R. Di Prima, Elementary Differential Equations and Boundary Value Problems, Wiley 1997.
C. H. Edwards and D. E. Penney, Differential Equations and Boundary Value Problems, Prentice Hall 2000.
K. R. Nagle, E. Saff, and D. A. Snider, Fundamentals of Differential Equations and Boundary Value Problems, Addison Wesley 1999.

Subject specific skills

See learning outcomes.

Transferable skills

Students will acquire key reasoning and problem solving skills which will empower them to address new problems with confidence.

Study

Study time

Type	Required
Lectures	20 sessions of 1 hour (20%)
Tutorials	8 sessions of 30 minutes (4%)
Private study	76 hours (76%)
Total	100 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 D

	Weighting	Study time	Eligible for self-certification
Assignments	15%		No
In-person Examination	85%		No

- Answerbook Pink (12 page)

Assessment group R

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

- Answerbook Pink (12 page)

Feedback on assessment

Marked assignments and exam feedback.

Availability

Anti-requisite modules

If you take this module, you cannot also take:

- MA144-10 Methods of Mathematical Modelling 2
- MA145-10 Mathematical Methods and Modelling 2
- MA146-10 Methods of Mathematical Modelling 1
- MA147-10 Mathematical Methods and Modelling 1

Courses

This module is Optional for:

- Year 1 of USTA-G300 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics
- Year 1 of USTA-G1G3 Undergraduate Mathematics and Statistics (BSc MMathStat)
- Year 1 of USTA-GG14 Undergraduate Mathematics and Statistics (BSc)
- Year 1 of USTA-Y602 Undergraduate Mathematics,Operational Research,Statistics and Economics

This module is Option list B for:

- Year 1 of UCSA-G4G1 Undergraduate Discrete Mathematics
- Year 1 of UCSA-G4G3 Undergraduate Discrete Mathematics