FP084-30 Mathematical Software and Modelling

26/27

Department
Warwick Global Academy
Level
Foundation
Module leader
Hina Nasir
Credit value
30
Module duration
25 weeks
Assessment
100% coursework
Study location
University of Warwick main campus, Coventry

Description

Introductory description

This module provides an integrated introduction to foundational mathematical concepts through a software-based learning approach and the application of mathematical modelling techniques - to enhance students' computational thinking, creativity, and practical skills by combining mathematics with programming and visual tools.

Module web page

Module aims

This module will cover:

A) Mathematical Software: Students will be introduced to a suite of mathematical software tools, including:

- MATLAB – for programming and numerical analysis,
- LaTeX – for professional mathematical typesetting and documentation, and
- GeoGebra – for interactive graphing and visualization.

The module will cover essential programming constructs in MATLAB such as loops, conditionals, and functions. To encourage the fusion of mathematics and coding, students will explore mathematical topics where programming constructs naturally apply—such as numerical methods for solving equations and computing definite integrals.

B) Mathematical Modelling:
Adopting an interdisciplinary approach, this component focuses on how mathematics is applied in various fields including engineering, physical sciences, and beyond. The module emphasizes real-world applications through topics like first-order ordinary differential equations (ODEs), statistical analysis and numerical methods, enabling students to see how mathematics helps explain and model real-life phenomena.

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.

- LATEX: Learn to create professional-looking documents in academic and scientific publishing; producing technical and scientific documents, especially those with complex mathematical notations.
- GEOGEBRA: Learn to use software that combines geometry, algebra, statistics, and calculus into one platform, allowing for interactive visualization and exploration of mathematical ideas.
- MATLAB: Learn a high-level programming language and understand the environment primarily used for numerical computation, data analysis, and visualisation. Express mathematical operations and algorithms in a concise and intuitive way for engineering, science, and other technical fields.
- SYMBOLIC TOOLBOX: Perform symbolic computations using MATLAB Symbolic Math Toolbox, which involves working with mathematical expressions in their symbolic form (e.g., variables, functions, and equations) rather than just numerical values.
- MATHEMATICAL MODELLING: Learn the process of using mathematics, in particular, differential equations, to represent and analyse real-world phenomena, systems, or problems.

Learning outcomes

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

- Knowledge and Understanding • Demonstrate a sound understanding of mathematical tools and foundational programming principles and their relevance to mathematical problem-solving.
- Intellectual Skills • Develop logical and structured approaches to solving both mathematical and real-world problems using programming. • Engage in creative thinking and work effectively both independently and collaboratively.
- Professional Practical Skills • Use mathematical software tools proficiently for modelling, computation, and visualization. • Implement numerical methods and analyse data effectively using appropriate software.

- Transferable Skills • Apply mathematical reasoning within programming constructs. • Write and structure basic programs in MATLAB. • Develop self-directed learning skills and effectively engage with digital learning platforms.

Indicative reading list

Reading lists can be found in Talis

Interdisciplinary

Students will have opportunities to draw on knowledge and skills acquired within the different modules on their pathway.

International

All students are international, representing a wide range of cultural, linguistic, and educational backgrounds. They bring diverse experiences and perspectives, enriching discussion and supporting the development of intercultural awareness. Examples for analysis and evaluation are drawn from a variety of countries, ensuring that teaching and learning are embedded in an international context.

Subject specific skills

- Use mathematical software tools proficiently for modelling, computation, and visualization.
- Develop logical and structured approaches to solving both mathematical and real-world problems using programming.
- Implement numerical methods and analyse data effectively using appropriate software.

Transferable skills

- Apply mathematical reasoning within programming constructs.
- Write and structure basic programs in MATLAB.
- Develop self-directed learning skills and effectively engage with digital learning platforms.

Study

Study time

Type	Required
Seminars	25 sessions of 4 hours (33%)
Private study	140 hours (47%)
Total	300 hours

Type	Required
Assessment	60 hours (20%)
Total	300 hours

Private study description

Extra class reading of books and learning materials on Moodle in preparation for seminars. Weekly worksheets.

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group A

	Weighting	Study time	Eligible for self-certification
Assessment component			
MCQ and Short answer-based test (conceptual) on Latex and MATLAB	30%	18 hours	No

This assessment evaluates students' understanding of the theoretical and practical aspects of the mathematical tools taught in the module. The tests are designed to ensure breadth of coverage across topics such as LaTeX syntax and basics of MATLAB programming.
Topics:

1. LaTeX syntax for equations, figures, and tables
2. MATLAB basics (e.g., functions, loops, conditional statements etc.)

Reassessment component is the same

Assessment component			
MCQ and Short answer-based test on numerical methods	20%	12 hours	No

This assessment evaluates students' understanding and application of the numerical methods

	Weighting	Study time	Eligible for self-certification

Topics:

- Numerical root finding
- Numerical integration
- Numerical differentiation

Reassessment component is the same

Assessment component

Programming and Modelling Project	50%	30 hours	Yes (extension)

Students will complete a comprehensive computational and modelling project designed to demonstrate their ability to apply numerical, statistical, and mathematical modelling techniques to solve applied mathematical problems.
The project requires students to:

- Formulate the problem using appropriate mathematical frameworks
- Select and apply suitable modelling techniques (numerical, statistical, and analytical)
- Develop and analyse mathematical models, including differential equation models where appropriate
- Implement computational solutions using MATLAB
- Interpret results and critically evaluate findings within the relevant applied context

Reassessment component is the same

Feedback on assessment

Marked scripts shown in class for the two in-class tests and
Written Feedback on Report task via Tabula

Availability

There is currently no information about the courses for which this module is core or optional.