MA265-10 Methods of Mathematical Modelling 3

24/25

Department
: Warwick Mathematics Institute

Level
: Undergraduate Level 2

Module leader
: Marie-Therese Wolfram

Credit value
: 10

Module duration
: 10 weeks

Assessment
: Multiple

Study location
: University of Warwick main campus, Coventry

Description

Introductory description

Our comprehension of many phenomena in the world relies heavily on partial differential equations (PDEs). These equations are instrumental to describe various phenomena such as heat propagation, the vibrations of solids, fluid dynamics, chemical reactions, photon-electron interactions, or electromagnetic wave radiation. Moreover, PDEs play an important role in contemporary mathematics, particularly in geometry and analysis.
This course will give an introduction providing insights into mathematical modeling, the fundamental properties of partial differential equations and the methodologies employed in their analysis.

Module aims

The module aims at providing a broad perspective on the subject, and illustrate the rich variety of phenomena which can be described by PDEs. It will provide students with the most important techniques to construct so-called classic solutions to PDEs – the methods of characteristics, the method of the separation of variables as well as Fourier series. Students will learn to differentiate cetrain types of PDEs and comprehend their inherent characteristics. The modeule will also illustrate how PDEs arise naturally in the phyiscal and life sciences.

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.

The course will start with an introduction to PDES, outlining what PDEs actually are, how some of them can be classified, how do they arise in physics and the life sciences, and what the notion of well-posedness means. It will mainly focus on three classical equations – the heat equation, the wave equation and the Laplace equation – on unbounded and bounded domains.

Learning outcomes

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

- understand and apply fundamental physical principles to derive certain types of PDEs.
- the ability to differentiate between various types of PDEs and comprehend the distinctions in their inherent characteristics.
- calculate solutions to the three main types of PDEs on unbounded and bounded domains
- You will also understand that properties of solutions to PDEs sensitively depend on the type.

Indicative reading list

W. Strauss Partial Differential Equations, an introduction Wiley 1992
J.D. Logan Applied Partial Differential Equations, 2nd edition Springer, 2004

Subject specific skills

At the end, students will be familiar with the notion of well-posed PDE problems and have an idea what kind of initial or boundary conditions may be imposed for this purpose. Students will have studied some techniques which enable you to solve some simple PDE problems. They will also understand that properties of solutions to PDEs sensitively depend on the type.

Transferable skills

The module provides technical competence in solving basic partial differential equations that feature at least as building blocks in applications. There are aspects of critical thinking and creativity related to analysing and solving PDE problems.

Study

Study time

Type	Required
Lectures	30 sessions of 1 hour (30%)
Seminars	9 sessions of 1 hour (9%)
Private study	61 hours (61%)
Total	100 hours

Private study description

Working on assignments, going over lecture notes, text books, exam revision.

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 D1

	Weighting	Study time
Assignments	15%	
Examination	85%	

Assessment group R1

	Weighting	Study time
In-person Examination - Resit	100%	

Feedback on assessment

Marked homework (both assessed and formative) is returned and discussed in smaller classes. Exam feedback is given.

Past exam papers for MA265

Availability

Courses

Course availability information is based on the current academic year, so it may change.
This module is Core 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)
- Year 2 of UMAA-G101 Undergraduate Mathematics with Intercalated Year