MA136-6 Introduction to Abstract Algebra

20/21

Department
Warwick Mathematics Institute
Level
Undergraduate Level 1
Module leader
David Wood
Credit value
6
Module duration
5 weeks
Assessment
Multiple
Study location
University of Warwick main campus, Coventry

Description

Introductory description

This module introduces important algebraic structures including groups, rings and fields. Students will learn how to verify that a set is a group, ring or field, and how to carry out elementary operations in these structures. They will understand the relation between a group, a subgroup and the cosets of a subgroup which leads to Lagrange's theorem. They will also assimilate permutations, symmetric groups, and alternating groups, and know how to determine the unit group of a ring.

Module web page

Module aims

To introduce First Year Mathematics students to abstract Algebra, covering Group Theory and Ring Theory

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.

Section 1 Group Theory
Motivating examples: numbers, symmetry groups
Definitions, elementary properties
Subgroups, including subgroups of Z
Arithmetic modulo n and the group Z_n
Lagrange's Theorem
Permutation groups, odd and even permutations (proof optional) Normal subgroups and quotient groups

Section 2 Ring Theory
Definitions: Commutative and non-commutative rings, integral domains, fields
Examples: Z, Q, R, C, Z_n, matrices, polynomials, Gaussian integers
Unit, unit groups, factorisation, examples where unique factorisation fails

Learning outcomes

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

- Understand the abstract definition of a group, and be familiar with the basic types of examples, including numbers, symmetry groups and groups of permutations and matrices.
- Understand what subgroups are, and be familiar with the proof of Lagrange’s Theorem.
- Understand the definition of various types of ring, and be familiar with a number of examples, including numbers, polynomials, and matrices.
- Understand unit groups of rings, and be able to calculate the unit groups of the integers modulo n.

Indicative reading list

Reading lists can be found in Talis

Subject specific skills

This module introduces important algebraic structures including groups, rings and fields. Students will learn how to verify that a set is a group, ring or field, and how to carry out elementary operations in these structures. They will understand the relation between a group, a subgroup and the cosets of a subgroup which leads to Lagrange's theorem. They will also assimilate permutations, symmetric groups, and alternating groups, and know how to determine the unit group of a ring.

Transferable skills

The module reinforces logical thinking and deductive reasoning which are valuable transferable skills. The algebraic structures introduced are the heart of modern cryptography and information security.

Study

Study time

Type	Required
Lectures	15 sessions of 1 hour (25%)
Tutorials	5 sessions of 1 hour (8%)
Private study	40 hours (67%)
Total	60 hours

Private study description

40 hours private study, revision for exams, and non-assessed assignments

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	Eligible for self-certification
Weekly assignments	15%		Yes (waive)
In-person Examination Exam	85%		No

- Answerbook Green (8 page)

Assessment group R

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

	Weighting	Study time	Eligible for self-certification

- Answerbook Green (8 page)

Feedback on assessment

Marked assignments and exam feedback.

Past exam papers for MA136

Availability

Courses

This module is Core for:

- Year 1 of UMAA-G100 Undergraduate Mathematics (BSc)
- UMAA-G103 Undergraduate Mathematics (MMath)
  - Year 1 of G100 Mathematics
  - Year 1 of G103 Mathematics (MMath)
- Year 1 of UMAA-G106 Undergraduate Mathematics (MMath) with Study in Europe
- Year 1 of UMAA-G1NC Undergraduate Mathematics and Business Studies
- Year 1 of UMAA-G1N2 Undergraduate Mathematics and Business Studies (with Intercalated Year)
- Year 1 of UMAA-GL11 Undergraduate Mathematics and Economics
- Year 1 of UECA-GL12 Undergraduate Mathematics and Economics (with Intercalated Year)
- Year 1 of UMAA-GV17 Undergraduate Mathematics and Philosophy
- Year 1 of UMAA-GV18 Undergraduate Mathematics and Philosophy with Intercalated Year
- Year 1 of UMAA-G101 Undergraduate Mathematics with Intercalated Year

This module is Optional for:

- Year 1 of UPXA-FG33 Undergraduate Mathematics and Physics (BSc MMathPhys)
- Year 1 of UPXA-GF13 Undergraduate Mathematics and Physics (BSc)
- UPXA-FG31 Undergraduate Mathematics and Physics (MMathPhys)
  - Year 1 of GF13 Mathematics and Physics
  - Year 1 of FG31 Mathematics and Physics (MMathPhys)
- Year 1 of USTA-G1G3 Undergraduate Mathematics and Statistics (BSc MMathStat)
- Year 1 of USTA-GG14 Undergraduate Mathematics and Statistics (BSc)

This module is Option list A for:

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