

MA136-6 Introduction to Abstract Algebra

22/23

Department

Warwick Mathematics Institute

Level

Undergraduate Level 1

Module leader

Richard Lissaman

Credit value

6

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

Any library book with Abstract Algebra in the title would be useful.

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 (75%) |
| Tutorials | 5 sessions of 1 hour (25%) |
| Total | 20 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 |
|-------------------------------|-----------|------------|
| Weekly assignments | 15% | |
| In-person Examination Exam | 85% | |

- Answerbook Green (8 page)

Assessment group R

| | Weighting | Study time |
|---------------------------------------|-----------|------------|
| In-person Examination - Resit exam | 100% | |

- Answerbook Green (8 page)

Feedback on assessment

Marked assignments and exam feedback.

[Past exam papers for MA136](#)

Availability

Courses

This module is Core for:

- UMAA-GV18 Undergraduate Mathematics and Philosophy with Intercalated Year
 - Year 1 of GV18 Mathematics and Philosophy with Intercalated Year
 - Year 1 of GV18 Mathematics and Philosophy with Intercalated Year

This module is Optional for:

- Year 1 of UPXA-FG33 Undergraduate Mathematics and Physics (BSc MMathPhys)
- UPXA-GF13 Undergraduate Mathematics and Physics (BSc)
 - Year 1 of GF13 Mathematics and Physics
 - Year 1 of GF13 Mathematics and Physics
- UPXA-FG31 Undergraduate Mathematics and Physics (MMathPhys)
 - Year 1 of FG31 Mathematics and Physics (MMathPhys)
 - Year 1 of FG31 Mathematics and Physics (MMathPhys)

This module is Option list A for:

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