

MA442-15 Group Theory

23/24

Department

Warwick Mathematics Institute

Level

Undergraduate Level 4

Module leader

Derek Holt

Credit value

15

Module duration

10 weeks

Assessment

Multiple

Study location

University of Warwick main campus, Coventry

Description

Introductory description

See outline syllabus.

[Module web page](#)

Module aims

The main aim of this module is to classify all simple groups of order up to 500. Techniques will include the theorems of Sylow and Burnside, which will be proved in the module, and you will become familiar with different classes of groups, such as finite groups and dihedral groups. The module will give some of the flavour of the greatest achievement in group theory during the 20th century.

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 main emphasis of this course will be on finite groups, and the classification of groups of small order. However, results will be stated for infinite groups too whenever possible.

- Permutation groups and groups acting on sets. The Orbit-Stabiliser Theorem. Conjugacy Classes.
- The Sylow Theorems. Direct and semidirect products of groups.
- Classification of groups of order up to 20 (except 16).
- Nilpotent and soluble groups.
- More on permutation groups. Primitivity and multiple transitivity.
- Groups of matrices. Simplicity of the alternating groups and the groups $\text{PSL}(n,K)$.
- The transfer homomorphism. Burnside's transfer theorem.
- Classification of finite simple groups of order up to 500.

Learning outcomes

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

- By the end of the module students should be familiar with the topics. In particular, they should be able to prove Sylow's Theorems, and to use them and other techniques as a tool for analysing the structure of a finite group of a given order.

Subject specific skills

The group theory module offers an introduction to the classification of finite simple groups, one of the handful of the most significant mathematical achievements of the late twentieth century. Students taking the module learn some of the techniques required for working on a large-scale research project. These techniques are partly algorithmic and computational, and include the development of databases for storing and retrieving information about specific groups.

Transferable skills

Clear and precise thinking, and the ability to follow complex reasoning, to construct logical arguments, and to expose illogical ones. The ability to retrieve the essential details from a complex situation and thereby facilitate problem resolution. Formulating problems as algorithms, thereby enhancing understanding of details and rendering them suitable for computer implementation.

Study

Study time

Type	Required
Lectures	30 sessions of 1 hour (20%)
Tutorials	9 sessions of 1 hour (6%)
Private study	111 hours (74%)
Total	150 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 B2

	Weighting	Study time
In-person Examination	100%	
<ul style="list-style-type: none">• Answerbook Gold (24 page)		

Assessment group R1

	Weighting	Study time
In-person Examination - Resit	100%	
<ul style="list-style-type: none">• Answerbook Gold (24 page)		

Feedback on assessment

Exam feedback

[Past exam papers for MA442](#)

Availability

Courses

This module is Optional for:

- Year 1 of TMAA-G1PE Master of Advanced Study in Mathematical Sciences

This module is Option list A for:

- Year 1 of TMAA-G1PD Postgraduate Taught Interdisciplinary Mathematics (Diploma plus MSc)
- Year 1 of TMAA-G1P0 Postgraduate Taught Mathematics
- Year 4 of USTA-G1G3 Undergraduate Mathematics and Statistics (BSc MMathStat)
- Year 5 of USTA-G1G4 Undergraduate Mathematics and Statistics (BSc MMathStat) (with Intercalated Year)

This module is Option list B for:

- Year 4 of UCSA-G4G3 Undergraduate Discrete Mathematics
- Year 5 of UCSA-G4G4 Undergraduate Discrete Mathematics (with Intercalated Year)
- Year 3 of USTA-G1G3 Undergraduate Mathematics and Statistics (BSc MMathStat)
- Year 4 of USTA-G1G4 Undergraduate Mathematics and Statistics (BSc MMathStat) (with Intercalated Year)

This module is Option list C for:

- UMAA-G105 Undergraduate Master of Mathematics (with Intercalated Year)
 - Year 4 of G105 Mathematics (MMath) with Intercalated Year
 - Year 5 of G105 Mathematics (MMath) with Intercalated Year
- UMAA-G103 Undergraduate Mathematics (MMath)
 - Year 3 of G103 Mathematics (MMath)
 - Year 3 of G103 Mathematics (MMath)
 - Year 4 of G103 Mathematics (MMath)
 - Year 4 of G103 Mathematics (MMath)
- Year 4 of UMAA-G106 Undergraduate Mathematics (MMath) with Study in Europe