

MA3K4-15 Introduction to Group Theory

26/27

Department

Warwick Mathematics Institute

Level

Undergraduate Level 3

Module leader

Adam Thomas

Credit value

15

Module duration

10 weeks

Assessment

Multiple

Study location

University of Warwick main campus, Coventry

Description

Introductory description

The module is planned as a serious introduction into the subject of Theory of Groups. See outline syllabus.

Module aims

The main aim of this module is to lay the foundation for the study of modern group theory.

The notions of group actions fundamental to the subject will be investigated in depth.

You will become familiar with different classes of groups such as finite groups, dihedral groups, simple groups,

soluble groups. Techniques will include the theorems of Sylow and Jordan-Holder, which will be proved in the module.

Distinct proofs of these results will demonstrate different technical approaches.

The module will give some of the flavour of the modern group 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.

The main emphasis of this course will be on finite groups. However, results will be stated for infinite groups too whenever possible. In this course we will study group actions, Sylow's theorem and its various proofs, study direct and semidirect products of groups, use those to identify up to isomorphism various groups of relatively small orders, study the notion of soluble groups, state and prove Jordan-Holder Theorem.

Learning outcomes

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

- 1. Understand the notion of group actions.
- 2. Be able to state Sylow's Theorem and provide distinct proofs of this theorem.
- 3. Be able to apply Sylow's Theorems and its corollaries to show that A_n , $n > 4$, is simple.
- 4. Use Sylow Theorems to demonstrate that certain finite groups are not simple.
- 5. Understand the notions of direct and semidirect products.
- 6. Be able to identify (up to isomorphisms) certain finite groups.
- 7. Understand the notion of soluble groups.
- 8. State and prove Jordan-Holder Theorem.

Subject specific skills

This module lays a solid foundation to the study of group theory. It develops in depth the notions that allow one to investigate the structure of finite and infinite groups.

Students taking the module will learn some of the techniques required for working on a large-scale research project. These techniques are partly theoretical, and partly computational.

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.

Study

Study time

Type	Required
Lectures	30 sessions of 1 hour (26%)
Total	117 hours

Type	Required
Tutorials	9 sessions of 1 hour (8%)
Online learning (independent)	(0%)
Private study	78 hours (67%)
Total	117 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.

Assessment group B

	Weighting	Study time	Eligible for self-certification
Centrally-timetabled examination (On-campus)	100%	33 hours	No
3 hour exam, no books allowed			

- Answerbook Pink (12 page)

Assessment group R

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

- Answerbook Gold (24 page)

Feedback on assessment

Exam feedback

[Past exam papers for MA3K4](#)

Availability

Courses

This module is Optional for:

- Year 1 of TMAA-G1PD Postgraduate Taught Interdisciplinary Mathematics (Diploma plus MSc)
- Year 1 of TMAA-G1P0 Postgraduate Taught Mathematics
- TMAA-G1PC Postgraduate Taught Mathematics (Diploma plus MSc)
 - Year 1 of G1PC Mathematics (Diploma plus MSc)
 - Year 2 of G1PC Mathematics (Diploma plus MSc)
- Year 3 of UCSA-G4G1 Undergraduate Discrete Mathematics
- UCSA-G4G3 Undergraduate Discrete Mathematics
 - Year 3 of G4G1 Discrete Mathematics
 - Year 3 of G4G3 Discrete Mathematics
- Year 4 of UCSA-G4G4 Undergraduate Discrete Mathematics (with Intercalated Year)
- Year 4 of UCSA-G4G2 Undergraduate Discrete Mathematics with Intercalated Year

This module is Core option list A for:

- Year 4 of UMAA-GV18 Undergraduate Mathematics and Philosophy with Intercalated Year

This module is Core option list B for:

- Year 3 of UMAA-GV17 Undergraduate Mathematics and Philosophy
- Year 3 of UMAA-GV19 Undergraduate Mathematics and Philosophy with Specialism in Logic and Foundations

This module is Core option list C for:

- Year 3 of UMAA-GV17 Undergraduate Mathematics and Philosophy
- Year 3 of UMAA-GV19 Undergraduate Mathematics and Philosophy with Specialism in Logic and Foundations

This module is Core option list D for:

- Year 4 of UMAA-GV18 Undergraduate Mathematics and Philosophy with Intercalated Year
- Year 4 of UMAA-GV19 Undergraduate Mathematics and Philosophy with Specialism in Logic and Foundations

This module is Core option list F for:

- Year 4 of UMAA-GV19 Undergraduate Mathematics and Philosophy with Specialism in Logic and Foundations

This module is Option list A for:

- UMAA-G105 Undergraduate Master of Mathematics (with Intercalated Year)
 - Year 3 of G105 Mathematics (MMath) with Intercalated Year
 - Year 4 of G105 Mathematics (MMath) with Intercalated Year
 - Year 5 of G105 Mathematics (MMath) with Intercalated Year
- Year 3 of UMAA-G100 Undergraduate Mathematics (BSc)
- UMAA-G103 Undergraduate Mathematics (MMath)
 - Year 3 of G100 Mathematics
 - Year 3 of G103 Mathematics (MMath)
 - Year 4 of G103 Mathematics (MMath)
- Year 4 of UMAA-G107 Undergraduate Mathematics (MMath) with Study Abroad
- UMAA-G106 Undergraduate Mathematics (MMath) with Study in Europe
 - Year 3 of G106 Mathematics (MMath) with Study in Europe
 - Year 4 of G106 Mathematics (MMath) with Study in Europe
- Year 3 of UPXA-GF13 Undergraduate Mathematics and Physics (BSc)
- UPXA-FG31 Undergraduate Mathematics and Physics (MMathPhys)
 - Year 3 of GF13 Mathematics and Physics
 - Year 3 of FG31 Mathematics and Physics (MMathPhys)
- Year 4 of UPXA-GF14 Undergraduate Mathematics and Physics (with Intercalated Year)
- 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)
- Year 4 of UMAA-G101 Undergraduate Mathematics with Intercalated Year

This module is Option list B for:

- Year 3 of USTA-GG14 Undergraduate Mathematics and Statistics (BSc)

This module is Option list C for:

- 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 E for:

- USTA-G301 Undergraduate Master of Mathematics, Operational Research, Statistics and Economics (with Intercalated)
 - Year 3 of G30H Master of Maths, Op.Res, Stats & Economics (Statistics with Mathematics Stream)
 - Year 4 of G30H Master of Maths, Op.Res, Stats & Economics (Statistics with Mathematics Stream)
 - Year 5 of G30H Master of Maths, Op.Res, Stats & Economics (Statistics with Mathematics Stream)