

## ACE Network Subject Guide

### Representation Theory

Semester 2, 2025

#### Administration and contact details

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Host institution	The University of Western Australia
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#### Subject details

Handbook entry URL	<a href="https://handbooks.uwa.edu.au/unitdetails?code=math4033">https://handbooks.uwa.edu.au/unitdetails?code=math4033</a> . The handbook entry is very generic
Subject homepage URL	N/A
Honours student hand-out URL	N/A
Teaching period (start and end date):	<b>21/7/25-17/10/25</b>
Exam period (start and end date):	<b>25/10/25-7/11/25</b>
Contact hours per week:	<b>3</b>
ACE enrolment closure date:	<b>25/7/25</b>
Lecture day(s) and time(s):	<b>TBA -finalised week before semester</b>
Description of electronic access arrangements for students (for example, LMS)	<b>TBA, if not able to arrange LMS access will provide materials via a Dropbox link</b>

## Subject content

### 1. Subject content description

This unit will focus on Representation Theory, which is an important area of algebra that enables groups to be studied as groups of matrices. We will mainly look at representation theory over the complex numbers but other fields will also be mentioned. Topics will include Maschke's Theorem, Schur's Lemma, the group algebra, irreducible representations, characters, induced modules and Burnside's Theorem.

### 2. **Week-by-week topic overview:** The following is a rough outline and is subject to change

1. Revision of group theory and linear algebra
2. Group representations, FG-modules
3. Group algebras, Modules and module homomorphisms
4. Irreducibility and Maschke's Theorem
5. Schur's Lemma
6. Irreducible modules and the group algebra
7. Characters
8. Inner products of characters
9. Normal subgroups and lifted characters, tensor products
10. restriction to a subgroup, induced modules and characters
11. algebraic integers, permutation characters
12. Revision

### 3. **Assumed prerequisite knowledge and capabilities**

A first course in groups and rings that includes things such as normal subgroups, ideals, Lagrange's Theorem, homomorphisms, isomorphisms, quotients and First Isomorphism Theorem.

A first course in linear algebra.

### 4. **Learning outcomes and objectives**

#### **AQF specific Program Learning Outcomes and Learning Outcome Descriptors (if available):**

AQF Program Learning Outcomes addressed in this subject	Associated AQF Learning Outcome Descriptors for this subject
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develop mathematical intuitions and the ability to articulate these intuitions within a formalism at an appropriate level;	K1, S1, S2, S3, S5, A2
prove results about group representations and construct examples demonstrating key concepts;	K1, S1, S2, S3, S5, A2
demonstrate a deep understanding of representation theory and the techniques involved in proving the main results in the field	K1, S1, S2, S3, S5, A2

### Learning Outcome Descriptors at AQF Level 8

#### Knowledge

K1: coherent and advanced knowledge of the underlying principles and concepts in one or more disciplines

K2: knowledge of research principles and methods

#### Skills

S1: cognitive skills to review, analyse, consolidate and synthesise knowledge to identify and provide solutions to complex problem with intellectual independence

S2: cognitive and technical skills to demonstrate a broad understanding of a body of knowledge and theoretical concepts with advanced understanding in some areas

S3: cognitive skills to exercise critical thinking and judgement in developing new understanding

S4: technical skills to design and use in a research project

S5: communication skills to present clear and coherent exposition of knowledge and ideas to a variety of audiences

#### Application of Knowledge and Skills

A1: with initiative and judgement in professional practice and/or scholarship

A2: to adapt knowledge and skills in diverse contexts

A3: with responsibility and accountability for own learning and practice and in collaboration with others within broad parameters

A4: to plan and execute project work and/or a piece of research and scholarship with some independence

5. **Learning resources** Skeletal notes will be provided. Any textbook on representation theory of finite groups would be suitable reading. The course will mainly be covering the material in 'Representations and Characters of Groups' by James and Liebeck.

### 6. Assessment breakdown

Exam	60%
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<b>Assignments</b>	<b>20%</b>
<b>Mid semester test</b>	<b>20%</b>

<b>Assignment due dates</b>	<b>Exam date (approximate)</b>
22/8/25	Final exam in exam period. Mid semester test in week of 8 <sup>th</sup> of September
26/9/25	
<a href="#">Click here to enter a date.</a>	
<a href="#">Click here to enter a date.</a>	

### Institution honours program details

<b>Weight of subject in total honours assessment at host department</b>	<b>12.5%</b>
<b>Thesis/subject split at host department</b>	<b>50//50</b>
<b>Honours grade ranges at host department</b>	
<b>H1</b>	80+
<b>H2a</b>	70-79
<b>H2b</b>	60-69
<b>H3</b>	50-59

### Institution masters program details

<b>Weight of subject in total masters assessment at host department</b>	<b>N/A</b>
<b>Thesis/subject split at host department</b>	
<b>Masters grade ranges at host department</b>	
<b>H1</b>	Enter range %
<b>H2a</b>	Enter range %
<b>H2b</b>	Enter range %
<b>H3</b>	Enter range %