ACE Network Subject Information Guide

MATH4031: Algebra – Permutation groups

Semester 1, 2023

Administration and contact details

Host department	**Mathematics and Statistics**
Host institution	**The University of Western Australia**
Name of lecturer	**Michael Giudici**
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Name of masters coordinator	N/A
Phone number	
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Subject details

Handbook entry URL	**https://handbooks.uwa.edu.au/unitdetails?code=math4031**
Subject homepage URL	
Honours student hand-out URL	
Teaching period (start and end date):	**27th Feb – 26th May**
Exam period (start and end date):	**3rd June – 16th June**
Contact hours per week:	**3**
ACE enrolment closure date:	27th Feb
Lecture day(s) and time(s):	**TBA – finalised week before semester starts**
Description of electronic access arrangements for students (for example, LMS)	**TBA, if not able to arrange LMS access will provide materials via a Dropbox link**

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Subject content

1. Subject content description

Permutation groups embody the notion of a group being a measure of symmetry and are an important tool for exploring geometric and combinatorial structures. This course will look at the modern theory of permutation groups which takes advantage of recent advances in abstract group theory such as the Classification of Finite Simple Groups. The course will cover topics such as group actions, wreath products, multiply transitive groups, primitive groups, the O'Nan-Scott Theorem, and will look at applications to study the symmetry of graphs such as Cayley graphs and 2-arc-transitive graphs.

2. Week-by-week topic overview

A rough outline is as follows but is subject to change.
Week 1: Group theory revision
Week 2: Permutation groups and group actions
Week 3: Coset actions and equivalent actions, Intransitive groups
Week 4: Graphs and digraphs,
Week 5: Actions in group theory
Week 6: Primitive groups
Week 7: Semidirect products and groups with a regular normal subgroup
Week 8: Wreath products, Soluble and simple groups
Week 9: Multiply transitive groups
Week 10: O'Nan-Scott Theorem, Structure of finite primitive groups
Week 11: Applications of O'Nan-Scott Theorem
Week 12: Revision

3. Assumed prerequisite knowledge and capabilities

A first course in group theory that includes things such as groups, the symmetric and alternating groups, subgroups, cosets, normal subgroups, Lagrange's Theorem, homomorphisms, isomorphisms and quotient groups.

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
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 algebraic structures and construct examples demonstrating key concepts;	K1, S1, S2, S3, S5, A2
demonstrate a deep understanding of algebraic structures and the techniques involved in proving the main results in the field	K1, S1, S2, S3, S5, A2
Insert Program Learning Outcome here	Choose from list below
Insert Program Learning Outcome here	Choose from list below
Insert Program Learning Outcome here	Choose from list below
Insert Program Learning Outcome here	Choose from list below

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

Students who would like further reading on the topics should see the following books. Skeletal notes will also be provided during the course.

Permutation groups, by John D. Dixon and Brian Mortimer

Permutation groups, by Peter J. Cameron

Permutation groups and cartesian decompositions, by Cheryl E. Praeger and Csaba

6. Assessment

Exam/assignment/classwork breakdown					
Exam	60 %	**Assignments**	20 %	**Mid semester test**	20 %
Assignment due dates		31st March.	12th May.	Click here to enter a date.	Click here to enter a date.
Approximate exam date				Final exam in exam period. Mid semester test in week of 17th of April	

Institution honours program details

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

Institution masters program details

Weight of subject in total masters assessment at host department	N/A
Thesis/subject split at host department	Click here to enter text.
Masters grade ranges at host department	
H1	Enter range %
H2a	Enter range %
H2b	Enter range %
H3	Enter range %