ACE Network Subject Information Guide

PURE MTH 4123 Fields & Modules – Honours

Semester 2, 2023

Administration and contact details

Host department	**School of Computer & Mathematical Sciences**
Host institution	**University of Adelaide**
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Subject details

Handbook entry URL	**https://www.adelaide.edu.au/course-outlines/108741/1/sem-2/**
Subject homepage URL	
Honours student hand-out URL	
Teaching period (start and end date):	**24.07.2023 – 3.11.2023**
Exam period (start and end date):	**4.11.2023 – 18.11.2023**
Contact hours per week:	
ACE enrolment closure date:	
Lecture day(s) and time(s):	**FRI 2:00 – 4:00 pm**
Description of electronic access arrangements for students (for example, LMS)	**LMS (My-Uni)**

Subject content

1. Subject content description

This subject presents the foundational material for the last of the basic algebraic structures pervading contemporary pure mathematics, namely fields and modules. The basic definitions and elementary results are given, followed by two important applications of the theory: to the classification of finitely generated abelian groups, and to Jordan canonical form for matrices. The subject concludes by returning to fields to present interesting applications of the theory. Fields: vector spaces, matrices, characteristic values; extension fields. Modules: finitely generated modules over a PID; canonical forms for matrices; Jordan canonical form. Applications of fields to algebraic and geometric problems.

2. Week-by-week topic overview

Week 1: Fields; review of ring theory, fields – basic definitions and examples
Week 2: Fields; vector spaces, polynomial rings, field extensions
Week 3: Fields; field extensions, splitting fields
Week 4: Fields; splitting fields, normal extensions, primitive elements
Week 5: Fields; Galois theory
Week 6: Fields; solubility by radicals
Week 7: Modules; definitions, examples and basic properties
Week 8: Modules; finitely generated modules, free modules
Week 9: Modules; torsion-free modules, modules over pids
Week 10: Modules; Fundamental Theorem of finitely generated modules over a pid
Week 11: Modules; Fundamental Theorem, continued, canonical forms for matrices
Week 12: Modules; canonical forms, continued

3. Assumed prerequisite knowledge and capabilities

A first course in abstract algebra, covering group theory and basic ring theory. In particular, in terms of ring theory, students should have an understanding of the following topics: definitions and basic properties of rings and ring homomorphisms; ideals and quotient rings; integral domains and fields; polynomials; factorization in integral domains and unique factorization domains.

4. Learning outcomes and objectives

1. Demonstrate understanding of the concepts of a field and a module and their role in mathematics.

2. Demonstrate familiarity with a range of examples of these structures.
3. Prove the basic results of field theory and module theory.
4. Explain the structure theorem for finitely generated modules over a principal ring and its applications to abelian groups and matrices.
5. Apply the theory in the course to solve a variety of problems at an appropriate level of difficulty.
6. Demonstrate skills in communicating mathematics orally and in writing.

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**
Insert Program Learning Outcome here	Choose from list below
Insert Program Learning Outcome here	Choose from list below
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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

Topic videos and PDF notes supplied through LMS.

6. Assessment

Exam/assignment/classwork breakdown					
Exam	**50%**	**Assignment**	**20%**	**Quizzes**	**10%**
Mid-semester Test: 20% (28 August)					
Assignment due dates	**11 Aug**	**25 Aug**	**8 Sep**	**6 Oct**	**20 Oct**
Approximate exam date				Click here to enter a date.	

Institution honours program details

Weight of subject in total honours assessment at host department	**(Elective) 3/24 units**
Thesis/subject split at host department	**(Thesis) 9 units/(Coursework) 15 units**
Honours grade ranges at host department	
H1	**80-100**
H2a	**70-79**
H2b	**60-69**
H3	**50-59**

Institution masters program details

Weight of subject in total masters assessment at host department	**(Elective) 3/48 units**
Thesis/subject split at host department	**(Thesis) 12 units/(Coursework) 36 units**
Masters grade ranges at host department	
HD	**85-100**
D	**75-84**
C	**65-74**
P	**50-64**