On-line course materials

MATH20212 - Algebraic Structures 2

Year: 2 - **Semester:** 2 - **Credit Rating:** 10

Requisites

Prerequisites
MATH20201 Algebraic Structures 1

Aims

The course unit aims to introduce the algebraic structures of rings and fields; describe the quotient structure and its connection with homomorphisms of rings; present important examples rings and develop some of their properties with particular emphasis on polynomial rings and factorisation in rings.

Brief Description

This course builds on Algebraic Structures 1, which is a prerequisite, and continues the strong emphasis on examples.

The algebraic structures of rings and fields will be introduced. The construction of quotient rings and the relationship with homomorphisms is one of the main themes. These ideas will be used to construct roots of polynomials in extension fields. Factorisation in polynomial rings and rings of integers of number fields will also be studied.

Learning Outcomes

On completion of this unit successful students will have:

- practical knowledge of a range of iterative techniques for solving linear and nonlinear systems of equations, theoretical knowledge of their convergence properties, an appreciation of how small changes in the data affect the solutions and experience with key examples arising in the solution of differential equations;
- practical knowledge of polynomial interpolation, its numerical implementation and theoretical knowledge of associated approximation properties;
- practical knowledge of quadrature schemes and theoretical knowledge of their associated approximation properties.

Syllabus

1.Definitions and examples of rings (rings of numbers, rings of matrices, quaternions, rings of endomorphisms, group rings, rings of polynomials, subrings); [4 lectures]

2.Domains, fields and division rings; nilpotent and idempotent elements, products of rings; (many) examples; with students gaining familiarity with the ideas and examples through attempting exercises. [4]

3.Isomorphisms and homomorphisms (of rings): what is preserved and reflected; kernel of a homomorphism, ideals; principal ideals, operations on ideals. [4]

4.The quotient construction (for rings): the construction and connection with homomorphisms; maximal ideals; ideals of the quotient ring; examples. [3]

5.Polynomial rings and unique factorisation: polynomial rings; division algorithm; unique factorisation. [3]

6.Constructing roots of polynomials: construction of extension fields; examples, including finite fields. [4]

Teaching & Learning Process (Hours Allocated To)

Lectures	Tutorials/ Example Classes	Practical Work/ Laboratory	Private Study	Total
22	11	0	67	100

Assessment and Feedback

- Coursework; Weighting within unit 20%
- 2 hours end of semester examination; Weighting within unit 80%

Further Reading

J.B. Fraleigh, A First Course in Abstract Algebra, (any edition: the library has many copies) Addison-Wesley (recommended but not essential).

Also similar books like:

R.B.J.T. Allenby, Rings, Fields and Groups: an Introduction to Abstract Algebra, Addison-Wesley.

Staff Involved

Dr Louise Walker - Lecturer

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