

MATH3711: Higher Algebra (2007,S1)¹**Tentative Syllabus**

- Examples of Groups (5 lectures)
How do mathematicians study symmetry? Matrix groups. Basic properties. Subgroups. Permutation groups. Generators and relations. Alternating group. Abelian groups. Review of equivalence relations.
- Basic Concepts and Constructions (7 lectures)
Cosets and Lagrange's theorem. Normal subgroups and quotient groups. Isomorphisms and homomorphisms. Kernels and images. Universal property of quotient groups. Isomorphism theorems. Products.
- Symmetry of polygons and polyhedra (7 lectures)
Symmetry of regular polygons. Group operations, orbits and stabilisers. Classification of G -orbits. Counting formula and permutation representations. Finite subgroups of SO_3 .
- Introduction to ring theory (7 lectures)
Rings and subrings. Examples (polynomial rings, matrix rings, algebraic integers). Ideals and quotient rings. Homomorphisms and the isomorphism theorems. Special rings (commutative rings and fields).
- Factorisation in commutative rings (6 lectures)
Primes and irreducibility. Unique factorisation domains. Principal ideal domains. Euclidean domains. Gauss's lemma. Gaussian integers.
- Field Theory (4 lectures)
Algebraic and transcendental extensions. Towers of field extensions. Algebraic closure. Ruler and compass constructions.
- Sylow theory (2 lectures)
Class equation and consequences. Sylow theorems.

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