FACULTY OF SCIENCE
Department of Mathematics and Statistics

Mathematics 511 and 607 Algebra III

(see Course Descriptions under the year applicable: http://www.ucalgary.ca/pubs/calendar/)

Syllabus

Topics	**Number of hours**
Review of basic ring theory: homomorphisms, ideals and the isomorphism theorem; integral domains, unique factorization domains, principal ideal domains and Euclidean domains	6
Chain conditions on ideals; Noetherian and Artinian rings	3
Modules over rings; submodules; quotient modules; module homomorphisms and kernels	3
Direct sums of modules; free modules; basis and rank	3
Exact sequences; hom and tensor functors and their adjointness, left and right exactness; projective and injective modules; flat modules	9
Cyclic and torsion modules over PIDs	3
Finitely generated modules over PIDs; invariant factors; canonical forms of matrices	3
Additional topics (time permitting)	6
TOTAL HOURS	**36**

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MATH 511 & 607 Algebra III
Course Outcomes

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General outcomes

By the end of this course, students will be fluent in several central and advanced techniques of Algebra.

Specific outcomes

Specifically, by the end of this course, students will be fluent in the following three topics:
• The theory of finite fields
• The structure theorem for finitely generated modules over a principal ideal domain, and
• Applications to the proof of the rational and Jordan canonical forms for matrices over a field.

Moreover the students will be fluent in aspects of one or more of the following topics:

1. Projective and injective modules, the injective hull, projective dimension, the functors hom(M;N) and M □ N.

2. The Wedderburn-Artin structure theorem for semiprime rings with the descending chain condition for left ideals.

3. The Lasker-Noether theory of commutative rings with the ascending chain condition on ideals.

4. Introduction to commutative algebra.

5. The theory of solvable and nilpotent groups.

6. An introduction to Galois Theory for finite field extensions.

A student who successfully completes this course will:

7. Have a global appreciation of these algebraic systems.

8. Understand the use of the basic theorems about these systems and how they shape the development of the system.

9. Be able to see some of the interconnections between the systems under study and related systems.