

**Mathematics 607**
**Algebra III**

**Calendar Description:** Linear algebra: modules, direct sums and free modules, tensor products, linear algebra over modules, finitely generated modules over PIDs, canonical forms, computing invariant factors from presentations; projective, injective and flat modules.

**Prerequisites:** PMAT 431 or MATH 411 or department consent. PMAT 431 is recommended.

**Textbook:** Hungerford, Algebra

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

## *Syllabus*

<u>Topics:</u>	<u>Number of Hours</u>
Recap of rings and ideals; isomorphism theorem	3
Integral domains; maximal and prime ideals; principal ideal domains (PIDs)	3
The ascending chain condition; unique factorization in PIDs	3
Modules over rings; submodules; quotient modules; linear transformations and kernels	3
Direct sums of modules; free modules; basis and rank; the matrix of a linear transformation	3
Tensor product; extension of scalars	3
Symmetric and alternating products; determinants	3
Cyclic and torsion modules over PIDs	3
The structure of finite abelian groups; canonical forms of matrices	3
Finitely generated modules over PIDs; invariant factors	3
Presentations of modules; computing invariant factors	3
Exact sequences; hom and tensor functors and their adjointness, left and right exactness	3
<b>TOTAL:</b>	<b>36</b>

**Time permitting:** Projective, injective and flat modules

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