

Contents of Math 640:551

640:551 is a standard introductory graduate level course in algebra. The course assumes that students have had an undergraduate course in modern algebra. The graduate level course will cover much of the same material, but in greater depth and at a faster pace. There will be an emphasis on proving theorems as well as mastering the important examples.

- Group Theory: Basic concepts, isomorphism theorems, normal subgroups, Sylow theorems, direct products and free products of groups. Groups acting on sets: orbits, cosets, stabilizers. Alternating and symmetric groups.
- Basic Ring Theory: Fields, principal ideal domains (PIDs), matrix rings, division algebras, field of fractions.
- Modules over a PID: Fundamental Theorem for abelian groups, application to linear algebra: rational and Jordan canonical form.
- Bilinear Forms: Alternating and symmetric forms, determinants. Spectral theorem for normal matrices, classification over \mathbb{R} and \mathbb{C} .
- Categories and functors: Introduction