

## Applied Algebra – MATH 202 A/B/C

Topics for 2025 Qualifying Exam

### **202A**

Vector spaces, linear transformations, matrix representations, eigenvalues and eigenvectors, nondefective matrices and diagonalization, invariant subspaces, normal matrices, block diagonalization, Jordan canonical form, field of values, Courant-Fischer theorem, SVD, polar decomposition, norms and metrics, linear functionals and dual norms, matrix norms, matrix powers and perturbations

### **202B**

- 1) Basics of linear representations of finite-dimensional associative algebras: irreducible representations, Burnside's theorem, Schur's lemma.
- 2) Representations of finite groups: discrete Fourier transform, character theory.
- 3) Representations and character of symmetric groups.

### **202C**

Rings and ideals

Hilbert Basis Theorem

Gröbner bases, Buchberger algorithm, standard monomial theory

Hilbert's Nullstellensatz

Linear group actions on polynomial rings; invariant subrings; Noether's Theorem