

# Oral Qualifying Exam Syllabus

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## Major Topic: Noncommutative Localization

- (1) Noncommutative Ring Theory
  - Semisimple modules and rings
  - Wedderburn-Artin theory
  - Jacobson radical
- (2) Basic Localization
  - Commutative localization
  - Localization of modules
- (3) Examples and A Counterexample
  - Ore localization
  - Constructions of Jategaonkar and Fisher
  - Malcev's example of a domain which is not embeddable in a division ring.
- (4) Cohn's Construction
  - Prime matrix ideals
  - Category of epic R-fields with specializations as maps
  - Correspondence between epic R-fields and prime matrix ideals
  - Sylvester domains
  - Construction of the free field over a Sylvester domain using prime matrix ideals
- (5) Inversion Height
  - Amitsur's construction of the free skew field over  $D\langle X \rangle$  for a division ring  $D$  which is infinite-dimensional over its center
  - Construction of the free skew field over  $D\langle X \rangle$  using rational series.
  - Minimal representations of rational series
  - Height structure of matrices and its relationship with inversion height of elements of  $D\langle X \rangle$

## Minor Topic: Representation Theory

- Maschke's Theorem
- Structure of the group algebra  $kG$  when  $k$  is an algebraically closed field with  $|G|$  not divisible by the characteristic of  $k$
- Characters
- Orthogonality relations
- Irreducible representations of  $S_n$  using Young diagrams