Algebra (Ph.D.)

Preparatory Courses: MATH 5613, 5623

1. Group Theory: Homomorphism theorems; direct products; symmetric groups; normal subgroups; group actions; Sylow theorems; abelian groups; solvable groups; free groups; generators and relations.

2. Ring Theory: Polynomial rings; PIDs; euclidean domains; factorial domains; fields of fractions; noetherian and artinian rings; radicals; prime and maximal ideals; Hilbert basis theorem.

3. Module Theory: Hom and $\otimes$; multilinear algebra; free modules; exact sequences; projective and injective modules; fundamental theorem on finitely generated modules over PIDs.

4. Field Theory: Extensions; splitting fields; separability; Galois theory; finite fields; fundamental theorem of algebra.

REFERENCES: S. Lang, *Algebra*; T. Hungerford, *Algebra*; I.N. Herstein, *Topics in Algebra*; E. Artin, *Galois Theory*; L. Grove, *Algebra*; N. Jacobson, *Basic Algebra I, II*.

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