



COMPUTATIONAL COMMUTATIVE ALGEBRA

PROF. MANOJ KUMMINI

Department of Mathematics
Chennai Mathematical Institute

PRE-REQUISITES : Introduction to basic theory of rings, modules

INTENDED AUDIENCE : Advanced undergraduate / post-graduate students

COURSE OUTLINE :

This is an introductory course in computational commutative algebra. Topics in a typical first course in commutative algebra are developed along with computations in Macaulay2. The emphasis will be on concrete computations, more than on giving complete proofs of theorems.

ABOUT INSTRUCTOR :

Prof. Manoj Kummini is an Associate Professor at CMI. His research is in commutative algebra, especially on homological properties of ideals and modules. He got his Ph. D. from Kansas, under the direction of Craig Huneke. In my dissertation, 'Homological Invariants of Monomial and Binomial Ideals', He studied numerical invariants of free resolutions.

COURSE PLAN :

Week 1: Introduction: rings and ideals, ring homomorphisms, Hilbert basis theorem, Hilbert Nullstellensatz, introduction to Macaulay2

Week 2: Groebner bases, ideal membership, solving systems of polynomial rings

Week 3: Modules.

Week 4: Associated primes and primary decomposition

Week 5: Associated primes and primary decomposition, ctd.

Week 6: Integral extensions, integral closure, Noether normalization

Week 7: Integral extensions, integral closure, Noether normalization, ctd.

Week 8: Hilbert functions, dimension theory

Week 9: Hilbert functions, dimension theory ctd.

Week 10: Applications to geometry.

Week 11: Homological algebra: depth, Koszul complex

Week 12: Homological algebra: free resolutions, Auslander-Buchsbaum formula