

Title: Introduction to Commutative Algebra

Proposed Course Meeting times: Tuesday-Thursdays 10-11:15

Text (tentative): Commutative Algebra by
M. Atiyah and I.G. MacDonald

Required course: Algebra core course

Contents: Modules projective, injective, local rings, flatness, power series rings, spectra of rings and their properties, primary decomposition theorem, depth, dimension theory, regular local rings, Auslander-Buchsbaum theorem (characterization of regular local rings). If time permits Cohen-Macaulay rings and Gorenstein rings or Matlis duality.

Description: Commutative algebra is the foundation stone of modern algebraic geometry and this course should be viewed as a preparatory (and even required!) course for the Algebraic Geometry course which we offer and which runs every alternate year. The course is designed with this purpose in mind. We will begin with the notion of localization of rings, notions of free, projective, injective modules, flat modules and move on to discuss prime and primary ideals and the primary decomposition theorem. After this we will introduce depth and dimension and prove the dimension theorem and introduce and study properties of local rings in some detail. The course may end with the Auslander-Buchsbaum theorem which characterizes regular local rings. This theorem is, roughly speaking, lays the groundwork for the algebro-geometric analogue of the notion of smoothness. If time permits we will study the notion of Cohen-Macaulay and Gorenstein rings and some of their characterizations.

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