

SU DEPARTMENT OF MATHEMATICS & COMPUTER SCIENCE
 SYLLABUS (*Tentative*)
 MATH 490. SPECIAL TOPICS: COMPUTATIONAL ALGEBRAIC GEOMETRY

Objective: To introduce students to modern algorithms for solving systems of polynomial equations and connections of these computational techniques to geometry.

Intended for: Junior and Senior Mathematics, Computer Science, and Physics majors.

Prerequisite: Math 306 and Math 310 or permission from the instructor.

Texts: *Ideals, Varieties, and Algorithms: An Introduction to Algebraic Geometry and Commutative Algebra*, by Cox, Little, and O’Shea (Springer-Verlag).

Technology: Maple, Mathematica, and possibly other software packages.

Topics:	Weeks
<i>Polynomials and Affine Varieties</i> Polynomials and affine space, affine varieties, parameterizations of affine varieties, ideals in polynomial rings, review of the division algorithm for polynomials of one variable and Gaussian elimination for systems of linear equations.	4
<i>Groebner Bases</i> Orderings of monomials in multivariable polynomial rings, the multivariable division algorithm, the Hilbert Basis Theorem, Groebner Bases, Buchberger’s Algorithm, properties and applications of Groebner Bases.	5
<i>Algebra-Geometry Dictionary</i> Hilbert’s Nullstellensatz, radical ideals and the ideal-variety correspondence, operations on ideals and correspondences to varieties.	3
<i>Optional Topics and Exams</i> Elimination theory, applications to robotics, quotients of polynomial rings.	2
Total	14

EVALUATION

Homework	50%
Tests	30%
Final Exam	20%