MATH 552 ALGEBRAIC GEOMETRY I

İzzet Coşkun, MWF 12:00-12:50 p.m.
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Welcome to Math 552! This course serves as an introduction to Algebraic Geometry. Algebraic Geometry is a central subject in modern mathematics, with close connections with number theory, combinatorics, representation theory, differential and symplectic geometry. We will study basic properties of projective algebraic varieties such as dimension, degree and singularities. At the same time, we will develop a large body of examples that motivate the study of the subject. Depending on time, we will develop the classical theory of curves and surfaces. This course should be enough preparation for a course on the theory of schemes.

Course webpage: http://www.math.uic.edu/~coskun/math5522017.html

Venue: Taft Hall 304

Office hours: MW 10-11, F 11-12 and by appointment in SEO 423.

Text: There are three recommended texts for this course.
- (FC) Joe Harris, Algebraic Geometry: a first course, Springer 1992.
- (BAG) Igor Shafarevich, Basic Algebraic Geometry I, Varieties in Projective Space, Springer-Verlag 1994.
- David Mumford, Algebraic Geometry I, Complex Projective Varieties, Springer 1995.

Prerequisites: A solid background in commutative algebra, especially in the theory of rings and modules at the level of a first year graduate class. Some familiarity with complex analysis, algebraic topology and differential geometry useful, but not required.

Requirements: There will be weekly homework. Homework is a very important component of this course. It will count for 100 % of your grade. No late homework will be accepted. You may collaborate on the homework problems, but you must write your own solutions and properly acknowledge any help you receive from others.

Topics: The following is a tentative list of topics that will be covered in the course. Please read the subject in the recommended texts before class.

Aug 28	Affine varieties	BAG p. 22-32
Aug 30	Examples: Plane curves	BAG p.1-21
Sep 1	Rational Functions	BAG p. 32-40
Sep 4	No class: Labor day	
Sep 6	Projective varieties	BAG p. 41-53
Sep 8	Examples	FC p. 1-16
Sep 11	Products	BAG p. 54-60
Sep 13	Maps of projective varieties	FC p. 17-31
Sep 15	Examples; Finite maps	BAG p. 61-66
Sep 18	Dimension	BAG p. 67-76
Sep 20	Dimension	FC p. 133-150
Sep 22	Dimension of Fibers	BAG p. 76-82
Sep 25	Examples: Grassmannians	FC p. 63-71
Sep 27	Applications	FC p. 151-162
Sep 29	Hilbert Polynomials	FC p. 163-173
Oct 2	Degree of projective varieties	FC p. 88-97
Oct 4	Degree	FC p. 224-238
Oct 6	Examples	FC p. 239-250
Oct 9	Tangent spaces	BAG p. 83-97
Oct 11	Examples	FC p. 174-185
Oct 13	Gauss maps, dual varieties	FC p. 186-199
Oct 16	Power series rings	BAG p. 98-113
Oct 18	Blow-ups	BAG p. 114-124
Oct 20	Blow-ups	FC p. 72-87
Oct 23	Normal varieties	BAG p. 125-131
Oct 25	Curve singularities	BAG p. 131-138
Oct 27	Divisors	BAG p. 151-159
Oct 30	Divisors	BAG p. 159-166
Nov 1	Divisors on curves	BAG p. 168-174
Nov 3	Rational curves	
Nov 6	Elliptic curves	BAG p. 175-187
Nov 8	The group law on elliptic curves	
Nov 10	Abelian varieties	BAG p. 188-194
Nov 13	Differential forms	BAG p. 195-204
Nov 15	Differential forms	BAG p. 204-210
Nov 17	The canonical class	BAG p. 210-215
Nov 20	The Riemann-Roch Theorem for curves	BAG p. 215-222
Nov 22	Applications	
Nov 24	No class: Thanksgiving	
Nov 27	Intersection numbers	BAG p. 223-232
Nov 29	Intersection numbers	BAG p. 232-236
Dec 1	Bezout's theorem	BAG p. 236-241
Dec 4	Surfaces	BAG p. 241-245
Dec 6	Birational maps between surfaces	BAG p. 251-261
Dec 8	Cubic surfaces	BAG p. 246-251