Math 145 - Algebraic Geometry

Instructor: Dragos Oprea, oprea@math.you-know-where.edu.

Office hours: Room 382D, Wednesday 3-5pm (tentatively, most likely this will change).

Course Assistant: Yu-jong Tzeng, ytz@math.you-know-where.edu, Room 380L.

Textbook: Miles Reid - Undegraduate Algebraic Geometry. The textbook is on reserve in the Math library.

Lectures: MWF (11am-11:50pm, 381U).

Webpage: http://math.stanford.edu/˜ oprea/145.html.

Goals: This course provides an introduction to algebraic geometry. We will cover the following topics:

1. Affine space. Affine curves. Smooth affine curves. Ideals in polynomial rings. Coordinate rings. Hilbert Nullstellensatz. The correspondence between ideals and affine varieties. Zarisky topology.

2. Projective space. Projective curves. Conics. Projective varieties. Hypersurfaces.

3. Functions on varieties. Morphisms and isomorphisms. Rational maps. Dominant rational maps. Birational maps. Rational varieties. Products.

4. Tangent spaces. Smoothness. Dimension.

5. Intersection multiplicities. Bezout's theorem. Applications of Bezout e.g. Pascal's mystic hexagon.

6. Addition law on cubic curves. More on elliptic curves e.g. cubic curves dont have rational parametrization. Lattices. The Weierstrass function.

7. Curves of arbitrary degree. Informal discussion of genus. The degree-genus formula.

8. Surfaces. The cubic surface is rational. The 27 lines on the cubic surface.

Prerequisites: This course is intended for 3rd or 4th year undegraduate students. It is difficult to give a comprehensive list of prerequisites for this course. The following is meant to convey some idea.

Algebra: You will need some familiarity with linear algebra as well as some abstract algebra at the level of Math 120 e.g. the notions of rings, fields, polynomial rings, factorization etc.

Complex analysis: We will occasionally use some of the material which forms the core of Mathematics 116: holomorphic functions of one complex variable, contour integrals, Cauchy's theorem and the residue theorem.

Topology: Some knowledge of point-set topology e.g. open sets, closed sets, continuity, compactness may be useful.

Exams: There will be a take-home midterm and a take-home final. There is no make up midterm. The midterm is tentatively scheduled for the weekend of May 2 - May 4.

Problem Sets: There will be weekly problem sets, usually due on Friday. The problem sets will be posted online. Group work is encouraged, but you have to hand in your own write up of the homework problems. Late problem sets will not be accepted.

Final Grades: Problem sets (30 percent), Midterm (30 percent), Final Exam (40 percent).

Important dates: Drop deadline: April 27. Withdrawal deadline: May 26. Last day of classes: June 4.