

# Syllabus for MATH 349 Algebraic Geometry

## Spring 2009

### ***Instructor Info***

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Instructor: Ismar Volic  
Meeting times: Mondays and Thursdays 1:30—2:40, every other Wednesday 2:15—3:25; in SCI 364  
Office hours: Tuesdays 1:30—3:30, Thursdays 3—5, and by appointment; in SCI 352  
Phone: 781-283-3103  
Email: [ivolic@wellesley.edu](mailto:ivolic@wellesley.edu)

### ***Textbook, FirstClass Conference, and Webpage***

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Text: • *Ideals, varieties, and algorithms*, by D. Cox, J. Little, and D. O'Shea, 3<sup>rd</sup> edition, Springer-Verlag, 2008. This is the required text. We will cover most of Chapters 1—4.

FirstClass Conference: The FirstClass conference for this course is *MATH349-02-S09*. Please add the icon to your desktop and check it often for new items. The conference will contain various important announcements, materials, and information about the course. You can also ask questions, have discussions, or arrange study groups through the conference. I will be checking the messages posted to it regularly.

Webpage: I will also post the materials for this course on my web page at <http://palmer.wellesley.edu/~ivolic/classes/MATH349AlgebraicGeometrySpring09.html>. However, this page will not contain anything that is not already on our FirstClass conference and is just meant to be a backup source of information in case you cannot access FirstClass for whatever reason.

### ***Prerequisites and Policies***

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Prerequisites: MATH 305 Algebra I is required.

Attendance: It is not required that you come to class, although it is doubtful that you will do well in the course if you miss too many lectures. If you do decide to attend, *please be on time*. If you miss a class, please copy the notes from a classmate. I will not relecture the material in my office hours, but will be happy to clear up any confusion you might still have after you have studied the notes and the textbook.

Special Arrangements: If you need special arrangements for the exams or any other aspect for the course due to religious observances or disabilities, please contact me as soon as possible. If you think you might need special arrangements, you should contact Jim Wice, the Director of Disability Services.

### ***Course Outline and Objectives***

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This course is a study of the geometric properties of sets of solutions of polynomial equations with coefficients in various fields. We will start with the review of basic ring and field theory. Some abstract linear algebra over a generic field would also be reviewed/introduced. We would then define affine varieties and study how they relate to ideals in polynomial rings. Next, Groebner bases for those ideals would be discussed in detail, and we would along the way encounter Hilbert Basis Theorem and Buchberger's Algorithm.

Next topic would be The Elimination Theorem and its geometric interpretation, with applications to singular curves. This would be followed by Hilbert's Nullstellensatz which can be used for construction of a "dictionary" between geometry and algebra. This will allow us to obtain more information about varieties by carefully studying the ideals singled out by the Nullstellensatz and seeing how some standard operations on them (such as sum, intersection, and quotient) affect the corresponding varieties. Other topics that will be briefly covered, time permitting, are irreducible varieties, projective varieties, and the dimension of a variety.

## **Assignments, Quizzes, Exams, and Grading**

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- Workload:** You should expect to spend 3—4 hours of studying on your own for each hour of lecture.
- Homework:** Homework sets will be posted on our FirstClass conference every week. You will turn in the solutions the following Friday by 5 pm and you can leave them in an envelope in the box on my door (or you can give them to me in class any time). You will be graded on the content, but also in large part on clarity and presentation, and will be expected to follow the guidelines from the document *HWguidelines.pdf* which can be found in the *Homework* subconference. It is very important that you keep up with the assigned work since homework counts for a large portion of your final grade. In addition, exams will be based on the homework problems. Feel free to work on the homework assignments together, but write them up individually. Late homework will not be accepted, but you are allowed to turn in any two homework assignments *except the last one* up to one week later than the due date.
- Solutions:** I will do my best to provide you with the solutions to the problem sets and exams. However, please keep in mind that I am under no obligation to do this and may in fact not be able to do it for all the assignments. It is your responsibility to solve all the problems and are more than welcome to talk to me in office hours about them.
- Exams:** There will be one take-home midterm and a take-home final exam. You will have a week to do each. The midterm will be given on Monday, March 30 and will be due the following Monday.
- Makeup Exams:** Please do not ask me for a postponement of an examination. I will not determine if you deserve a postponement, but I will accept your personal judgment based on the policy outlined here.
- There are only two contingencies which are acceptable for the postponement of an exam: personal illness or family crisis. If either of these prevents you from taking an exam, you are entitled to take the exam at a later date. However, any illness or crisis which allows you to study for / take another exam or to prepare a paper for another course, but not this class, does not entitle you to a postponement.
- If a postponement is taken, the following steps must be followed:
1. Prior to the class period at which the exam is to be given, notify me (x3103 or ivolic@wellesley.edu) or the department secretary (x3148) that you will not be present at the exam. This notification must be made before the actual class begins.
  2. If you are eligible for a postponement, please submit to me a written statement indicating that you are acting in accord with Wellesley's Honor Code and state that the reason for your not being present at the exam is consistent with the criteria I have established. Note that you do not have to specify the reason, just that you fit the criteria. I will assume that anyone who does not notify me before a test that she will be unable to be present is opting to take a zero for that exam. Unless the circumstances are very unusual, I will ask that you make up the exam within 3 days of the original exam date. The makeup will take place in my office, *will be an oral exam, and will not be curved.*
- Extra credit lectures:** For every student seminar or a colloquium you attend, you will receive 1/3 extra point on the final exam after the curve. Further, if you give a student seminar, you will receive 3 extra points on your final exam. Schedules for the seminars and colloquia can be found at [http://www.wellesley.edu/Math/activities\\_lectures.html](http://www.wellesley.edu/Math/activities_lectures.html)  
[http://www.wellesley.edu/Math/activities\\_seminars.html](http://www.wellesley.edu/Math/activities_seminars.html)
- Extra credit essay:** If you go to <http://palmer.wellesley.edu/~ivolic/pages/reading.html>, you will find a variety of short stories, essays, etc., available for download and reading. These are all in one way or another mathematically motivated. You may choose one (or more) of the writings and write a 4-5 page essay explaining and elaborating its content and the effect it has had on you (or lack thereof). The essay will be due at the end of the semester. If you are interested, we might even devote some class time to discussion of some of the writings. More details can be found in *ExtraCreditGuidelines.pdf* on our conference.
- Grading:** 50% homework  
25% midterm  
25% final

## Resources

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- Office hours: Please take advantage of my office hours whenever you can. You do not need an appointment to come in. If you need help with the homework or material from class, if you feel that you are falling behind or that the material is consistently too difficult, or if you simply want to chat about anything, please see me. It is imperative that you talk me as soon as a problem arises so that we can fix it quickly. If you cannot make the office hours, feel free to contact me and we will arrange a time to meet. The best way to reach me is through email, although I cannot guarantee that I will reply to a message sent after 9 pm until the next morning or a message sent during the weekend until the following Monday. When communicating via email with me or with each other, please follow the suggestions from the *Netiquette* handout you received when you entered Wellesley (this can also be found online).
- Other resources: Variety of assistance is available to you through the Pforzheimer Learning and Teaching Center. Please visit their website at <http://www.wellesley.edu/PLTC/>. Your academic dean is also a good source of information and advice.

## Important Dates

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Friday, February 13	Last day to add
Monday, February 16	No classes (Presidents' Day)
Friday, February 27	Last day to drop. Credit/non ends
Thursday, March 12	First in-class midterm
Monday—Friday, March 23—27	No classes (spring break)
Monday, April 20	No classes (Patriot's Day)
Tuesday, April 21	Monday schedule
Thursday, April 23	Second in-class midterm
Wednesday, April 29	No classes (Ruhlman conference)
Wednesday, May 13	Last day of classes
Monday, May 18	Final exams begin
Friday, May 22	Final exams end

For a more complete list of important dates, see <http://www.wellesley.edu/Registrar/0809calendar.html>.