

ALGEBRAIC CURVES OVER FINITE FIELDS

MAT 6932 - Special topic course - Fall 2018
Syllabus

INSTRUCTOR AND CLASS INFORMATION

Instructor: Dr. Annamaria Iezzi

Office: CMC 110

E-mail: aiezzi@usf.edu

Office hours: MW 5-6 pm or by appointment

Website: <http://www.aiezzi.it/>. In the *teaching* tab you will find a link to a webpage dedicated to this course, that you can visit in addition to Canvas.

Time and location of class: MW 3:30-4:45 pm in CMC 109

COUSE INFORMATION

Course description and content: In this course we develop the theory of *algebraic curves defined over finite fields*, a subject that, beyond its own mathematical interest, has essential applications in areas such as finite geometry, number theory, error-correcting codes, and cryptography. We will treat this topic from two different points of view, by describing both the algebraic geometry and the function field approach to algebraic curves, while highlighting peculiarities occurring for positive characteristic.

One of the main aspects in dealing with curves over finite fields is the study of *rational points*, i.e. points with coordinates in the ground field. This will lead, in the second part of the course, to the study of the properties of the *zeta function* of a curve, as well as to the discussion of one of the main results of the theory: the Hasse-Weil-Serre bound.

We will devote the last part of the course to the study of some applications of curves over finite fields to coding theory and cryptography: algebraic geometric codes, elliptic-curve cryptography, etc.

Prerequisites: A reasonable background in abstract algebra (group theory, ring theory, field theory).

References: No textbook is required. The lectures will be mainly based on the following books:

★ *Algebraic Curves: An Introduction to Algebraic Geometry*, W. Fulton.

- ★ *Basic Algebraic Geometry 1: Varieties in Projective Space*, I. Shafarevich.
- ★ *The Arithmetic of Elliptic Curves* (2nd edition), J. H. Silverman.
- ★ *Algebraic Function Fields and Codes* (2nd edition), H. Stichtenoth.
- ★ *Algebraic Geometric Codes: Basic Notions*, M. Tsfasman, S. Vlăduț and D. Nogin.

GRADING POLICY

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| Homework | 50% |
| Final project | 50% |

Homework: Throughout the semester, you will be assigned a variety of exercises, based on the material we have covered in class. It is highly recommended to try to solve as many exercises as possible, however it will not be mandatory to turn in your homework on a weekly basis. Half of the homework assignments will be collected at the end of September and the other half at the beginning of November. The two due dates will be communicated in class. For each assignment you will have to hand in the solution of 7 problems of your choice (if you hand in more exercises, I will count the 7 with the highest score). Discussion of the homework problems with me, or collaboration (in a reasonable degree) with your classmates, is encouraged, but you have to provide a note on which problems you had assistance.

Final project: At the beginning of November you will select a topic of your preference (on algebraic curves over finite fields and their applications), and you will present it on a date on which we will agree later during the semester. For each topic I will provide the related literature.

IMPORTANT DATES

The last day to withdraw from this course and receive a tuition refund is Friday, August 24. Students who have not registered or paid for this course by this date and time must stop attending, unless the instructor has given written permission otherwise.

The last date to drop a class and receive a grade of W is Saturday, October 27.

The last date of Fall classes is Wednesday, November 28.

Final Exam Week is Saturday, December 1, through Thursday, December 6.

Reading Days this semester are Thursday, November 29, and Friday, November 30.

University Holidays (no classes) are:

- Monday, September 3, Labor Day.
- Monday, November 12, Veteran's Day.
- Thursday and Friday, November 22-23, Thanksgiving Holiday.

UNIVERSITY POLICY

Attendance Policy: Attendance during the whole class time is required. It is your responsibility to know what is going on in class. Class announcements and materials as well as homework assignments will be posted on Canvas.

Early Notification Requirement for Observed Religious Days: Students who anticipate the necessity of being absent from class due to the observation of a major religious observance must provide notice of the date(s) to the instructor, in writing, at the beginning of the term. For further information, go to: [USF System Policy 10-045](#).

Incomplete Grade Policy: An "I" grade indicates incomplete coursework and may be awarded to graduate and undergraduate students. (Undergraduate rules apply to non-degree-seeking students.) It may be awarded to an undergraduate student only when a small portion of the student's work is incomplete and only when the student is otherwise earning a passing grade (C or better).

S-U Grade Policy: Students who want to take this course for a grade of S-U must sign the S-U contract no later than the end of the Third week of classes. There will be no exceptions. Courses to satisfy Gordon Rule may not be taken on an S/U basis. Required courses in the major may not be taken on an S/U basis. Courses to satisfy Foundations of Knowledge & Learning (FKL) General Education may not be taken on an S/U basis.

Unauthorized Recordings: All unauthorized recordings of class are prohibited. Recordings that accommodate individual student needs must be approved in advance and may be used for personal use during the semester only; redistribution is prohibited.

Academic Integrity of Students: Instances of academic dishonesty including but not limited to: cheating, plagiarism, fabrication, forgery, complicity and computer misuse will not be tolerated. For further information, go to: [USF System Regulation 3.027](#)

Disruption of the Academic Process: Please do not hold conversations, either with your classmates or your cell phones, during the lecture sessions. (Cell phones must be turned off at all times). For further information, go to: [USF System Regulation 3.025](#)

Gender-Based Crimes USF has a commitment to the safety and well-being of our students. Please be aware that educators must report incidents of sexual harassment and

gender-based crimes including sexual assault, stalking, and domestic/relationship violence that come to their attention. I am required to report such incidents in order for the Office of Student Rights and Responsibilities or the Office of Diversity, Inclusion, and Equal Opportunity can investigate the incident or situation as a possible violation of the USF Sexual Misconduct/Sexual Harassment Policy and provide assistance to the student making the disclosure. If you disclose in class or to me personally, I must report the disclosure and will assist you in accessing available resources. The Center for Victim Advocacy and Violence Prevention, the Counseling Center and Student Health Services are confidential resources where you can talk about such situations and receive assistance without the incident being reported.

1) Center for Victim Advocacy and Violence Prevention:

- (813) 974-5757
- <http://sa.usf.edu/advocacy>

2) Counseling Center

- (813) 974-2831
- <http://usf.edu/student-affairs/counseling-center>

1) Student Health Services

- (813) 974-2331
- <http://usf.edu/student-affairs/student-health-services>

Students with Disabilities: Students in need of academic accommodations for a disability should consult with the office of Students with Disabilities Services (SVC 1133) to arrange appropriate accommodations. The student must bring a current Memorandum of Accommodations from the SDS office; this is a prerequisite for receiving accommodations. Students are required to give reasonable notice (typically 5 business days) prior to requesting an accommodation. Students may request accommodations at any time throughout the semester. However, as accommodations are not retroactive, any grades earned before a student requests accommodations will typically stand. Note: If you need extra time on exams, you must make arrangements to take your exams with the SDS office. You cannot receive extra time if you choose to take your exams with the course instructor. For further information, go to: [USF System Policy 0-108](#)

University Emergency Policy: In the event of an emergency, it may be necessary for USF to suspend normal operations. During this time, USF may opt to continue delivery of instruction through methods that include but are not limited to: Canvas, Elluminate, Skype, and email messaging and/or an alternate schedule. It's the responsibility of the

student to monitor Canvas site for each class for course specific communication, and the main USF, College, and department websites, emails, and MoBull messages for important general information.