

McGill University
Department of Mathematics and Statistics
MATH 596 Topics in Algebra and Number Theory, Winter 2017

Instructor. Jan Vonk: Burnside Hall 1242, jan.vonk@mcgill.ca

Syllabus. We will discuss a number of topics, loosely connected to the theory of complex multiplication for elliptic curves, and some of its applications to arithmetic. Topics include:

- Quadratic forms, genus theory, Gauss composition, representations
- Complex multiplication for elliptic curves
- The class number one problem
- Selmer groups and explicit descent via isogeny; Chabauty's method
- Rational points on modular curves; 13-torsion on elliptic curves

Prerequisites. Students need to be familiar with basic number theory: Number fields, rings of integers, class groups, fields of p -adic numbers \mathbf{Q}_p . In addition, we will assume they have previous exposure to the basic theory of modular forms and elliptic curves: The j -function, quotients of the upper half plane by congruence subgroups of $\mathrm{SL}_2(\mathbf{Z})$, algebraic modular curves, Weierstrass equations, elliptic functions, basic arithmetic of elliptic curves. Previous exposure to class field theory is helpful, but not necessary as the basics will be reviewed.

Lectures. The class will be held in Burnside 1214 on Mondays, Wednesdays, and Fridays 9:35–10:25am.

Office Hours. The instructor will be available for students at the following times:

- Mondays 10:30–11:30 and Fridays 10:30–11:30 (Burnside 1242).

Assessment. Assessment for the course is based on performance on the assignments. There will be a number of assignments during the semester, which will be posted on the course webpage. During problem sessions in class, students will present their solutions.

Academic Integrity. McGill University values academic integrity. Therefore all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures.
(see <http://www.mcgill.ca/integrity/> for more information)

Language Policy. Conformément à la Charte des Droits de l'Étudiant de l'Université McGill, chaque étudiant a le droit de soumettre en français ou en anglais tout travail écrit devant être noté (sauf dans le cas des cours dont l'un des objets est la maîtrise d'une langue). / In accord with McGill University's Charter of Students' Rights, students in this course have the right to submit in English or in French any written work that is to be graded.

Please note that in the event of extraordinary circumstances beyond the University's control, the content and/or evaluation scheme in this course is subject to change.