

Iwasawa Theory of Elliptic Curves.

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This is the draft description of the course which will be given in the week from the 19th to the 23rd at the Universitat Politècnica de Catalunya as part of the Màster en Matemàtica Aplicada. There will be five sessions of a double hour (with a break in between) and – if there is any interest for it – an additional computer-oriented session.

The approximative contents, which may well have to be adapted to the audience, is listed here:

First lecture

- Recall basics about the arithmetic of elliptic curves.
- Recall basics about Galois cohomology.
- Selmer groups.
- Iwasawa modules.

Second lecture

- Control theorem for curves with good ordinary reduction.
- Euler characteristic for finite Selmer groups.

Third lecture

- Analytic p -adic heights.
- Geometric and Iwasawa-theoretic p -adic heights.
- Euler characteristic formula.

Fourth lecture

- p -adic L -functions.
- The main conjecture.
- Kato's zeta elements.
- Euler systems.

Fifth lecture

- The supersingular case.
- The multiplicative case.
- Non-commutative Iwasawa theory.

Additional lecture

Use of `sage` for computational Iwasawa theory of elliptic curves.

Some References

- John Coates and Ramdorai Sujatha, *Galois cohomology of elliptic curves*, Tata Institute of Fundamental Research Lectures on Mathematics, vol. 88, Narosa Publishing House, 2000.
- John Coates, Ralph Greenberg, Kenneth A. Ribet and Karl Rubin, *Arithmetic theory of elliptic curves*, Lecture Notes in Mathematics, vol. 1716, Springer, 1999, Lectures from the 3rd C.I.M.E. in Cetraro, 1997.
- Ralph Greenberg, *Introduction to Iwasawa Theory for Elliptic Curves*, <http://www.math.washington.edu/~greenber/research.html>.
- Barry Mazur and John Tate, *The p -adic sigma function*, Duke Math. J. **62** (1991), no. 3, 663–688.
- Bernadette Perrin-Riou, *Théorie d'Iwasawa et hauteurs p -adiques (cas des variétés abéliennes)*, Séminaire de Théorie des Nombres, Paris, 1990–91, Progr. Math., vol. 108, Birkhäuser, 1993, pp. 203–220.

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