

Syllabus for Math 689

Groups and Holomorphic Dynamics

Fall 2006

Instructor: Volodymyr Nekrashevych

Office: Milner 223

Office hours: Monday and Wednesday 10:30–11:30 AM or by appointment.

e-mail: nekrash@math.tamu.edu

Home-page: <http://www.math.tamu.edu/~nekrash>

Telephone: (979) 845 24 50

Class hours: TR 11:10–12:25 MILN 313

MATH 689 web page: The web page of the course is

<http://www.math.tamu.edu/~nekrash/teaching/06F/MATH689.html>

Course Description.

The course will explore connections of group theory with holomorphic and topological dynamics and fractal geometry. We will start from the basics of holomorphic dynamics: Julia sets, Fatou sets, theory of fixed points, iterations of rational functions and polynomials. We will learn the general theory of self-similar groups and show how they appear naturally in the study of iterations of self-coverings and see how self-similar groups can be used to construct nice symbolic presentations of Julia sets and to study their topology. We will also explore the structure of the Mandelbrot set and see how self-similar groups can be used to construct plane-filling curves.

Prerequisites are MATH 415 and MATH 446 or approval of instructor.

Outline of the course.

1. **Basics of Holomorphic dynamics.** (Riemann surfaces. Schwarz lemma. Universal cover. Poincare metric. Normal families. Iterations of holomorphic maps, Julia set. Local theory of fixed points. Hyperbolic and sub-hyperbolic maps.)
2. **Self-similar groups and iterated monodromy groups.** (Self-similar groups. Iterated monodromy groups. Contracting groups and their limit spaces. Limit spaces of iterated monodromy groups. Examples.)
3. **Quadratic family.** (Mandelbrot set. Iterated monodromy groups of quadratic polynomials. Kneading sequences and symbolic dynamics of quadratic polynomials. Mating and examples of plane-filling curves.)

Recommended texts.

1. *Dynamics in one complex variable*, by J. Milnor, Third edition. Annals of Mathematics Studies, 160. Princeton University Press, Princeton, NJ, 2006.
2. *Self-similar groups*, by V. Nekrashevych, published by American Mathematical Society, "Mathematical Surveys and Monographs" vol. 117.

Grading. Your grade will be determined by the final exam and homeworks in proportion 70:30.

Make-up policy: Make-ups for missed exams will only be allowed for a university approved excuse in writing. Wherever possible, students should inform the instructor before an exam is missed. Consistent with University Student Rules, students are required to notify an instructor by the end of the next working day after missing an exam. Otherwise, they forfeit their rights to a make-up.

Late Homeworks will not be accepted.

Scholastic dishonesty: Copying work done by others, either in-class or out of class, is an act of scholastic dishonesty and will be prosecuted to the full extent allowed by University policy. Collaboration on assignments, either in-class or out-of-class, is forbidden unless permission to do so is granted by your instructor. For more information on university policies regarding scholastic dishonesty, see University Student Rules.

Remember the Aggie Code of Honor: "*An Aggie does not lie, cheat, or steal or tolerate those who do.*"

Copyright policy: All printed materials disseminated in class or on the web are protected by Copyright laws. One xerox copy (or download from the web) is allowed for personal use. Multiple copies or sale of any of these materials is strictly prohibited.

Americans with Disabilities Act (ADA) Policy Statement: The following ADA Policy Statement (part of the Policy on Individual Disabling Conditions) was submitted to the University Curriculum Committee by the Department of Student Life. The policy statement was forwarded to the Faculty Senate for information.

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact the Department of Student Life, Disability Services Office, in Room B116 of Cain Hall or call 862-4570.