

IMMERSE 2009 — Algebra

Location: Avery Hall, Room 351

Instructors:	Nicholas Baeth	Violeta Vasilevska
Office:	330 Avery Hall	329 Avery Hall
Office Phone:	(402) 472 – 7251	(402) 472 – 7248
E-mail:	baeth@ucmo.edu	Violeta.Vasilevska@usd.edu

Office Hours: Open door policy and by appointment.

Graduate students mentors:

<u>Name</u>	<u>Office</u>	<u>E-mail</u>
Nathan Axvig	232 Avery Hall	s-naxvig1@math.unl.edu
Abigail Brackins	228 Avery Hall	s-abracki1@math.unl.edu
Jesse Burke	341 Avery Hall	s-jburke13@math.unl.edu
Kathryn Haymaker	228 Avery Hall	s-khaymak1@math.unl.edu

Required Paper: P.-J. Cahen, J.-L. Chabert, *Elasticity for integral-valued polynomials*, J. of Pure and Applied Algebra 103 (1995) 303-311.

Objectives:

- Prepare for graduate school by learning some topics often covered during the first year or two of most programs.
- Study topics in commutative ring and field theory.
- Write original proofs that will demonstrate understanding of these topics.
- Learn how to present your own results as well as results from the research paper, demonstrating your fluency in math communication.
- Learn how to read a mathematical research paper.

Homework Problems: A few times each week you will be given a set of homework problems. Solutions to the homework problems **will not be collected**. You will have time to work on them (individually or in small groups) during the problem sessions under the guidance of the graduate students mentors. In addition, you will be asked to present some of the solutions to the homework problems during these problem sessions. The presentations will be assigned in advance and the graduate students will be assisting you in preparing for these presentations.

Note: Some of the homework problems are labeled by a '*''. These are the problems that you are strongly encouraged to work through since these results are needed to understand the material covered in the research paper and/or lectures.

In-Class Presentations: By the end of the first week, each student will be assigned a part of the research paper for an in-class presentation. You are expected to make your presentation using BEAMER (a LaTeX document class). You will be offered LaTeX classes during the IMMERSE program. You are strongly encouraged to discuss the topic that you are presenting with the Instructors before you present it in class.

Course Outline:

1. Rings and Ideals.
2. PIDs, UFDs and Euclidian Domains.
3. Noetherian Rings, Atomicity and Elasticity.
4. Algebraic Extensions and Algebraic Closures.
5. Localization, Primary Decomposition and Integral Closure.
6. Discrete Valuation Rings and Dedekind Domains.
7. Modules.
8. Krull & Mori Domains, Algebraic Number Fields and Function Fields (time permitting).

Additional References: A copy of the first book (Atiyah–MacDonald) will be provided for each student. The rest of the books will be on reserve in the math library.

1. Atiyah, M.F. & MacDonald, I.G., *Introduction to Commutative Algebra*. Westview, 1969.
2. Artin, M., *Algebra*. Prentice Hall, 1991.
3. Dummit, D. & Foote, R., *Abstract Algebra*. Wiley, 2003.
4. Herstein, I.N., *Topics in Algebra*. Wiley, 1975.
5. Hungerford, T., *Algebra*. Springer-Verlag, 1997.
6. Lang, S., *Algebra*. Springer-Verlag, 2002.
7. Rotman, J.J., *Advanced Modern Algebra*. Prentice Hall, 2002.