

MATH 433, Section 500
Applied Algebra
Spring 2023

Instructor: Yaroslav Vorobets

Time: MWF 10:20–11:10 a.m.

Location: BLOC 163

Web page: <http://www.math.tamu.edu/~yvorobet/MATH433/>

Office: BLOC 301b (email: yvorobets@tamu.edu).

Office hours: MWF 1:00–2:00 p.m. (in person), Thursday 5:00–6:00 p.m. (via ZOOM), and by appointment.

Text: J. F. Humphreys, M. Y. Prest, *Numbers, Groups and Codes*, 2nd ed., Cambridge University Press, 2004.

Prerequisites: MATH 300 or 302 (discrete mathematics); MATH 304 or 323 (linear algebra).

Grading system: There will be 12 quizzes, 3 in-class exams and the final comprehensive exam. The midterm exams are worth 100 points (or 16.6% of the final grade) each, the final exam is worth 150 points (or 25% of the final grade). Extra credit can be earned by solving bonus problems on exams. The quizzes will account for another 150 points (or 25% of the final grade). The final grades will be assigned according to the 90–80–70–60% scale, that is, A for 540+ pts, B for 480–539 pts, C for 420–479 pts, D for 360–419 pts, and F for less than 360 pts.

The *tentative* dates for the midterms are February 17, March 29 and April 28. The final exam is scheduled for Monday, May 8, 8:00–10:00 a.m.

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

Academic integrity: Copying another student's work is dishonest and academically worthless. Information about the Honor Council Rules and Procedures can be found at <http://aggiehonor.tamu.edu/>

Copyright notice: All course materials (both printed and web-based) are protected by U.S. Copyright Laws. No multiple copies can be made without written permission by the instructor.

Students with disabilities: If you experience barriers to your education due to a disability or think you may have a disability, please contact Disability Resources in the Student Services Building or at (979) 845–1637 (or visit <http://disability.tamu.edu>). Disabilities may include, but are not limited to attentional, learning, mental health, sensory, physical, or chronic health conditions. All students are encouraged to discuss their disability related needs with Disability Resources and their instructors as soon as possible.

Title IX and limits to confidentiality: Class materials are generally considered confidential pursuant to student record policies and laws. As a University employee, I, however, must report allegations of sexual assault, sexual discrimination, or sexual harassment when they involve TAMU students, faculty, or staff, or third parties visiting campus if you share such information with me.

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Course content: This course is an introduction to the algebraic concepts of groups, rings, and fields, with an emphasis on modular arithmetic. Applications include topics in number theory and coding theory.

Course outline

Part I (≈ 4.5 weeks): *Number theory*

- Mathematical induction
- Euclidean algorithm
- Primes, factorisation
- Congruence classes, modular arithmetic
- Euler's theorem
- Public key encryption

Humphreys/Prest: Chapter 1

Part II (≈ 5 weeks): *Abstract algebra and more*

- Functions, relations
- Finite state machines
- Permutations
- Abstract groups
- Other algebraic structures (rings, fields, etc.)

Humphreys/Prest: Chapters 2 and 4

Part III (≈ 4.5 weeks): *Group theory and polynomials*

- Subgroups, cyclic groups
- Cosets, Lagrange's theorem
- Classification of groups
- Error-detecting and error-correcting codes
- Division of polynomials
- Factorisation of polynomials

Humphreys/Prest: Chapters 5–6