MATH 252: ABSTRACT ALGEBRA II

JOHN VOIGHT

Course Info

- **Lectures**: Monday, Wednesday, Friday, 10:10–11:00 a.m.
- **Room**: Torrey Hall 201
- **Instructor**: John Voight
- **Office**: 16 Colchester Ave, Room 207C
- **E-mail**: `jvoight@gmail.com`
- **Instructor's Office Hours**: Mondays, 1:00 p.m.–2:00 p.m. and Wednesdays, 11:00 a.m.–12:00 noon and 1:00 p.m.–2:00 p.m.; or please make an appointment!
- **Course Web Page**: `http://www.cems.uvm.edu/~voight/252/`
- **Instructor's Web Page**: `http://www.cems.uvm.edu/~voight/`

- **Prerequisites**: Math 251.
- **Required Text**: David Dummit and Richard Foote, *Abstract Algebra*, Third edition, 2004.
- **Grading**: Homework will count for 65% of the grade. Computer lab projects will count for 10% of the grade. A final paper/presentation will count for 25% of the grade. There will be no exams.

I am happy to provide appropriate and fair accommodations for students with documented special needs; early in the semester, please contact the ACCESS office (`http://www.uvm.edu/~access/`) directly.

Homework

There will be a 'jumbo' homework assignment for each of the major topics, every two weeks. Homework is due on the following Friday.

Be sure to show your work and explain how you got your answer. Correct but incomplete answers will only receive partial credit. Part of the beauty of mathematics is in the elegance of its proofs, and one goal of this course is for you to learn to write mathematics excellently.

Cooperation on homework is permitted (and encouraged), but if you work together, do not take any paper away with you—in other words, you can share your thoughts (say on a blackboard), but you have to walk away with only your understanding. In particular, write the solution up on your own.

Final project

A typed, final paper of length 6 to 8 pages will be due at the time of the final exam. A suggested list of topics will be given to you at some time during the semester, though you are free to choose your own! You will give a 15 minute presentation on the topic of your choice during the final exam time. It is *strongly recommended* that you turn in a rough draft to me to solicit comments, and note that the quality of those comments will be directly proportional to the length of time you give me to read through your paper.

Computer labs

There will be three roughly hour-long labs in Perkins 102 during the semester; the exact dates and times of these labs will be decided upon by mutual agreement. You will be given an introduction to some computational and algorithmic aspects of abstract algebra, and will have time to complete the assignment during the lab.

To make up for this extra time, there are three days during the semester (February 20, March 7, and March 28) when regular class is cancelled.

Exams

The final exam time, scheduled to be Monday, May 5 from 8:00 a.m.–11:00 a.m., will instead be used for in-class presentations of the final projects.

Syllabus

According to the "official" catalog description, we will cover:

> Modules, vector spaces, linear transformations, rational and Jordan canonical forms. Finite fields, field extensions, and Galois theory leading to the insolvability of quintic equations.

Although we may deviate from this by adding or skipping topics, the tentative plan for the course is as follows.

- Euclidean domains, PIDs, and UFDs, and polynomial rings
  - **1**, 14 Jan (M): §8.1: Euclidean domains
  - **2**, 16 Jan (W): §8.1
  - **3**, 18 Jan (F): §8.2: Principal ideal domains
  - -, 21 Jan (M): *No class, Martin Luther King Holiday*
  - **4**, 23 Jan (W): §8.3: UFDs
  - **5**, 25 Jan (F): §9.2, §9.5: Polynomial Rings over Fields I and II
- Modules
  - **6**, 28 Jan (M): §10.1: Basic definitions and examples
  - **7**, 30 Jan (W): §10.1
  - **8**, 1 Feb (F): §10.1
  - **9**, 4 Feb (M): §10.2: Quotient modules and module homomorphisms
  - **10**, 6 Feb (W): §10.2
  - **11**, 8 Feb (F): §10.2
- Vector spaces
  - **12**, 11 Feb (M): §11.1: Definitions and basic theory
  - **13**, 13 Feb (W): §11.2: The matrix of a linear transformation
  - **14**, 15 Feb (F): §11.3: Dual vector spaces
  - -, 18 Feb (M): *No class, President's Day Holiday*
  - -, 20 Feb (W): *No class, Lab exchange day*
  - **16**, 22 Feb (F): §11.4: Determinants
- Modules over PIDs
  - **17**, 25 Feb (M): §12.1: Basic theory
  - **18**, 27 Feb (W): §12.1
  - **19**, 29 Feb (F): §12.2: Rational canonical form
  - **20**, 3 Mar (M): §12.2
  - **21**, 5 Mar (W): §12.3: Jordan canonical form
  - -, 7 Mar (F): *No class, Lab exchange day*

- Spring break: 10–14 Mar (M–F): *No class, Spring Recess*
- Field theory
  - **23**, 17 Mar (M): §13.1: Basic theory of field extensions
  - **24**, 19 Mar (W): §13.1
  - **25**, 21 Mar (F): §13.2: Algebraic extensions
  - **26**, 24 Mar (M): §13.2
  - **27**, 26 Mar (W): §13.3: Classical straightedge and compass constructions
  - -, 28 Mar (F): *No class, Lab exchange day*
- Galois theory
  - **29**, 31 Mar (M): §14.1: Basic definitions
  - **30**, 2 Apr (W): §14.1
  - **31**, 4 Apr (F): §14.2: The fundamental theorem of Galois theory
  - **32**, 7 Apr (M): §14.2
  - **33**, 9 Apr (W): §14.2
  - **34**, 11 Apr (F): Introduction to algebraic number theory
- Finite fields and insolvability of the quintic
  - **35**, 14 Apr (M): §14.3: Finite fields
  - **36**, 16 Apr (W): §14.3
  - **37**, 18 Apr (F): Topics in finite fields
  - **38**, 21 Apr (M): §14.7: Solvable and radical extensions
  - **39**, 23 Apr (W): §14.7
  - **40**, 25 Apr (F): §14.7
- TBD
  - **41**, 28 Apr (M): TBD
  - **42**, 30 Apr (W): TBD