

Math 103B Winter 2006: Applied Modern Algebra  
MWF 2-2:50, WLH 2113  
Professor D. Rogalski

1. CONTACT INFORMATION

**Prof. Rogalski's Office:** 5131 AP&M

**E-mail:** drogalsk@math.ucsd.edu

**Class web site:** [www.math.ucsd.edu/~drogalsk/math103b.html](http://www.math.ucsd.edu/~drogalsk/math103b.html). Check frequently for updated homework and lecture information.

**Office hours:** TBA

**Section Leader:** John Farina, 5018 AP&M

**E-mail:** jfarina@math.ucsd.edu

**Meeting Times:** W 7-7:50 in WLH 2110

**Office hours:** TBA

2. CLASS DESCRIPTION

Math 103B is the second quarter of a two quarter sequence. Math 20F and Math 109 (and Math 103A) are prerequisites. While the material from Math 103A will be referred to only occasionally, if you have not taken that course in a while you may need to review the basic facts about groups.

The main topic of 103B is the theory of rings and fields, and as an application, algebraic coding theory. We will cover roughly chapters 12-23 and chapter 31 of Gallian's text. Homework will be assigned weekly, and due Fridays in lecture (No homework will be due on exam weeks.) Spending a good amount of time grappling with the homework is the only way to really learn the material in this class well, so you *must* take it seriously. Late homework will not be accepted, but to account for possible illness, etc. the lowest homework score will be dropped.

The lectures will be designed to complement rather than precisely duplicate the material in the textbook so both sources are important. In particular, regular attendance at lecture and section is strongly encouraged. Wednesday section will provide an opportunity for you to ask questions about that week's homework, to ask other general questions about the material, and to see sample exercises worked in detail. If you would like to meet with me to ask questions but are unable to see me during regular office hours, you may set up an appointment by e-mail to meet at a different time.

There will be 2 in-class midterm exams on Wednesday 2/1/06 and Wednesday 3/1/06 and a final exam on Monday 3/20/06 from 3-6pm. No calculators, books, or notes can be use during exams. No makeup exams will be given. The final grades will be determined using the following breakdown: homework 25%, midterms 25%, final exam 50%.

## 3. TENTATIVE SYLLABUS

The following is a suggested outline of what we will cover when. This is subject to change, and updates to the schedule will be announced in class or posted on the website.

- 1/9 Chap 12: Introduction to course. Definitions of rings.
- 1/11 Chap 12-13: Subrings. Zero-divisors and integral domains.
- 1/13 Chap 13. Fields. Characteristic of a ring or field.
  
- 1/16 **NO CLASS** (MLK Day)
- 1/18 Chap 14: Ideals. Factor rings.
- 1/20 Chap 14: More on factor rings. Prime and maximal ideals.
  
- 1/23 Chap 15: Homomorphisms of rings.
- 1/25 Chap 15: Properties of homomorphisms.
- 1/27 Chap 15: Field of fractions of a domain.
  
- 1/30 Chap 16: Polynomial rings
- 2/1 **EXAM I** covering chapters 12-15.
- 2/3 Chap 16: Division algorithm. A polynomial ring is a PID.
  
- 2/6 Chap 17: Factorization of polynomials
- 2/8 Chap 17: Irreducibility tests.
- 2/10 Chap 18: Irreducibles and primes
  
- 2/13 Chap 18: Unique factorization domains
- 2/15 Chap 18: Euclidean domains
- 2/17 Chap 19: Review of linear algebra
  
- 2/20 **NO CLASS** (President's Day)
- 2/22 Chap 20: Extension Fields. Splitting Fields.
- 2/24 Chap 20: Multiple Zeros. Perfection.
  
- 2/27 Chap 21: Degree of an extension.
- 3/1 **EXAM II** covering chapters 16-20.
- 3/3 Chap 21: Theorem of the primitive element.
  
- 3/6 Chap 22: Finite Fields I.
- 3/8 Chap 22: Finite fields II.
- 3/10 Chap 31: Algebraic coding theory I.
  
- 3/13 Chap 31: Algebraic coding theory II.
- 3/15 Chap 31: Algebraic coding theory III.
- 3/17 Review Day
  
- 3/20 Final exam, 3-6pm.