Mathematics MAT 341 : Number Theory
Spring 2011
MWF 10:30 am - 11:20 am, Room 205

Instructor: Dr. Brad Emmons
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Course Materials

A Friendly Introduction to Number Theory, 3rd Edition, by Silverman (required)

Introduction

Number Theory is the study of the set of integers $\mathbb{Z} = \{\ldots, -2, -1, 0, 1, 2, \ldots\}$. Because of the basic nature of the object of study (you have been dealing with them your whole life!), it is a very attractive area of mathematics. We can study Number Theory and understand some of the most challenging open problems in mathematics without devoting a great deal of time to the mechanics. Therein lies one of the fundamental features of Number Theory: Number Theory contains some of the simplest problems to state and the hardest to prove. In this course we will cover some elementary techniques which will help us understand the nature of the natural numbers. These include the Fundamental Theorem of Arithmetic, congruences, primitive roots, and quadratic reciprocity.

As this class meets only twice a week, it is your responsibility to make an effort to look over the material at least 30 minutes every day in addition to the time you spend on course work.

Exams

There will be two in-class exams in this class. The exams will test your understanding of concepts, your ability to work through some of the computations, as well as your ability to apply the techniques to certain applications. The first exam is scheduled for Friday, February 18, the second exam is scheduled for Friday, April 1. All exams will count for 25% percent of your final grade. There will be NO make-ups for missed exams. Please look over your schedule as soon as possible. If you see a potential conflict, inform me immediately.

Homework

The best way to learn Mathematics is to solve problems. At the end of each section, there are a variety of exercises that you can look at to help understand concepts and hone your skills. I will suggest problems for you to attempt from the end of the section, but I will not grade these. Instead, I will assign weekly problem sheets that will be collected and graded. These problems will be more in-depth than the drill-type activities and will require more exposition on your part. You will be graded on content, organization and completion of the assignments. In addition to the graded problems, each assignment will carry 5 completion points. To earn 5 out of 5 of the completion points, the assignment must be written up neatly and thoroughly with complete solutions to all of the assigned problems. Late homework will not be graded, but you may still earn completion points on late assignments. The homework is designed to help you identify where you might have difficulties. If you encounter any trouble with an assignment or a concept, seek help!

Projects

Number Theory provides easy access to some of the most fascinating areas of mathematics. (Perhaps I betray my bias?) Many of the topics can be studied without very much in the way of technical background. Thus they can be studied independently. The purpose of the projects is to get you to explore a concept relating to Number Theory that we might not ordinarily cover in a course. The projects will count for 25% of your final grade. We will discuss the project more in depth the 2nd or 3rd week of the course.

Attendance

While there is no official attendance policy for MAT 341, I strongly suggest you come to class prepared every day. If you must miss a class for any particular reason, it is your responsibility to get the notes from another student and to turn in your assignment *before* the class period to earn full credit.

Grading

Your grade in this course will be based on three main factors: homework, projects and exams. The exams will be worth 50% of your final grade, the projects 25%, and the homework 25%. In addition to these factors, minor ethereal factors such attendance, attitude, and improvement over the course of the semester can also affect your grade. To determine your final grade, 90–100% = A, 80–89% = B, 70–79% = C, 60–69% = D, 59 and below = F, with the top two percents receiving a + and the bottom two percents receiving a −.

Important Dates

Thursday, February 17 – Exam I
Monday, March 14 - Friday, March 18 – `NO CLASS`
Thursday, March 31 – Exam II
Wednesday, May 4 – Last Day of Class
Monday, May 2 – Presentations
Wednesday, May 4 – Presentations
Friday, May 6, 9:00 a.m. – Presentations

Suggestions

Come to class with your homework assignment completed every day
Study for at least 30 minutes each day in addition to completing your homework assignment
Read the section we will be covering in class *before* arriving to class
Do not fall behind!
Come to office hours to discuss homework and concepts. I am here to help!

Academic Honesty

Please read the *Utica College Catalog* regarding Intellectual Honesty. Any student caught plagiarizing or cheating in the course will receive an "F for cheating" on their transcript. By submitting work in this course you are asserting that the work and conclusions are your own and not from an outside source. However, I do allow and *encourage* collaboration with other classmates on written assignments in this class.

Special Needs

Any student with a disability requiring special needs should contact both me and Academic Support Services, 315-792-3032 or khenkel@utica.edu. If you will be requiring any accommodations due to your documented learning or physical special need, you should notify me within the first two weeks of class. I will make every effort to accommodate you in a manner which will maintain the integrity of the course and its' content.

Syllabus
MAT 341 : Number Theory
Spring 2011

Week 1	January 21	Course Policies, Syllabus, Chapter 1
Week 2	January 24	Chapter 2 – Pythagorean Triples
	January 26	Chapter 2 – Pythagorean Triples
	January 28	Chapter 3 – Pythagorean Triples and the Unit Circle
Week 3	January 31	Chapter 3 – Pythagorean Triples and the Unit Circle
	February 2	Chapter 5 – Divisibility and the Greatest Common Divisor
	February 4	Chapter 5 – Divisibility and the Greatest Common Divisor
Week 4	February 7	Chapter 6 – Linear Equations and the Greatest Common Divisor
	February 9	Chapter 6 – Linear Equations and the Greatest Common Divisor
	February 11	Chapter 7 – Factorization and the Fundamental Theorem of Arithmetic
Week 5	February 14	Chapter 7 – Factorization and the Fundamental Theorem of Arithmetic
	February 16	Review
	February 18	**Exam I**
Week 6	February 21	Chapter 8 – Congruences
	February 23	Chapter 8 – Congruences
	February 25	Chapter 9 – Congruences, Powers, and Fermat's Little Theorem
Week 7	February 28	Chapter 9 – Congruences, Powers, and Fermat's Little Theorem
	March 2	Chapter 10 – Congruences, Powers, and Euler's Formula
	March 4	Chapter 10 – Congruences, Powers, and Euler's Formula
Week 8	March 7	Chapter 11 – Euler's Phi Function and the Chinese Remainder Theorem
	March 9	Chapter 11 – Euler's Phi Function and the Chinese Remainder Theorem
	March 11	Chapter 12 – Prime Numbers
Week 9	March 14	`NO CLASS`
	March 16	`NO CLASS`
	March 18	`NO CLASS`
Week 10	March 21	Chapter 12 – Prime Numbers
	March 23	Chapter 13 – Counting Primes
	March 25	Chapter 13 – Counting Primes
Week 11	March 28	Chapter 14 – Mersenne Primes
	March 30	Review
	April 1	**Exam II**
Week 12	April 4	Chapter 14 – Mersenne Primes
	April 6	Chapter 15 – Mersenne Primes and Perfect Numbers
	April 8	Chapter 15 – Mersenne Primes and Perfect Numbers
Week 13	April 11	Chapter 16 – Powers Module m and Successful Squaring
	April 13	Chapter 16 – Chapter 16 – Powers Modulo m and Successful Squaring
	April 15	Chapter 17 – Computing kth Roots Modulo m
Week 14	April 18	Chapter 17 – Computing kth Roots Modulo m
	April 20	Chapter 18 – Powers, Roots, and "Unbreakable" Codes
	April 22	Chapter 18 – Powers, Roots, and "Unbreakable" Codes
Week 15	April 25	Chapter 19 – Primality Testing and Carmichael Numbers
	April 27	Chapter 19 – Primality Testing and Carmichael Numbers
	April 29	Chapter 20 – Euler's Phi Function and Sums of Divisors
Week 16	May 2	Presentations
	May 4	Presentations