MTH 582 Topics in Number Theory
Spring 2015 – Course Information

Instructor: Ivan Soprunov
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Office phone: (216) 687-4707
Office hours: TuWeFr 12:30–1:30 pm or by appointment

Course Web page: via Blackboard (see below)
Class time & Location: MoWe 4:00–5:50, MC 317

Textbook: Niven, Zuckerman, Montgomery An Introduction to the Theory of Numbers, 5th edition, recommended, but not required

Course Description: This course presents advanced topics in number theory. Topics include congruences, some Diophantine equations, rational points on curves, Lagrange’s theorem on sum of four squares, as well as introduction to algebraic numbers.

About the Course: This is a rigorous mathematics course where you are expected to understand and write proofs of various statements we will encounter. You will be solving many different problems where you cannot simply apply known formulas or results and have to come up with your own logical arguments. Even if a solution to a problem is available to you, always try to solve the problem yourself first.

Attendance/Class participation: You will be responsible for the material as it is presented in lecture. This may include material not found in the text book. Therefore, I expect that you attend every class and take notes. Repeated unexcused absences will lower your participation grade. Also active participation is encouraged and will contribute positively to your grade. Such participation includes answering questions in class, asking good questions in class, etc.

Homework: Doing the homework is essential to understanding the material. Work on the material outside class. Carefully read the textbook and lecture notes before coming to class. While reading use pencil and paper to work on examples and fill in omitted steps in proofs. You should seek help when you have trouble.

Solving the assigned problems and writing up the solutions will require a lot of time. I encourage you to work with other students from the class, but each student must write their solutions independently! Solutions copied from other’s work (including solutions found online) will receive a grade of zero and may result in administrative sanctions. See section on Scholastic Dishonesty below.

If you are writing by hand, please leave large margins and space between problems free for corrections and comments. Write legibly. If you are typing, you should use a 12 point font with 1 inch margins. Staple the pages (in proper order) together.

I strongly suggest that you retain all graded work from the course until the end of the semester and final grades are posted. This way if a discrepancy arises between a recorded grade and the actual grade, we have the actual document to examine in order to rectify the situation. Also graded works make for excellent study materials for upcoming exams.

I will collect homework every other Wednesday (starting Jan 21) at the beginning of class. No late homework will be accepted!
**Blackboard:** Blackboard is an online learning system. You must log in regularly. There are homework assignments, discussion areas, grades, handouts, etc. You were automatically signed up when you registered for this course. To access Blackboard Learn go to

https://bbelearn.csuohio.edu/MACAuth/login.jsp

and log in using your CampusPass. See me if you have trouble.

**Exams:** There will be one in-class midterm exam and a comprehensive final (see syllabus for dates).

**Make-Up Policy:** If you are unable to take an exam at the scheduled time due to sickness or an emergency, notify me as soon as possible and we will work out an appropriate accommodation. If you have a non-emergency conflict, you must notify me at least a week in advance in order to have the possibility of making other arrangements.

**Grades:** Your grade will be determined as follows.

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<thead>
<tr>
<th>Percentage</th>
<th>Component</th>
<th>Minimum Grade</th>
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<tbody>
<tr>
<td>5%</td>
<td>Class participation</td>
<td>A 90% – 100%</td>
</tr>
<tr>
<td>25%</td>
<td>Homework</td>
<td>A− 85% – 89%</td>
</tr>
<tr>
<td>20%</td>
<td>Exam I</td>
<td>B+ 80% – 84%</td>
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<tr>
<td>20%</td>
<td>Exam II</td>
<td>B 77% – 79%</td>
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<tr>
<td>30%</td>
<td>Final Exam</td>
<td>B− 74% – 76%</td>
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<tr>
<td>100%</td>
<td>TOTAL</td>
<td>C 60% – 73%</td>
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F below 60%

**Getting help:** There are several options for getting help with this course:

- Ask questions about the material or lecture during class. Chances are that other students are also confused and a brief question in class may save you hours of misery later.
- Ask questions of your peers, either in person or using the Discussions area in Blackboard.
- Come to my office during office hours. You should be prepared with specific questions. Try to do as much as possible to pinpoint your confusion before coming to see me so that we can make effective use of our time together. Bring any work you have done so far. If you cannot attend my office hours, feel free to contact me and make an appointment.
- For general academic help the Focus Center (UC 563, 687-5114) runs workshops about time management, test taking skills, study skills, etc.

**Accommodations for students with disabilities:** CSU provides classroom accommodations, auxiliary aids and services to ensure equal educational opportunities for all students regardless of their disability. For more information contact the Office of Disability Services at (216) 687-2015. Accommodations need to be requested in advance and will not be granted retroactively.

**Scholastic Dishonesty:** Cheating of any form is not acceptable and it will be dealt with harshly if detected. If not detected, you will still be punished since you will be ill-prepared for future exams in this course or future courses. In addition, it degrades the value of a CSU degree. Copying work done by others, in or out of class, is an act of scholastic dishonesty and it will be prosecuted to the full extent allowed by university policy. For more information regarding scholastic dishonesty, see the Code of Student Conduct.
Math 582 Number Theory – Spring 2015 – Weekly Syllabus

This is a tentative syllabus as of \(01/07/15\). Lecture topics are subject to change without notice. Exam dates are also subject to change, but any changes will be announced at least a week in advance.

**Text:** Niven, Zuckerman, Montgomery *An Introduction to the Theory of Numbers, 5th edition*

**Exam Dates:**
- Monday, February 23, in class Exam 1
- Wednesday, April 1, in class Exam 2
- Monday, May 4, 4-6 pm Final Exam (cumulative)

**Week 1: Jan 12–16**
Introduction
Divisibility and Euclidean Algorithm
Primes and Fundamental Theorem of Arithmetic
*Friday is last day to drop, full refund*

**Week 2: Jan 19–23**
*Monday is MLK Day; no classes*
Congruences
Groups, rings, and fields

**Week 3: Jan 26–29**
The Chinese Remainder Theorem
Prime power moduli

**Week 4: Feb 2–6**
Prime modulus
Primitive roots and power residues

**Week 5: Feb 9–13**
Public-key cryptography
Irrational numbers

**Week 6: Feb 16–20**
*Monday is President’s Day; no classes*
Irrationality of \(e\) and \(\pi\)
Q&A for exam

**Week 7: Feb 23–27**
EXAM I
Quadratic residues

**Week 8: March 2–6**
Quadratic reciprocity
Week 9: March 9–13
Spring Break

Week 10: March 16–20
Solving linear systems over integers
Rational points on curves

Week 11: March 23–27
The equation $ax^2 + by^2 + cz^2 = 0 \mod p$
The geometry of numbers: Minkowski’s theorem
Friday is last day to withdraw

Week 12: March 30– April 3
Lagrange’s theorem on sum of four squares
Q&A for exam
EXAM II

Week 13: April 6–10
Polynomials
Algebraic numbers
Algebraic number fields

Week 14: April 13–17
Algebraic integers
Quadratic fields

Week 15: April 20–24
Units in quadratic fields
Primes in quadratic fields
Unique factorization

Week 16: April 27– May 1
Primes in quadratic fields having the unique factorization property
The equation $x^3 + y^3 = z^3$
Review

Final Exam: Monday May 4, 4–6 pm in MC 317