

Syllabus for MATH 3527, Number Theory, Section 01

Northeastern University, Spring 2018

Instructor: Dr. Neranga Fernando

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Office hours: Tuesdays 3pm – 4pm and Wednesdays 3pm – 5pm.

Meeting times and location: MWR, 1.35pm – 2.40pm at West Village G 108.

Textbook: A Friendly Introduction to Number Theory, fourth edition by J. Silverman, Prentice Hall, 2013 (ISBN 13: 978-0-321-81619-1).

Course objectives: The goal of this course is to introduce students to some of the basic problems and techniques of elementary number theory. Topics include linear Diophantine equations, congruences, Fermat's little theorem, Euler's formula, Euler's phi function, computing powers and roots in modular arithmetic, the RSA encryption system, primitive roots and indices, the law of quadratic reciprocity, and Pell's equation.

Prerequisites: MATH 1342 (Calculus 2 for Engineering and Science) or the equivalent.

Web materials: All class announcements, material, and grades will be posted on Blackboard.

Homework: Homework will NOT be collected. It is strongly advised that you do all of assigned homework since the tests will closely resemble the homework problems.

Tests and final exam:

There will be six tests, and a cumulative final exam in this course. The tests are 65-minute in-class tests. There will be NO make-up tests.

Final exam will be held from 1pm to 3pm on April 27, 2018. Location of the final exam is to be determined. **Check for exam schedule conflicts as soon as possible.** Only two finals at the same time or three in one day is a University recognized legitimate reason to be excused from taking the final at the scheduled time. Students with such a conflict should complete a final exam conflict form, available on the registrar's website.

Snow days: If classes are cancelled due to snow, or for other official reasons, any scheduled quiz will occur on the next class meeting.

Grading: The course grade will be determined as follows:

Final exam: 40%

Tests: 60% (10% each)

Letter grades are determined numerically:

$A \geq 93$,	$92 \geq A- \geq 90$,	$89 \geq B+ \geq 87$,	$86 \geq B \geq 83$,	$82 \geq B- \geq 80$,
$79 \geq C+ \geq 77$,	$76 \geq C \geq 73$,	$72 \geq C- \geq 70$,	$69 \geq D+ \geq 67$,	$66 \geq D \geq 63$,
$62 \geq D- \geq 60$,	$F \leq 59$			

The grade I (Incomplete) will be given only if you have a good attendance record, have missed the final exam for a good reason, and otherwise are doing passing work. An incomplete is given at the discretion of the instructor.

Additional resources:

The Mathematics Department Tutoring Center is in Room 540B, Nightingale Hall. This peer tutoring is free. Peer Tutoring appointments can be booked via MyNEU under TUTORING. Although you can walk in, it is really best to sign up in advance. Tutoring requests are scheduled by students in real-time and confirmed by email. Next-day appointments must be booked by 9:00 pm the previous day. It is expected that tutoring services in the Mathematics Department Tutoring Center will begin shortly after the start of classes. See

<http://www.northeastern.edu/csastutoring/setting-up-appointments/> For more information about peer tutoring.

Issues with the course/instructor: If you have issues with this course and/or instructor which you are not comfortable discussing with your instructor, you should contact the Teaching Director, Prof. D. Massey, at d.massey@northeastern.edu.

Academic honesty: Collaboration on quizzes, tests and final exam is not allowed. From Student Code of Conduct (see <http://www.northeastern.edu/osccr/academicintegrity>): "A necessary prerequisite to the attainment of the goals of the University is maintaining complete honesty in all academic work. Students are expected to present as their own only that which is clearly their own work in tests and in any material submitted for credit. Students may not assist others in presenting work that is not their own. ... Offenders are subject to disciplinary action." For more on Academic Integrity see: <http://www.northeastern.edu/registrar/courses/cat1213-univ-proc.pdf>

Note the following dates:

Monday, January 22: last day to elect pass/fail for Spring-18 classes

Monday, January 29: last day to withdraw without a W

Thursday, February 1: last day to file a final exam conflict form

Thursday, April 19: last day to withdraw with a W

Important:

1) Any student with a disability is encouraged to meet with the instructor during the first week of classes to discuss accommodations. The student must bring a current Memorandum of Accommodations from the Disability Resource Center (DRC).

2) If you are an athlete and have conflicts with an important class activity (quiz, mid-term, or final), you should let your instructor know before the end of second week of classes. You should also bring an official letter from the Office of Athletics.

3) All electronic devices (mobile phones, laptops etc.) should be turned off during class time, quizzes, tests and final exam.

Syllabus: Syllabus is subject to change. It is your responsibility to be aware of any changes the instructor may make to the syllabus as they are announced in class. Students are responsible for all information given when they are absent.

TRACE: Please complete the TRACE evaluations at the end of the course.

Schedule of Topics and Suggested Homework Exercises

Week 1: Jan. 8-12

Chapter 1 What is Number Theory? 1*, 2, 3*, 4*(read)

Chapter 2 Pythagorean Triples 1, 3*, 4*, 5, 6

Chapter 3 Pythagorean Triples and the Unit Circle 1, 2, 3; 4*, 5

Monday, Jan. 15: Martin Luther King, Jr.'s birthday - no classes

Week 2: (partial) Jan. 15-19

Chapter 4 Sums of Higher Powers and Fermat's Last Theorem 2

Chapter 5 Divisibility and the Greatest Common Divisor 1, 4; 5

Week 3: Jan. 22-26

Chapter 6 Linear Equations and the Greatest Common Divisor 1, 2, 6 a – c, 6 d -f

Chapter 7 Factorization and the Fundamental Theorem of Arithmetic Ch. 7: 1, 2, 3, 4 a, b, c, d, 5, 6

[Test 1](#)

Week 4: Jan. 29-Feb. 2

Chapter 26 As Easy as One, Two, Three (Induction) Ch. 26: 1b, c*, 2, 3, 5

Chapter 8 Congruences 2, 3, 4; 9-10

Chapter 9 Congruences, Powers, and Fermat's Little Theorem 1,2, 4; 3

Week 5: Feb. 5-9

Chapter 10 Congruences, Powers, and Euler's Formula & 1,2, 3a, 3b*

Chapter 11 Euler's Phi Function and the Chinese Remainder Theorem 1, 2, 3, 5, 6,7, 9*,11

[Test 2](#)

Week 6: Feb. 12-16

Chapter 12 Prime Numbers 2, 3*, 6; 4, 5

Chapter 13 Counting primes 1b, 2b, 3, 5, 6a*

Chapter 14 Mersenne Primes 1, 2, 3

Monday, Feb. 19: President's Day - no classes

Week 7: (partial) Feb. 19 – 23

Chapter 15 Mersenne Primes and Perfect Numbers 1, 2, 3abc, 3d*, 3e*, 8*

Chapter 16 Powers Modulo m and Successive Squaring 1, 3, 5

[Test 3](#)

Week 8: Feb. 26 - March 2

Chapter 17 Computing k^{th} Roots Modulo m 1, 2, 3a, 4*, 5a, 5b

Chapter 18 Powers, Roots, and "Unbreakable Codes" 1, 2; 6

Chapter 19 Primality Testing and Carmichael Numbers 1; 2*, 3, 4, 7 a, b

Saturday, March 3 - Sunday, March 11: Spring Break - no classes

Week 9: March 12-16

Chapter 20 Squares Modulo p 1, 3a, b; 2

Chapter 21 Is (-1) a square modulo p ? Is 2 ? 1, 3, 4

[Test 4](#)

Week 10: March 19-23

Chapter 22 Quadratic Reciprocity 1, 2, 3, 7,8, 10*

Chapter 23 Proof of Quadratic Reciprocity 2, 3, 4, 5

Chapter 24 Which Primes are Sums of Two Squares? 2, 3, 4

Week 11: March 26-30

Chapter 25 Which Numbers are Sums of Two Squares? 1, 2, 3, 6*

Chapter 27 Euler's Phi Function and Sums of Divisors 1, 2a-c, 2d*, 2e*, 3

[Test 5](#)

Week 12: April 2-6

Chapter 28 Powers Modulo p and Primitive Roots 2, 3, 4, 5, 6a, 7, 8-10, 15

Chapter 31 Square-Triangular Numbers Revisited 1, 2, 3, 4

Chapter 32 Pell's Equation 1, 2, 3, 4b*

Week 13: April 9-13

Chapter 30 The equation $X^4 + Y^4 = Z^4$ (if time permits) 1, 2, 3*

Test 6

Monday, April 16: Patriot's Day - no classes

Week 14 (partial): April 16-19

Review

Thursday, April 19: reading day

Friday, April 20- 27: final exams