Texas A&M University
Departmental Request for a Change in Course
Undergraduate • Graduate • Professional
Submit original form and attachments.

1. This request is submitted by the Department of Mathematics.

2. Course prefix, number and complete title of course: Math 627 Theory of Numbers

3. Change requested:
   a. Prerequisite(s): From: approval of instructor To: Math 653 or approval of instructor
   b. Requirements (if any):
   c. Cross-list with:
   Cross-listed courses require the signature of both department heads.
   d. Change in course title and description. Enter complete current course title and current course description in item 4; enter proposed course title and proposed course description in item 5.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 6. Attach a course syllabus.

4. Complete current course title and current catalog course description: Theory of Numbers. Quadratic residues; the Legendre, Jacobi and Kronecker symbols; quadratic reciprocity; residue characters; character sums; sums of squares; diophantine equations.

5. Complete proposed course title and proposed catalog course description (not to exceed 50 words): Algebraic Number Theory. Algebraic number fields and rings of algebraic integers; arithmetic in algebraic number fields; ideals; unique factorization of ideals; class numbers and the class group; finiteness of the class number; Minkowski’s theorem; Dirichlet’s unit theorem; quadratic and cyclotomic number fields; splitting of primes in extension fields.

6. a. As currently in course inventory:

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<th>Prefix</th>
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<th>Title (excluding punctuation)</th>
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<tr>
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<td>Theory of Numbers</td>
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b. Change to:

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Approval recommended by: [Signature]

Department Head – Type Name & Sign Date

Department Head – Type Name & Sign (if cross-listed course) Date

Submitted to Coordinating Board by:

Associate Director, Curricular Services Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra-williams@tamu.edu.
Curricular Services – 12/08
Number Theory is an important field of mathematics, which centers on the fundamental mysteries of prime numbers and integers. It has many real applications, including to cryptography and coding theory. The topics we propose are essential to learn for any graduate student who intends to pursue a Ph.D. in Number Theory, and the change in the course will allow these topics to be covered regularly in course work, rather than in individual reading courses. We feel the course will also serve as a way to attract student work in Number Theory, as they will be able to explore some of its deeper aspects while they are deciding on which area of mathematics to focus on.
Sample Syllabus for
Algebraic Number Theory
Math 627
Fall 2010

TR 9:35–10:50 in BLOC 624

Instructor: Dr. Matthew Papanikolas
Contact Information: matthew.papanikolas@tamu.edu, (979) 845-7554
Office Hours: MWF 2-3 in Milner 102; also by appointment

Course Topics: This course will be an introduction to the study of algebraic numbers and algebraic integers. In number theory the key motivating problem is to understand the basic arithmetic of the integers. Algebraic number theory is the study of generalizations of integers to other domains, especially to number fields, i.e., finite algebraic extensions of \( \mathbb{Q} \). Interesting problems arise in the study of rings of algebraic integers that shed light on many basic number theory problems. The course will cover the following topics as time permits:

- Review of prerequisites from Algebra: rings, ideals, fields modules, abelian groups
- Algebraic number fields, rings of algebraic integers
- Conjugates, discriminants, norms and traces
- Examples of algebraic number fields: quadratic and cyclotomic fields
- Arithmetic in algebraic number fields: unique factorization domains, principal ideal domains, non-unique factorizations of algebraic integers
- Ideals: unique factorization of ideals into prime ideals
- Minkowski’s theorem
- Sums of two squares and sums of four squares
- The ideal class group and the finiteness of the class number
- Dirichlet’s unit theorem


Prerequisites: Math 653 (Algebra I), or permission from the instructor.

Grading: Course grades will be based on weekly homework problems (30%), on a short paper (8–10 pages) due at the end of the semester (50%), and on class participation (20%). The paper should be on a topic of your choice that is not covered in class but that is related to algebraic number theory: typically this will involve working through a topic in a research paper or advanced text and showing you have synthesized the topic well enough to write a short report on it. Class participation is based on attendance and involvement in class discussions.
**Missed Work:** Making up missed work (including missed exams, quizzes, and homework) will be arranged according to University policies only. A university approved excuse must be provided to the instructor in writing (e-mail is sufficient) within 1 working day for exams and within 2 working days for other work.

**Academic Dishonesty:** “An Aggie does not lie, cheat, or steal or tolerate those who do.” It is not permissible to hand in the work of others for a grade, including work on exams, quizzes, and homework. You are allowed to discuss homework with others, but your write-ups are expected to be done on your own and in your own words. Copying the work of others will be prosecuted to the full extent possible under University policies. Please see the Honor Council Rules and Procedures on the web at http://www.tamu.edu/aggiehonor/.

**Disability Assistance:** The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services in Cain Hall, Room B118, or call 845-1637. Students seeking special considerations for an exam must contact this office several weeks in advance of the exam. For more information, visit http://disability.tamu.edu.