Term Information

Effective Term	Autumn 2016

General Information

Course Bulletin Listing/Subject Area	Mathematics
Fiscal Unit/Academic Org	Mathematics - D0671
College/Academic Group	Arts and Sciences
Level/Career	Graduate
Course Number/Catalog	7121.02
Course Title	Algebraic Number Theory
Transcript Abbreviation	Algebr Numb Theory
Course Description	Algebraic integers, Dedekind domains, ideal class group; Galois theory of prime ideals, Frobenius automorphisms; geometry of numbers; cyclotomic fields, class field theory over Q; quadratic fields; local fields; ideles and adeles.
Semester Credit Hours/Units	Fixed: 3

Offering Information

Length Of Course	14 Week
Flexibly Scheduled Course	Never
Does any section of this course have a distance education component?	No
Grading Basis	Satisfactory/Unsatisfactory
Repeatable	No
Course Components	Lecture
Grade Roster Component	Lecture
Credit Available by Exam	No
Admission Condition Course	No
Off Campus	Never
Campus of Offering	Columbus

Prerequisites and Exclusions

Prerequisites/Corequisites	By permission of the instructor. This course section is open only to mathematics post-candidacy students.
Exclusions	

Cross-Listings

Cross-Listings

Subject/CIP Code

Subject/CIP Code	27.0102
Subsidy Level	Doctoral Course
Intended Rank	Doctoral

Requirement/Elective Designation

The course is an elective (for this or other units) or is a service course for other units

Course Details

Course goals or learning objectives/outcomes

- Students will acquire the theoretical understanding and problem solving skills in algebraic number theory that will enable them to use techniques in this field in conducting mathematical research in related areas.

Content Topic List

- Basic algebraic number theory: algebraic integers: rings of integers, Dedekind domains, unique factorization into prime ideals, ideal class group
- Galois theory of prime ideals: inertia groups, decomposition groups, Frobenius automorphisms
- Geometry of numbers: finiteness of class group, Dirichlet's unit theorem, discriminant and different, Minkowski's constant
- Cyclotomic fields, class field theory over Q (including statement of Kronecker-Weber, without proof); character sums, and exponential sums; quadratic fields
- Local fields: absolute values, completions, local rings of integers, extension of absolute values, unramified extensions
- Ideles and adeles
- Survey of class field theory

Attachments

- MATH_7121.02_Syllabus.pdf: 7121.02 Syllabus

(Syllabus. Owner: Kerler,Thomas)

Comments

- This course request relates to our course change request for Math 7121.01. (See that request for explanations and rationale) *(by Kerler,Thomas on 11/27/2015 09:42 PM)*

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Kerler,Thomas	12/01/2015 02:06 PM	Submitted for Approval
Approved	Husen,William J	12/01/2015 02:07 PM	Unit Approval
Approved	Haddad,Deborah Moore	12/01/2015 03:08 PM	College Approval
Pending Approval	Nolen,Dawn Vankeerbergen,Bernadette Chantal Hanlin,Deborah Kay Jenkins,Mary Ellen Bigler Hogle,Danielle Nicole	12/01/2015 03:08 PM	ASCCAO Approval

Math 7121.02 Syllabus **Autumn 2016**

Algebraic Number Theory

Instructor and Class Information

Lecturer: J. Cogdell

Office: MW 632

Phone: 2-8678

Email: cogdell.1

Course Number:

Lecture Room:

Lecture Times: 1:50

Office Hours:

About Course Goals

FORMAT

The course will meet three times a week for 55 minutes each meeting. Instructions will be mainly by lecture delivered by the instructor. It may also include occasional in-class discussion as well as short student presentations, particularly, by post-candidacy students.

DESCRIPTION & GOALS

7121 is a course in algebraic number theory. The main objects of study are number fields (finite extensions of the rational number field Q); their rings of integers, prime ideals, unique factorization into prime ideals, the ideal class group, and ramification; their invariants such as the the different and discriminant, the class number and the regulator. We use a combination of local and global techniques. In particular we will study local fields, the real and complex fields, and the various p-adic fields that arise as completions of number fields, and their relation with algebraic number fields. The remaining time will be dedicated to a survey of class field theory. Class field theory centers on the following type of question: for a number field k, describe the finite abelian extensions K/k, and particularly the splitting of primes in these extensions, in terms of data internal to k.

PREREQUISITES

This section is open only to mathematics post-candidacy students and requires, in addition, the permission of the instructor.

Textbook

MAIN REFERENCE

Jim Milne: *Algebraic Number Theory*. Course notes from the University of Michigan. Available at http://www.jmilne.org/math/CourseNotes/ant.html.

ADDITIONAL REFERENCES

E. Artin: *Theory of Algebraic Numbers*, in *Exposition by Emil Artin: A Selection*, Edited by: Michael Rosen, AMS, Providence, 2006.

S. Lang, *Algebraic Number Theory*, (1970). Springer GTM **110**.

J. Neukirch, *Algebraic Number Theory* (1992). Springer Grundlehren **322**.

Assessments

READING, PARTICIPATION, AND ATTENDANCE

Students are required to read scheduled textbook materials and actively participate in class room discussions that arise from lecture material. Students are expected to attend all classes.

RESEARCH ORIENTED PRESENTATION

Post-candidacy students in this section are required to deliver a half hour presentation that both synthesizes lecture material and connects it to relevant research questions, more advanced theoretical topics, or applications in other fields of mathematics. The topic and required independent reading will be determined by the instructor individually in negotiation with the student. Presentations may also be replaced by respective research papers upon the request of the student.

Grading

COURSE GRADE

This course section is graded satisfactory/unsatisfactory. A satisfactory outcome will require continued active participation in class (weighed about 20%) and be further based on the student's performance during the presentation (weighed about 80%).

Weekly Schedule

Week 1	Integrality, rings of integers in a number field
Week 2	The trace form; discriminants of number fields
Week 3	Dedekind domains; localization
Week 4	Prime factorization of ideals; fractional ideals
Week 5	Factorizations in extensions
Week 6	The discriminant and different
Week 7	Finiteness of the class number
Week 8	Class number & Minkowski's geometry of numbers
Week 9	Dirichlet unit theorem; the regulator
Week 10	Cyclotomic fields
Week 11	Valuations; local fields
Week 12	Hensel's Lemma & Krasner's Lemma
Week 13	Ramified and unramified extensions of local fields
Week 14	Class field theory

General Policies

ACADEMIC MISCONDUCT

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed;

illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct (http://studentaffairs.osu.edu/info_for_students/csc.asp)."

DISABILITY SERVICES

Students with disabilities that have been certified by the Office for Disability Services will be appropriately accommodated and should inform the instructor as soon as possible of their needs. The Office for Disability Services is located in 150 Pomerene Hall, 1760 Neil Avenue; telephone 292-3307, TDD 292-0901; http://www.ods.ohio-state.edu/.