2013年度 後期	対象学年	4年	レベル	2	2単位	専門科目・選択

【Subject and Title】 Perspectives in Mathematical Sciences IV
Kummer's ideal numbers

【Lecturer】 Lars Hesselholt

【The Method of Evaluation】Grades based on attendance and written reports.

【References】Lecture notes will be handed out at the beginning of each class. See also:

[1] Charles A. Weibel, *The K-book: An introduction to algebraic K-theory*, Chapters I and II, available for free download at www.math.rutgers.edu/∼weibel/Kbook.html.

【The Purpose of the Course】In 1847, Lamé and Cauchy announced proofs of Fermat's last theorem in a meeting of the French Academy of Sciences. However, shortly thereafter, Kummer pointed out a fatal error in the proofs. In a way, this was a most fortunate turn of events, for some very important parts of modern mathematics grew out of Kummer's work. This portion of the course will present some parts of this mathematics. In the end, I will present a conjecture of Kummer—or as he wrote, "a theorem still to be proved"—that to this day remains an important open problem.

【The Plan of the Course】Here is a tentative outline:

Lecture 1: Rings, modules, and their homomorphisms. Matrices. Simple rings and their classification. Semi-simple rings.

Lecture 2: Free modules and projective modules. Every projective module over a local ring is free. The Grothendieck group.

Lecture 3: Invertible modules over a commutative ring and the Picard group. Dedekind domains and their Picard groups. The Picard group of a ring of integers in a number field is finite.

Lecture 4: Rings of integers in cyclotomic fields and their Picard group. Kummer's theorem on regular prime numbers. The Kummer-Vandiver conjecture.

【Keywords】Modules, projective modules, Grothendieck group, invertible modules, Picard group, cyclotomic fields, regular prime numbers, the Kummer-Vandiver conjecture.

【Required Knowledge】Knowledge of standard undergraduate algebra and linear algebra.

【Attendance】This course is open for any students at Nagoya University as one of the "open subjects" of general education.

【Additional Advice】 《未記入》

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