科目ナンバリング	U-LAS70 10002 SE50						
授業科目名<英訳>	ILAS Seminar-E2 :Encounters with modern arithmetic（現代整数論との出会い） ILAS Seminar-E2 :Encounters with modern arithmetic			担当者所属職名・氏名	数理解析研究所 講師　　上田　福大		
群	少人数群	単位数	2単位	週コマ数	1コマ	授業形態	ゼミナール（対面授業科目）
開講年度・開講期	2024・前期	受講定員(1回生定員)	15 (15) 人	配当学年	主として1回生	対象学生	全学向
曜時限	木5	教室	共北36			使用言語	英語
キーワード	Galois theory / polynomials / modern algebra						

[授業の概要・目的]

It is a classical question from centuries ago whether a quintic (or of higher degree) polynomial equation is solvable in terms of its coefficients, with only use of the usual operations (addition, subtraction, multiplication, division) and application of radicals (square roots, cube roots, etc). It was French mathematician E. Galois who proposed the correct framework for such a question, the answer to which turns out to be negative in general. Nowadays, the theory of Galois has become an essential part of modern abstract algebra.

The so-called "fundamental theorem of Galois theory" is commonly considered as the summit of a course in (undergraduate) abstract algebra, which usually takes a year to complete. In this half-year course we start from the beginning of abstract algebra, with emphasis on the concepts and examples that shall help us reach Galois theory.

It is worth mentioning that abstract algebra has also found applications in science and engineering, e.g. in cryptography.

[到達目標]

We will learn the basic concepts and theorems in group theory, ring theory, field theory, and Galois theory. As an application, we shall also be able to determine which polynomial equations are solvable in radicals.

[授業計画と内容]

We intend to cover a big chunk of modern algebra in a condensed and interesting way, to make it accessible to most undergraduate students. Both concepts and examples will be emphasized.

Below is the plan and contents of the course. (The lectures, as well as the order of the lectures, may be modified, depending on students' background and understanding of the course materials.)

- Set Theory [1 week]:
  Notion of sets, mappings, mathematical induction, Zorn's lemma.

- Group theory [3-4 weeks]:
  Definition and examples of groups, homomorphisms, abelian groups, Sylow's theorem.

- Ring theory [3-4 weeks]:
  Definition and examples, ideals, Euclidean domains, PIDs, UFDs, polynomial rings.

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- Field theory [2-3 weeks]:
  Definition and examples, field extensions, polynomials, finite fields.

- Galois theory [2-3 weeks]:
  Galois extensions, roots of unity, solvability.

Total: 14 classes and 1 feedback

[履修要件]

It is helpful to know basics in linear algebra, but not required.

[成績評価の方法・観点]

The evaluation consists of the following weighted parts:

- Performance in class (20%).

- Presentation (60%): Each student reviews a mathematical topic assigned by the instructor.

- Report (20%): An essay on the topic of presentation.

[教科書]

D. Dummit and R. Foote 『Abstract Algebra』（Wiley; 3rd edition）ISBN:9780471433347
There is no need to purchase the textbook in advance. The details will be explained in the first class.

[参考書等]

（参考書）

Other supplemental materials will be introduced during the classes.

[授業外学修（予習・復習）等]

Along with preparation and review, students are encouraged to form study groups.

[その他（オフィスアワー等）]