SYLLABUS FOR MATH3040 - SPRING 2023

Description: This course is an introduction to the theory of field extensions and Galois theory. It is one of the continuations of MATH3030 (the other being MATH4080). Topics include: field extensions, algebraic extensions, algebraic closures, geometric constructions, finite fields, splitting fields, separable and inseparable extensions, Galois extensions, Galois correspondences, cyclotomic extensions, solvability by radicals, etc. Students are expected to have knowledge in MATH2040, MATH2070 and MATH3030, or equivalent.

Teachers:
  (1) Instructor: Michael McBreen,
      Lady Shaw Building, Office 235.
      email : mcb@math.cuhk.edu.hk
  (2) TA: Xie Kaitao
      email : ktxie@math.cuhk.edu.hk,

Lectures:
  - Mo 2:30PM - 4:15PM - Mong Man Wai Bldg 705
  - We 4:30PM - 5:15PM - Mong Man Wai Bldg 705

0.1. **Tutorial:**
  - We 5:30PM - 6:15PM - Mong Man Wai Bldg 705

0.2. **Office Hours:**
  - We 3:15PM-4:15PM - Lady Shaw Building 235

Texts:
  (1) Fraleigh: A first course in Abstract Algebra, Addison-Wesley, 7th edition.
  (2) Lecture notes to be posted on Blackboard.

Homework: Homework will be administered using Blackboard. You need to submit answers online on blackboard.

Assessment Scheme:
  (1) Homework 20%
  (2) Midterm 30%
  (3) Final Exam 50%

Topics by Week

(1) Recollections on field extensions and linear algebra over a field. §29, §30[1]
(2) Algebraic Extensions. §31
(3) Geometric Constructions. §32
(4) Finite Fields. §33
(5) Automorphisms of Fields §48
(6) Extending Isomorphisms §49
(7) Splitting Fields §50
(8) Separable Extensions §51
(9) Galois Theory §53
(10) Examples §54
(11) Cyclotomic Extensions (Part I) §55
(12) Cyclotomic Extensions (Part II) §55
(13) Insolvability of the Quintic §56

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[1]§n indicates the corresponding chapter of Fraleigh.

Grade Descriptor.

- **A :** Demonstrates well integrated knowledge and a deep understanding of the basics of field extensions and Galois theory; shows perfect logical rigorous arguments; able to completely solve unfamiliar and nonstandard problems, and provide innovative approaches to challenging ones.
- **A- :** Demonstrates good knowledge and a strong understanding of the basics of field extensions and Galois theory; shows almost impeccable rigor in deduction; able to provide highly accurate solutions to unfamiliar and nonstandard problems.
- **B :** Demonstrates essential knowledge and a good understanding of the basics of field extensions and Galois theory; shows successful derivation with rigor; able to solve unfamiliar but standard problems.
- **C :** Demonstrates satisfactory knowledge and an understanding, perhaps with gaps, of the basics of field extensions and Galois theory; shows reasonable but imperfect attempt in logical deduction; able to solve slight variations of routine problems.
- **D :** Demonstrates disconnected knowledge and only a limited understanding of the basics of field extensions and Galois theory; shows sketchy argument with barely rigorous logic; able to solve routine problems.
- **F :** Unable to demonstrate sufficient knowledge and understanding of the basics of field extensions and Galois theory; shows very little real attempt in deductive argument; unable to solve the simplest type of problems.

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