

ALGEBRAIC NUMBER THEORY II

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| 1 | Course Title: | ALGEBRAIC NUMBER THEORY II | |
| 2 | Course Code: | MAT5208 | |
| 3 | Type of Course: | Optional | |
| 4 | Level of Course: | Second Cycle | |
| 5 | Year of Study: | 1 | |
| 6 | Semester: | 2 | |
| 7 | ECTS Credits Allocated: | 6.00 | |
| 8 | Theoretical (hour/week): | 3.00 | |
| 9 | Practice (hour/week): | 0.00 | |
| 10 | Laboratory (hour/week): | 0 | |
| 11 | Prerequisites: | none | |
| 12 | Language: | Turkish | |
| 13 | Mode of Delivery: | Face to face | |
| 14 | Course Coordinator: | Prof. Dr. OSMAN BİZİM | |
| 15 | Course Lecturers: | Prof. Dr. Osman BİZİM | |
| 16 | Contact information of the Course Coordinator: | Uludağ Üniversitesi, Fen-Edebiyat Fakültesi Matematik Bölümü, Görükle Bursa-TÜRKİYE 0 224 294 17 57 / obizim@uludag.edu.tr | |
| 17 | Website: | | |
| 18 | Objective of the Course: | The aim of this lecture is to illustrate how basic notions from the theory of algebraic numbers may be used to solve problems in number theory. The main focus is to extend properties of the integer numbers to more general number structures: algebraic number fields and their rings of algebraic integers. So students can So students have the ability conduct original research and independent publication. | |
| 19 | Contribution of the Course to Professional Development: | | |
| 20 | Learning Outcomes: | | |
| | | 1 | Learns integral domains, unique factorization domains, ideals, Noetherian domains, principal ideal domains. |
| | | 2 | Learns field extensions, auto-morphisms, Galois groups. |
| | | 3 | Learns norms and traces, integral bases and discriminants, norms of ideals. |
| | | 4 | Learns class groups, binary quad-ratic forms, ideal class group. |
| | | 5 | Learns Kummer extensions and class-field theory and ideal decomposition in number fields, ramification. |
| | | 6 | Learns, the ideal class group, Minkowski theorem, determining the ideal class group. |
| | | 7 | Learns, Dirichlet's unit theorem, valuations and properties of valuations. |
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| 21 | Course Content: | | |
| | | Course Content: | |

| Week | Theoretical | Practice |
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| 1 | Integral domains, unique factorization domains, ideals. | |
| 2 | Noetherian domains, principal ideal domains, algebraic numbers and number fields, quadratic fields. | |
| 3 | Field extensions, automorphisms, Galois groups. | |
| 4 | Norms and traces, integral bases and discriminants, norms of ideals. | |
| 5 | Class groups, binary quadratic forms, ideal class group. | |
| 6 | Prime power representation, Bachet's equation, The Fermat equation, factor-ing. | |
| 7 | Ideal decomposition in number fields, ramification. | |
| 8 | Splitting of prime ideals, Galois theory and decomposition. | |
| 9 | The ramification of prime ideals in Galois extensions. | |
| 10 | The fundamental theorem of abelian extensions and numerical examples. | |
| 11 | Kummer extensions and class-field theory. | |
| 12 | The ideal class group, Minkowski theorem, determining the ideal class group. | |
| 13 | Dirichlet's unit theorem, valuations and properties of valuations. | |
| 14 | Roots of unity, fundamental units in cubic fields, regulator. | |

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| 22 | Textbooks, References and/or Other Materials: | [1]Algebraic Number Theory and Fermat's Last Theorem, Ian Stewart, David Tall. [2] Algebraic Number Theory, J. Neukirch. [3]Introductory Algebraic Number Theory, Ş. Alaca, K.S. Williams. [4]Algebraic Numbers, Paulo Ribenboim. |
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| 23 | Assesment | |
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| TERM LEARNING ACTIVITIES | NUMBE R | WEIGHT |
|--|---------|--------|
| Midterm Exam | 0 | 0.00 |
| Quiz | 0 | 0.00 |
| Homeworks, Performances | 0 | 0.00 |
| Final Exam | 1 | 100.00 |
| Total | 1 | 100.00 |
| Contribution of Term (Year) Learning Activities to Success Grade | | 0.00 |
| Contribution of Final Exam to Success Grade | | 100.00 |
| Total | | 100.00 |
| Measurement and Evaluation Techniques Used in the Course | | |

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| 24 | ECTS / WORK LOAD TABLE | |
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| Activites | Number | Duration (hour) | Total Work Load (hour) |
|----------------------------|--------|-----------------|------------------------|
| Theoretical | 14 | 3.00 | 42.00 |
| Practicals/Labs | 0 | 0.00 | 0.00 |
| Self study and preperation | 14 | 5.00 | 70.00 |
| Homeworks, Performances | 0 | 0.00 | 0.00 |
| Projects | 0 | 0.00 | 0.00 |
| Field Studies | 0 | 0.00 | 0.00 |
| Midterm exams | 0 | 0.00 | 0.00 |
| Others | 14 | 5.00 | 70.00 |
| Final Exams | 1 | 43.00 | 43.00 |
| Total Work Load | | | 225.00 |
| Total work load/ 30 hr | | | 7.50 |
| ECTS Credit of the Course | | | 6.00 |

| 25 | CONTRIBUTION OF LEARNING OUTCOMES TO PROGRAMME QUALIFICATIONS | | | | | | | | | | | | | | | |
|---|---|-----|--------------|-----|-----|-----------------|-----|-----|---------------|------|------|--------------------|------|------|------|------|
| | PQ1 | PQ2 | PQ3 | PQ4 | PQ5 | PQ6 | PQ7 | PQ8 | PQ9 | PQ10 | PQ11 | PQ12 | PQ13 | PQ14 | PQ15 | PQ16 |
| ÖK1 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| ÖK2 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| ÖK3 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| ÖK4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| ÖK5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| ÖK6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| ÖK7 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| LO: Learning Objectives PQ: Program Qualifications | | | | | | | | | | | | | | | | |
| Contribution Level: | 1 very low | | 2 low | | | 3 Medium | | | 4 High | | | 5 Very High | | | | |