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Master in Mathematics

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MODULE HANDBOOK

Module Name	*Algebraic Number Theory*
Module level, if applicable	*Master Programme*
Code, if applicable	*MMM-6210*
Subtitle, if applicable	-
Courses, if applicable	*Algebraic Number Theory*
Semester(s) in which the module is taught	*1st Semester*
Person responsible for the module	*Chair of the Algebra Laboratory*
Lecturer(s)	*1. Dr. Budi Surodjo, M.Si.* *2. Uha Isnaini, M.Sc., Ph.D.*
Language	*Bahasa Indonesia*
Relation to curriculum	*Compulsory for Master of Mathematics*
Teaching methods	*lecture, project based*
Workload (incl. contact hours, self-study hours)	*Total workload is 136 hours per semester, which consists of 150 minutes lectures per week for 14 weeks, 180 minutes structured activities per week, 180 minutes individual study per week, in total is 16 weeks per semester, including mid exam and final exam.*
Credit points	*3*
Required and recommended prerequisites for joining the module	*Students should be familiar to elementary number theory and algebraic structures.*

Module objectives/intended learning outcomes	*On successful completion of this course, students should be able to:* *CO 1. solve problems related to basic number theory.* *CO 2. solves problems related to quadratic field arithmetic Q[$\sqrt{D}$].* *CO 3. solve problems related to quadratic forms and elliptic curves.* *CO 4. apply algebraic number theory to other fields such as cryptography and coding*
Content	*The study material for algebraic number theory can be divided into 2 parts:* *A. Elementary number theory and quadratic field (before mid-exam)* *Divisibility, Congruences, Division Algorithms, Diophantine equations, Jacobi symbols, quadratic residue, Basic Ring Theory (definitions and examples, ideals, homomorphisms, factor rings, prime ideals, operations on ideals, prime ideals and maximal ideals), Quadratic Field (Q[$\sqrt{D}$]) arithmetic, ideal factorization, ideal norm, fractional ideals, prime ideals, ideal group class, computational ideal group class,* *B. Quadratic form, elliptic curve, and application of algebraic number theory* *Theory of quadratic form, quadratic form parameters, reduced definite positive form, Elliptic curves (definitions and examples, transformations to the Weierstrass form, elliptic curves over C, R and other fields), Application of algebraic number theory in cryptography and coding theory.*
Examination forms	*oral presentation, writing project, written exam (for mid exam and final exam), project presentation*
Study and examination requirements	*The final mark will be weighted as follows:* *No — Assessment methods (components, activities) — Weight (percentage)* *1 — Final Examination — 25-35%* *2 — Mid-Term Examination — 25-35%* *3. — Project — 50%* *Minimum final mark to pass : 50 (grade C)*
Media employed	*Board, LMS eLOK UGM, Course Material*

Reading list	*[1] Trifković, M., 2013, Algebraic theory of quadratic numbers. Springer.* *[2] Koch, H., 2012, Algebraic number theory, Springer Science & Business Media.* *[3] Lang, S., 2013, Algebraic number theory, Springer Science & Business Media.* *[4] Cohen, H., Axler, S. and Ribet, K.A., 2007, Number theory: Volume I: Tools and diophantine equations, Springer New York.* *[5] Voight, J., 2021, Quaternion algebras, Springer Nature.*

CO-PLO Mapping

	PLO 1	**PLO 2**	**PLO 3**	**PLO 4**	**PLO 5**	**PLO 6**
CO 1		v	v	V		
CO 2		V	v	v		
CO 3		v	v		V	
CO 4		v	v		v	v

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