



UNIVERSITAS GADJAH MADA

Faculty of Mathematics and Natural Sciences

Mathematics Department

Sekip Utara Bulaksumur Yogyakarta 55281 Telp: +62 274 552243 Fax: +62 274 555131 Email: math@ugm.ac.id Website: matematika.fmipa.ugm.ac.id

Doctoral Program in Mathematics

Telp : +62 274 552243

Email : maths3@ugm.ac.id;

Website : <http://math.fmipa.ugm.ac.id/dpmath>

MODULE HANDBOOK
Doctoral in Mathematics

Module name:	Coding Theory												
Module level, if applicable:	Doctoral Program												
Code, if applicable:	MMM 6207												
Semester(s) in which the module is taught:	Even semester												
Person responsible for the module:	Chair of Algebra Research Group												
Lecturer(s):	Dr. Al. Sutjijana, M.Sc. Dr. rer. nat. Indah Emiliana, M.Si. Dr. Budi Surodjo, M.S.												
Language:	Bahasa Indonesia												
Relation to curriculum:	Doctoral Degree in Mathematics, Compulsory / Elective Course												
Credit points:	3 Semester Credit Unit												
Type of teaching, contact hours:	3x50 minutes lectures, 3x60 minutes structured activities.												
Workload:	<ul style="list-style-type: none"> • 3x50 minutes lectures, • 3x60 minutes structured activities, • 3x60 minutes individual study, • In 16 weeks per semester (including assignments and examinations) 												
Recommended prerequisites:	Students should be proficient in linear algebra, intro. to ring and group theories.												
Module objectives/intended learning outcomes:	<p>On successful completion of this course, students should be able to:</p> <p>CO 1. ability to prove the fundamental properties of coding such as encoding, decoding.</p> <p>CO 2. ability to find a generator matrix and a parity-check matrix of a linear code.</p> <p>CO 3. ability to encode and decode linear codes (standard array decoding, syndrome decoding) and some special linear codes, such as self- dual codes, and cyclic codes, BCH Codes, Reed Solomon Codes, Goppa Codes.</p> <p>CO 4. ability to do further studies and research in coding theory</p>												
Content:	<p>a. Introduction, basic theory and some over view of applications of Error Correcting Codes, Communication channels, maximum likelihood decoding, Hamming distance, nearest neighbor decoding, distance of a code.</p> <p>b. Fields, Polynomials rings, structure of finite fields, minimal polynomials.</p> <p>c. Linear Codes, Hamming weight, bases for linear code, Generator matrix and parity check matrix, equivalence code, encoding and decoding of linear code, cosets, nearest neighbor decoding, syndrome decoding.</p> <p>d. Cyclic Codes, BCH Codes, Reed Solomon Codes, Goppa Codes.</p>												
Study and examination requirements and forms of examination:	<p>The final mark will be weighted as follows:</p> <table border="1"> <thead> <tr> <th>No</th> <th>Assessment methods (components, activities)</th> <th>Weight (percentage)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Final Examination</td> <td>40%</td> </tr> <tr> <td>2</td> <td>Mid-Term Examination</td> <td>30%</td> </tr> <tr> <td>3</td> <td>Class Activities: Quiz, Homework, etc</td> <td>30%</td> </tr> </tbody> </table>	No	Assessment methods (components, activities)	Weight (percentage)	1	Final Examination	40%	2	Mid-Term Examination	30%	3	Class Activities: Quiz, Homework, etc	30%
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1	Final Examination	40%											
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3	Class Activities: Quiz, Homework, etc	30%											
Media employed:	White/Black Board, LCD Projector, Laptop/Computer												

Reading List:	<ol style="list-style-type: none"> 1. Scott A. Vanstone, Paul C van Oorschot, P.C.V., 1989, <i>An Introduction to Error Correcting Codes with Application</i>, Kluwer Academic Publishers 2. San Ling and Chaoping Xing, 2004, <i>Coding Theory A First Course</i>, Cambridge University Press.
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Mapping of The COs and PLOs

	PLO - 1 S3 Mat	PLO - 2 S3 Mat	PLO - 3 S3 Mat	PLO - 4 S3 Mat	PLO - 5 S3 Mat	PLO -6 S3 Mat
CO 1			√	√		
CO 2		√			√	
CO 3		√	√	√	√	
CO 4				√	√	√

Programme Learning Outcomes (PLO) Doctoral Programme in Mathematics

PLO-1	:	Attitude: Devote to God Almighty, uphold the humanity values, internalize academic values and ethics, responsible in working in the area of expertise independently.
PLO-2	:	Knowledge: Mastering philosophy of mathematics and one of the fields in mathematics (algebra, analysis, applied mathematics, statistics, computational mathematics, computational statistics).
PLO-3	:	Knowledge: Able to think logically, analytically, inductively, deductively, and structured; having the ability to manage, lead, and develop research programs independently, and able to communicate the thoughts as well as his work to the scientific community and the general public.
PLO-4	:	Skill: Creating new concepts and / or new methods (original) in the field of mathematics that are recognized nationally and internationally.
PLO-5	:	Skill: Able to apply mathematics according to their field of expertise to solve problems including those that require a multidisciplinary, cross-disciplinary, or trans-disciplinary approach.
PLO-6	:	Life Long Learning: Having lifelong learning skills and adaptive to the development of science and technology, especially in fields related to Mathematics and its applications.