



# 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](mailto:math@ugm.ac.id) Website: [matematika.fmipa.ugm.ac.id](http://matematika.fmipa.ugm.ac.id)

## Doctoral Program in Mathematics

Telp : +62 274 552243

Email : [maths3@ugm.ac.id](mailto:maths3@ugm.ac.id);

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

**MODULE HANDBOOK**  
Doctoral in Mathematics

<b>Module name:</b>	Module Theory												
<b>Module level, if applicable:</b>	Doctoral Program												
<b>Code, if applicable:</b>	MMM 5204												
<b>Semester(s) in which the module is taught:</b>	Second year (Even semester).												
<b>Person responsible for the module:</b>	Chair of Algebra Research Group												
<b>Lecturer(s):</b>	1. Prof. Dr. Indah Emilia Wijayanti 2. Dr. Ari Suparwanto, M.Si.												
<b>Language:</b>	Bahasa Indonesia												
<b>Relation to curriculum:</b>	Doctoral Degree in Mathematics, Compulsory / Elective Course												
<b>Credit points:</b>	3 Semester Credit Unit												
<b>Type of teaching, contact hours:</b>	3x50 minutes lectures, 3x60 minutes structured activities.												
<b>Workload:</b>	<ul style="list-style-type: none"> <li>• 3x50 minutes lectures,</li> <li>• 3x60 minutes structured activities,</li> <li>• 3x60 minutes individual study,</li> <li>• In 16 weeks per semester (including assignments and examinations)</li> </ul>												
<b>Recommended prerequisites:</b>	Linear Algebra												
<b>Module objectives/intended learning outcomes:</b>	On successful completion of this course, students should be able to: CO 1 : recognize the fundamental properties of modules and submodules CO 2 : recognize the concept of module homomorphism CO 3 : develop the concepts of generator and linear independence in modules CO 4 : recognize the concept of exact sequence and use it for further analysis												
<b>Content:</b>	<ol style="list-style-type: none"> <li>1. Modules and Submodules,</li> <li>2. Direct sums,</li> <li>3. Factor modules,</li> <li>4. Annihilators, torsion modules and torsion free modules.</li> <li>5. Module homomorphisms</li> <li>6. Exact sequences</li> <li>7. Generator, basis and free modules,</li> <li>8. Projective modules,</li> <li>9. Modules over Principal Ideal Domain,</li> <li>10. Free modules and projective modules,</li> <li>11. Miscellaneous topics related to module theory for enriching student knowledge</li> </ol>												
<b>Study and examination requirements and forms of examination:</b>	<p>The final mark will be computed from a proportional weight of assignments, mid examination and final examination. 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%
No	Assessment methods (components, activities)	Weight (percentage)											
1	Final Examination	40%											
2	Mid-Term Examination	30%											
3	Class Activities: Quiz, Homework, etc	30%											

<b>Media employed:</b>	Boards, projectors.
<b>Reading List:</b>	<ol style="list-style-type: none"> <li>1. William Adkins and Steven H. Weintraub, 1992, <i>Algebra An Approach via Module Theory</i>, Springer-Verlag,</li> <li>2. Serge Lang, 1965, <i>Algebra</i>, Addison-Wesley Publishing Company, Massachusetts.</li> <li>3. Thomas W. Hungerford, 1974, <i>Algebra</i>, Springer-Verlag, New York.</li> <li>4. Saunders MacLane, Garrett Birkhoff, 1979, <i>Algebra Second Edition</i>, Macmillan Publishing Co., New York</li> </ol>

### 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			V			
CO 2			V			
CO 3		V	V			
CO 4		V	V			

#### Programme Learning Outcomes (PLO) Doctoral Programme in Mathematics

<b>PLO-1</b>	<b>Attitude:</b> Devote to God Almighty, uphold the humanity values, internalize academic values and ethics, responsible in working in the area of expertise independently.
<b>PLO-2</b>	<b>Knowledge:</b> Mastering philosophy of mathematics and one of the fields in mathematics (algebra, analysis, applied mathematics, statistics, computational mathematics, computational statistics).
<b>PLO-3</b>	<b>Knowledge:</b> 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.
<b>PLO-4</b>	<b>Skill:</b> Creating new concepts and / or new methods (original) in the field of mathematics that are recognized nationally and internationally.
<b>PLO-5</b>	<b>Skill:</b> 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.
<b>PLO-6</b>	<b>Life Long Learning:</b> Having lifelong learning skills and adaptive to the development of science and technology, especially in fields related to Mathematics and its applications.