



# UNIVERSITAS GADJAH MADA

Faculty of Mathematics and Natural Sciences

Department of Mathematics

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## Master in Mathematics

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## MODULE HANDBOOK

Module Name	<i>Functional Analysis</i>
Module level, if applicable	<i>Master</i>
Code, if applicable	<i>MMM-5103</i>
Subtitle, if applicable	-
Courses, if applicable	<i>Functional Analysis</i>
Semester(s) in which the module is taught	<i>2<sup>nd</sup> (second) semester</i>
Person responsible for the module	<i>Chair of the Analysis Lab.</i>
Lecturer(s)	<i>Prof. Dr. Ch. Rini Indrati, M.Si.; Hadrian Andradi, M.Sc., Ph.D.</i>
Language	<i>Bahasa Indonesia</i>
Relation to curriculum	<i>Compulsory course in the first year (2<sup>nd</sup> semester) of master's degree for students majoring in mathematical analysis</i>
Teaching methods	<i>Lecture, class discussion, student presentation</i>
Workload (incl. contact hours, self-study hours)	<i>Total workload is 135 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</i>
Credit points	3
Required and recommended prerequisites for joining the module	<i>Students have taken Analysis I and have participated in the final exam of the course. Students also have some basic theory in algebra, especially vector space, linear independence set, and orthonormal basis.</i>

Module objectives/intended learning outcomes	<p>After completing this course, the students should have the ability to:</p> <p>CO 1 prove some properties of continuous linear mapping and its norm</p> <p>CO 2 prove some characteristic subsets of a Hilbert space based on its inner product and continuous linear mapping</p> <p>CO 3 justify properties of some operators, especially projection, self-adjoint, and normal operators</p> <p>CO 4 justify and make use of some characteristics of completely continuous operator and proper value</p>												
Content	<ol style="list-style-type: none"> <li>1. Banach space: definition of Banach space, continuous linear mapping and its norm, dual space.</li> <li>2. Hilbert space: definition of Hilbert space, orthonormal basis, separable space, Riesz representation theorem</li> <li>3. Operators in Hilbert space: bilinear and sesquilinear mappings, adjoint of an operator, some types of operators (adjoint operator, projection operator, isometric operator, unitary operator, normal operator), invariant and reducing space.</li> <li>4. Spectral Theorem: proper value, approximate proper value, cc-operator, spectral theorem of normal operator.</li> </ol>												
Examination forms	Oral presentation, essay												
Study and examination requirements	<p>The final mark will be weighted as follows:</p> <table> <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>30-40%</td> </tr> <tr> <td>2</td> <td>Mid-Term Examination</td> <td>30-40%</td> </tr> <tr> <td>3</td> <td>Class Activities: Quiz, Homework, etc.</td> <td>20-30%</td> </tr> </tbody> </table> <p>Minimum final mark to pass is C</p>	No	Assessment methods (components, activities)	Weight (percentage)	1	Final Examination	30-40%	2	Mid-Term Examination	30-40%	3	Class Activities: Quiz, Homework, etc.	20-30%
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1	Final Examination	30-40%											
2	Mid-Term Examination	30-40%											
3	Class Activities: Quiz, Homework, etc.	20-30%											
Media employed	Board, LCD Projector, Laptop/Computer												
Reading list	<ol style="list-style-type: none"> <li>1. Berberian, S.K., 1999, Introduction to Hilbert space Vol. 287. American Mathematical</li> <li>2. Kreyszig, E., 1991. Introductory functional analysis with applications (Vol. 17). John Wiley &amp; Sons.</li> <li>3. Bachman, G. and Narici, L., 1998, Functional Analysis 2<sup>nd</sup> Edition, Dover Publications.</li> <li>4. Conway, J.B., 2019, A Course in Functional Analysis 3<sup>rd</sup> Edition, Springer Verlag, New York.</li> <li>5. Taylor, A.E., 1980, Introduction to Functional Analysis, John Wiley and Sons, New York.</li> </ol>												

### CO-PLO Mapping

	PLO 1	PLO 2	PLO 3	PLO4	PLO5	PLO6
CO 1	v	v	v			
CO 2	v	v	v	v	v	
CO 3	v	v	v	v	v	v
CO 4	v	v	v		v	v

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