



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:	Functional Analysis															
Module level, if applicable:	Doctoral Program															
Code, if applicable:	MMM 5103															
Semester(s) in which the module is taught:	1 st (first) or 2 nd (second)															
Person responsible for the module:	Chair of Analysis Research Group															
Lecturer(s):	Assigned Lecturer(s)															
Language:	Bahasa Indonesia															
Relation to curriculum:	Doctoral Degree in Mathematics, 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 have learned at least real analysis and vector spaces.															
Module objectives/intended learning outcomes:	<p>After completing this course the students have ability to:</p> <p>CO 1. prove some properties of continuous linear mapping and its norm.</p> <p>CO 2. prove some characteristics of set or subset of an Hilbert space based on its inner product and continuous linear mapping.</p> <p>CO 3. analyze properties of some types of operators, especially projection, self-adjoint and normal operators.</p> <p>CO 4. analyze and use the characteristic of cc-operator and its approximate proper value in spectral theorem.</p>															
Content:	<ol style="list-style-type: none"> 1. Banach space: Definition of Banach space, continuous linear mapping and its norm, dual space, strong convergence and weak convergence. 2. Hilbert space: Hilbert space as a normed space, minimizing vector space, orthogonality, orthonormal bases, separable, Riesz Representation Theorem, decomposition. 3. Operator/continuous linear mapping: adjoint of an operator, some types of operators (adjoint operator, projection operator, isometric operator, unitary operator, normal operator), invariant space, reduce. 4. Spectral Theorem: proper value, approximate proper value, cc-operator, spectral theorem of normal operator. 															
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>30%</td> </tr> <tr> <td>2</td> <td>Mid-Term Examination</td> <td>30%</td> </tr> <tr> <td>3</td> <td>Presentation</td> <td>25%</td> </tr> <tr> <td>4.</td> <td>Homework and quiz</td> <td>15%</td> </tr> </tbody> </table>	No	Assessment methods (components, activities)	Weight (percentage)	1	Final Examination	30%	2	Mid-Term Examination	30%	3	Presentation	25%	4.	Homework and quiz	15%
No	Assessment methods (components, activities)	Weight (percentage)														
1	Final Examination	30%														
2	Mid-Term Examination	30%														
3	Presentation	25%														
4.	Homework and quiz	15%														

	The initial cut-off points for grades A, B, C, and D should not be less than 80%, 65%, 50%, and 40%, respectively.
Media employed:	Board, LCD Projector, Laptop/Computer
Reading List:	<ol style="list-style-type: none"> 1. George Bachman and Lawrence Narici, 2012, "Functional Analysis", 2nd edition, Dover Singapore 2. Conway, J.B., 2007, "A Course in Functional Analysis", Springer Verlag, New York. 3. Taylor, E., 1967, "Introduction to Functional Analysis", John Wiley and Sons, New York.

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	v			v
CO 2		v	v			v
CO 3		v	v			v
CO 4		v	v			v

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.