



# UNIVERSITAS GADJAH MADA

Faculty of Mathematics and Natural Sciences

Mathematics Department

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## Doctoral Program in Mathematics

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**MODULE HANDBOOK**  
Doctoral in Mathematics

<b>Module name:</b>	Theory of Differential Equations																
<b>Module level, if applicable:</b>	Doctoral Program																
<b>Code, if applicable:</b>	MMM 5109																
<b>Semester(s) in which the module is taught:</b>	1 <sup>st</sup> (first) or 2 <sup>nd</sup> (second)																
<b>Person responsible for the module:</b>	Chair of Analysis Research Group																
<b>Lecturer(s):</b>	Prof. Dr. Ch. Rini Indrati, M.Si.																
<b>Language:</b>	Bahasa Indonesia																
<b>Relation to curriculum:</b>	Doctoral Degree in Mathematics, 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>	Students have taken the module of completeness, compactness, continuous function, and Arzelà-Ascoli Theorem.																
<b>Module objectives/intended learning outcomes:</b>	<p>After completing this course the students have ability to:</p> <p>CO 1. analyze theorems of analysis which are used in analyzing the existence and uniqueness of the solution of differential equations.</p> <p>CO 2. analyze the existence and uniqueness of the solution of initial value problem.</p> <p>CO 3. analyze the existence and uniqueness of the solution of linear system of differential equations with initial conditions.</p> <p>CO 4. analyze the characteristic of solution of differential equation and system.</p>																
<b>Content:</b>	<ul style="list-style-type: none"> <li>• Some theories in analysis: completeness</li> <li>• Differential equation of order one: Peano Theorem, Lipschitz condition, existence and uniqueness of the solution of initial value problem, Picard Theorem, approximation solution.</li> <li>• System of differential equations: Lipschitz condition, fundamental system, existence and uniqueness of the solution of system of differential equations of order one and differential equations of higher order.</li> <li>• Theory of differential equation and Linear systems of differential equations: Wronskian, General Linear Systems, Linear equations of higher order, and Linear Systems with constants coefficients.</li> </ul>																
<b>Study and examination requirements and forms of examination:</b>	<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>Class Activities: Presentation and Quiz</td> <td>25%</td> </tr> <tr> <td>4.</td> <td>Homework</td> <td>15%</td> </tr> </tbody> </table>		No	Assessment methods (components, activities)	Weight (percentage)	1	Final Examination	30%	2	Mid-Term Examination	30%	3	Class Activities: Presentation and Quiz	25%	4.	Homework	15%
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4.	Homework	15%															

	The initial cut-off points for grades A, B, C, and D should not be less than 80%, 65%, 50%, and 40%, respectively.
<b>Media employed:</b>	Board, LCD Projector, Laptop/Computer
<b>Reading List:</b>	<ol style="list-style-type: none"> <li>1. Witold Hurewicz, 1958, <i>Lectures on Ordinary Differential Equations</i>, The Technology Press of Massachusetts Institute of Technology and John Wiley &amp; Sons. Inc., New York.</li> <li>2. Earl A. Coddington and Norman Levinson, 1955, <i>Theory of ordinary differential equations</i>, McGraw-Hill Book Company, Inc., New York-Toronto-London.</li> <li>3. Earl A. Coddington and Robert Carlson, 1997, <i>Linear ordinary differential equations</i>, SIAMS, Philadelphia.</li> <li>4. Royden, H.L. and Fitzpatrick, P.M., 2010, <i>Real Analysis</i>, Edisi ke-4, Pearson Education, Inc.</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	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

<b>PLO-1</b>	<b>:</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>:</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>:</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>:</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>:</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>:</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.
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