Module Description of Finite Difference Methods

Module Name	:	Finite Difference Methods
Module Level	:	Bachelor
Code, if applicable	:	23H01121503
Subtitle, if applicable	:	-
Courses, if applicable	:	Finite Difference Methods
Semester(s) in which the module is taught	:	4 (Fourth Semester)
Module coordinator(s)	:	Agustinus Ribal, S.Si., M.Sc., Ph. D
Lecturer(s)	:	Agustinus Ribal, S.Si., M.Sc., Ph. D, Dr. Khaeruddin, M.Sc.
Language	:	Bahasa (Indonesian language)
Relation to curriculum	:	Elective course in second year for Bachelor degree in Mathematics
Type of teaching/teaching method	:	Lecturing, Small Group Discussion, Cooperative Learning, Self-Directed Learning
Contact hours	:	150 minutes lectures per week, 180 minutes structured activities per week, and 180 minutes independent study per week
Workload	:	Total workload is 135 hours per semester which consists of 40 hours per semester for Learning and Teaching, 47.5 hours per semester for Self-Study, and 47.5 hours per semester for Structured Works
Credit points	:	3 (4.8 ECTS)
Requirements according to the examination regulations	:	Students are required to attend at least 80% of the total meetings which is recorded via the attendance menu at https://sikola-v2.unhas.ac.id/, complete all mandatory assignments, and obtain permission from the lecturer to participate in the written examination.
Recommended prerequisites	:	Students have completed and taken the exams for Differential equation and partial differential equation
Module objectives/intended learning outcomes	:	After the completion of this module, the student will be able to: CLO 1. Understand several mathematical methods and concepts and apply these methods in several related fields such as industry, economics, and agriculture; CLO 2. Analyze and implement several optimization methods into other fields of study; CLO 3. Construct several mathematical models, explain procedures, and solve optimization problems using appropriate techniques and interpret the results obtained in other related fields;

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<tr><td></td><td></td><td>CLO 4. Able to communicate ideas, develop personal skills based on local wisdom, and easily adapt to communities with diverse backgrounds.
The following is the mapping of the ILO and the CLO of this course:
<table>
<tr><th></th><th>ILO 3</th><th>ILO 4</th><th>ILO 6</th><th>ILO 7</th></tr>
<tr><td>CLO 1</td><td>X</td><td>X</td><td></td><td></td></tr>
<tr><td>CLO 2</td><td></td><td>X</td><td></td><td></td></tr>
<tr><td>CLO 3</td><td></td><td></td><td>X</td><td></td></tr>
<tr><td>CLO 4</td><td></td><td></td><td></td><td>X</td></tr>
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<tr><td>Content</td><td>:</td><td>The Finite Difference Method course equips students with knowledge and skills to apply numerical approaches in solving partial differential equations (PDEs). Students learn the fundamental concepts of finite difference approximations through Taylor series expansion (forward, backward, and central differences). These methods are then applied to solve elliptic, parabolic, and hyperbolic PDEs under various boundary conditions—both regular and irregular—and in different coordinate systems (Cartesian, polar, and cylindrical). Ultimately, students are able to implement finite difference methods to solve real-world problems, including the two-dimensional heat equation and the convection-diffusion equation.</td></tr>
<tr><td>Study and examination requirements</td><td>:</td><td>Study and examination requirements:
● Students must attend 15 minutes before the class starts.
● Students must switch off all electronic devices.
● Students must inform the lecturer if they will not attend the class due to sickness, etc.
● Students must submit all class assignments before the deadline.
● Students must attend the exam to get final grade.</td></tr>
<tr><td>Exams and assessment formats</td><td>:</td><td>Participants are marked based on their performance in theory: Quizzes (16%), Written Exam (40%), Report (35%), and Assignments (9%).

Assignments assess student's ability to apply concepts independently, while Reports measure analytical and writing skills. Quizzes are used to test continuous understanding of weekly content. The Written Exam assesses comprehension and synthesis of all materials discussed during the semester. Altogether, these components account for 100% of the final grade.

Students are marked based on their percentage of points obtained and based on the following grade scale:</td></tr>
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<tr><th>Percentage of Achievement</th><th>Grade</th><th>Conversion Value</th></tr>
<tr><td>85 – 100</td><td>A</td><td>4.00</td></tr>
<tr><td>80 - <85</td><td>A-</td><td>3.75</td></tr>
<tr><td>75 - < 80</td><td>B+</td><td>3.5</td></tr>
<tr><td>70 - < 75</td><td>B</td><td>3.0</td></tr>
<tr><td>65 - < 70</td><td>B-</td><td>2.75</td></tr>
<tr><td>60 - < 65</td><td>C+</td><td>2.5</td></tr>
<tr><td>50 - < 60</td><td>C</td><td>2.00</td></tr>
<tr><td>40 - < 50</td><td>D</td><td>1.00</td></tr>
<tr><td>< 40</td><td>E</td><td>0.00</td></tr>
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</td><td></td></tr>
<tr><td>Reading list</td><td>:</td><td>
1. Hoffmann, K.A., Chiang, S.T., “Computational Fluid Dynamics for Engineers Volume1, 3rd edition”Engineering Education System,1995
2. Noye, J., “Computational Techniques for Differential Equations”, Elsevier Science Publisher B.V, 1984
3. Leon, L., Pinder, G.F., “Numerical Solution of Partial Defferential Equation in Science and Engineering”, John Wiley & Sons, 1982
4. Strauss, W. A., 2007: Partial Differential Equations: An Introduction. John Wiley & Sons.
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<tr><td>Last revision date</td><td>:</td><td>February 5th, 2025</td></tr>
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