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Faculty of Mathematics and Natural Sciences
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MODULE HANDBOOK

Module designation	*Dynamical Systems*
Semester(s) in which the module is taught	*6*
Person responsible for the module	*Dr. Rahmi Rusin*
Language	*Indonesian*
Relation to curriculum	*Elective*
Teaching methods	*Lectures, group discussions*
Workload (incl. contact hours, self-study hours)	*(Estimated) Total workload: 8.5 hours x 14 weeks + 3 hours x 2 weeks* *Contact hours: 2.5 hours lectures per week* *Private study including examination preparation, specified in hours[1]:* *3 hours structured activities, and 3 hours individual study per week*
Credit points	*3 SKS (4.77 ECTS)*
Required and recommended prerequisites for joining the module	*Ordinary Differential Equations*
Module objectives/intended learning outcomes	*After completing the course, students have the ability to understand and use the techniques in dynamical systems and apply them to the real-world systems. The approach emphasizes qualitative ideas rather than explicit computation.*

[1] When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.

<table>
<tr><td>Content</td><td>1. Overview: Dynamical Systems
2. Types of Systems
3. Examples of Dynamical Systems
4. System Modeling
5. Characteristics of Dynamical Systems
6. Existence and Uniqueness of Solutions
7. Equilibrium and Nullclines
8. Stability
9. Lyapunov Functions
10. Types of Nonlinear Systems
11. Limit Cycles
12. Bifurcation
13. Chaos
14. Linearization</td></tr>
<tr><td>Examination forms</td><td>1. Class activities : Quiz, homework
2. Group discussion sessions
3. Mid-term examination
4. Final examination</td></tr>
<tr><td>Study and examination requirements</td><td>The final mark will be weighted as follows:
1. Homework (20%).
2. Written Quiz (20%).
3. Mid-term examination (30%).
4. Final examinations (30%).
To succesfully pass the module it requires a minimum 55% of the total mark.
Mark — Grade
85—100 — A
80—<85 — A-
75—<80 — B+
70—<75 — B
65—<70 — B-
60—<65 — C+
55—<60 — C
40—<55 — D
<40 — E</td></tr>
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Reading list	1. *Stephen Lynch, Dynamical Systems with Applications using Maple, 2nd Edition, Springer, 2010* 2. *Patricia Mellodge, A Practical Approach to Dynamical Systems for Engineers, Woodhead Publishing, 2016.* 3. *Lecturer's Handout.* 4. *Videos.*