Module Description of Dynamical System

Module Name	:	Dynamical System
Module Level	:	Bachelor
Code, if applicable	:	23H01121603
Subtitle, if applicable	:	-
Courses, if applicable	:	Dynamical System
Semester(s) in which the module is taught	:	4 (Fourth Semester)
Module coordinator(s)	:	Prof. Dr. Syamsuddin Toaha, M.Sc.
Lecturer(s)	:	Prof. Dr. Syamsuddin Toaha, M.Sc. Prof. Dr. Jeffry Kusuma, Prof. Dr. Kasbawati, S.Si., M.Si.
Language	:	Bahasa (Indonesian language)
Relation to curriculum	:	Elective course in the 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 must have a good understanding about the basic concepts of the Differential Equations.
Module objectives/intended learning outcomes	:	After the completion of this module, the student will be able to: CLO 1. investigate the stability of a system; CLO 2. understand the importance of initial conditions and understand the meaning of the terms attractor and repeller; CLO 3. understand the importance of parameter values in a model; CLO 4. describe qualitatively the longterm behavior of a system; CLO 5. understand the sensitivity of chaotic systems to initial conditions. The following is the mapping of the ILO and the CLO of this course:

		<table><tr><th></th><th>ILO 4</th><th>ILO 5</th><th>ILO 6</th></tr><tr><td>CLO 1</td><td>X</td><td></td><td>X</td></tr><tr><td>CLO 2</td><td>X</td><td></td><td>X</td></tr><tr><td>CLO 3</td><td>X</td><td>X</td><td>X</td></tr><tr><td>CLO 4</td><td></td><td>X</td><td>X</td></tr><tr><td>CLO 5</td><td></td><td>X</td><td>X</td></tr></table>
Content	:	In dynamical systems, the model—usually represented by a set of differential or difference equations—determines the evolution of the system solely based on its initial state, that is, its long-term behavior once the initial conditions are given. The objective of this module is to study how to use such models to analytically and qualitatively predict the long-term behavior of a system.
Study and examination requirements	:	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.
Exams and assessment formats	:	Participants are marked based on their performance in theory: Written Exam (20%), Report (60%), and Assignments (20%). Assignments assess student's ability to apply concepts independently, while Reports measure analytical and writing skills. 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: <table><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></table>
Reading list	:	1. Arrowsmith, D.K., Place, C.M. 1982. Ordinary Differenitial Equations. Chapman and Hall. London. 2. J.D. Murray, Mathematical Biolgy I, Springer, New York.
Last revision date	:	February 5th, 2025