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MODULE HANDBOOK

Module name	Dynamical System
Module level, if applicable	Bachelor
Code, if applicable	MMM-3306
Subtitle, if applicable	-
Courses, if applicable	Dynamical System
Semester(s) in which the module is taught	6th (Sixth Semester)
Person responsible for the module	Chair of the Lab. of Applied Mathematics
Lecture(s)	Dr. Fajar Adi Kusumo, M.Si., and Prof. Dr. Widodo, M.S.
Language	Bahasa Indonesia
Relation to curriculum	Compulsory course in the third year (6th semester) Bachelor Degree
Type of teaching, contact hours	150 minutes lectures and 180 minutes structured activities per week.
Workload	Total workload is 136 hours per semester, which consists of 150 minutes lectures per week for 14 weeks, 180 minutes structured activities per week, 180 minutes individual study per week, in total is 16 weeks per semester, including mid exam and final exam.
Credit points	3
Requirements according to the examination regulations	Students have taken Dynamical System course (MMM-3306) and have an examination card where the course is stated on.
Recommended prerequisites	Students have taken Elementary Linear Algebra course (MMM-1202), Elementary Differential Equations course (MMM-2301), and have participated in the final examination of the course. Before taking this course, students must have a good understanding about the basic concepts of the Linear Algebra and Differential Equations.
Module objectives/intended learning outcomes	After completing the course, the students will be able to: CO1. recognize the concept of the Discrete and Continuous Dynamical Systems. CO2. recognize the concept of the Nonlinear Differential Equations CO3. analyze the fixed point and periodic point of the Discrete Dynamical System. CO4. analyze the invariant structures of the continuous dynamical system. CO5. do simple analysis to the mathematical models which are use the nonlinear differential equations and difference equations.
Content	Topics : **a.** Discrete Dynamical Systems : History and Definition of Discrete Dynamical Systems, Orbits, Graphical Analysis, Fixed Point, Fixed point and periodic points, Fixed point and periodic points, Bifurcations, Dynamics of quadratic maps' family $Q_c(x)=x^2 + c$. b. Continuous Dynamical System : Linear and Nonlinear Differential Equations, Definition of the Dynamical System and examples, Invariant structures (equilibrium points, periodic solution, and invariant manifold), Linearization and Stability of the equilibrium point, First Integral and Lyapunov Function, Poincare Map (introduction).
Study and examination requirements and forms of examination	The final mark will be weighted as follows: No — Assessment methods (components, activities) — Weight (percentage) 1 — Final Examination — 40% 2 — Mid-Term Examination — 30%

	3 Class Activities: Quiz, Homework, etc 30% The initial cut-off points for grades A, B, C, and D should not be less than 80%, 70%, 50%, and 40%, respectively.
Media employed	White/Black Board, LCD Projector, Laptop/Computer
Reading List	1. Robert L. Devaney, 1992, *A first course in chaotic dynamical systems*, Adison-Wesley Pub. Comp., Massachussets. 2. Lawrence Perko, 2001, *Differential Equations and Dynamical System*, 3rd Ed, Springer. 3. Stephen Wiggins, 1990, *Introduction to Applied Nonlinear Dynamical Systems and Chaos*, Springer-Verlag New York, Inc. 4. Verhulst, F., 1996, *Nonlinear Differential Equations and Dynamical Systems*, 2nd Ed., Springer-Verlag Berlin Heidelberg.

PLO and CO Mapping

	LO 1	LO 2	LO 3	LO 4	LO 5	LO 6	LO 7	LO 8	LO 9
CO 1						v			v
CO 2						v			v
CO 3					v	v			
CO 4					v	v			v
CO 5					v				v