MINISTRY OF EDUCATION, CULTURE, RESEARCH, AND TECHNOLOGY
UNIVERSITAS NEGERI SURABAYA
FACULTY OF MATHEMATICS AND NATURAL SCIENCE
UNDERGRADUATE PROGRAM OF MATHEMATICS
Ketintang Campus, C8-C9 Buildings of FMIPA, Surabaya
Email: s1-mat@unesa.ac.id

Module Handbook

Module Name :	*Sistem Dinamik* Dynamical Systems
Module level :	Bachelor degree/Undergraduate Program
Course Code :	4420103118
Abbreviation, if applicable:	-
Courses included in the module, if applicable:	Not Applicable
Semester/Term	7th/ fourth year
Module coordinator(s)	Dr. Abadi, M.Sc
Lecturer(s):	Rudianto Artiono, M.Si Budi Priyo Prawoto, M.Si
Language:	Bahasa Indonesia (Indonesian Language)
Classification within the curriculum:	~~Compulsory~~/ Elective
Teaching format/class hours per week during the semester:	3 contact hours of lectures (*sks* or credit unit*)
Workload :	3 x 50 minutes lectures, 3 x 60 minutes structured activity, and 3 x 60 minutes individual activity per week, 14 weeks per semester 119 total hours per semester ~ 4.77 ECTS**
Credit Unit:	3 credit unit (4.77 ECTS)
Requirements:	Mathematics modelling Ordinary differential equations Elementary linear algebra

MINISTRY OF EDUCATION, CULTURE, RESEARCH, AND TECHNOLOGY
UNIVERSITAS NEGERI SURABAYA
FACULTY OF MATHEMATICS AND NATURAL SCIENCE
UNDERGRADUATE PROGRAM OF MATHEMATICS
Ketintang Campus, C8-C9 Buildings of FMIPA, Surabaya
Email: s1-mat@unesa.ac.id

Learning goals/competencies:	**Knowledge (KNO-1:** Demonstrating mathematical knowledge and mathematical insight**)**
	CLO-1: Demonstrate knowledge and insight of planar linear systems
	CLO2: Demonstrating knowledge and insight of nonlinear systems
	Skill (SKI-3: Able to analyze the formal structure of mathematical problems and relevant fields **)**
	CLO-3: Analyze the formal structure of mathematical problems and relevant areas.
	CLO-4: Analyze the formal structure of mathematical problems and relevant fields in nonlinear systems
	Competences (COM-2: Generating ideas used for completing mathematical tasks and to communicate them either in writing or orally, in accordance with scientific principles**)**
	CLO-5: Able to generate ideas that are used to complete mathematical tasks on a linear planar system and communicate them in writing and orally, in accordance with scientific rules.
	CLO-6: Able to generate ideas that are used to complete mathematical tasks on a planar nonlinear system and communicate them in writing and orally, in accordance with scientific rules
	Social (SOC-1: Able to work together and have social sensitivity and be able to bring change to a technoecopreneurship society)
	CLO-7: Able to work together and have social sensitivity and be able to bring change to a technoecopreneurship society
Content	This course discusses Studying Planar linear systems, planes and phase portraits, points of equilibrium, stability analysis, planar nonlinear systems, high dimensional nonlinear systems, linearization, eigenvalue analysis, bifurcation. Lecture activities are carried out in a student center with discussions, observations, project assignments, and presentations.

MINISTRY OF EDUCATION, CULTURE, RESEARCH, AND TECHNOLOGY
UNIVERSITAS NEGERI SURABAYA
FACULTY OF MATHEMATICS AND NATURAL SCIENCE
UNDERGRADUATE PROGRAM OF MATHEMATICS
Ketintang Campus, C8-C9 Buildings of FMIPA, Surabaya
Email: s1-mat@unesa.ac.id

Attribute Soft skill:	Active communication; Discipline; Collaboration; Responsibility; and Argumentation in class.
Study/exam achievements:	The final grade (*NA*) is calculated based on the following ratio: **Assessment Components / Percentage of contribution** Participation — 20% Assignment — 30% Mid-semester test — 20% Final semester test — 30% Grade conversion of 0-100 scale into 0-4 scale is set as below:
Learning Methods :	Student-centered approach; project-based learning; lecturer and discussion; and presentations (structured activities)
Form of Media:	Power point slides; video; worksheets, and textbooks

The final grade (*NA*) is calculated based on the following ratio:

Assessment Components	Percentage of contribution
Participation	20%
Assignment	30%
Mid-semester test	20%
Final semester test	30%

Grade conversion of 0-100 scale into 0-4 scale is set as below:

Letter	Number	Grade Interval
A	4,00	$85 \leq A \leq 100$
A-	3,75	$80 \leq A- < 85$
B+	3,50	$75 \leq B+ < 80$
B	3,00	$70 \leq B < 75$
B-	2,75	$65 \leq B- < 70$
C+	2,50	$60 \leq C+ < 65$
C	2,00	$55 \leq C < 60$
D	1,00	$40 \leq D < 55$
E	0,00	$0 \leq E < 40$

MINISTRY OF EDUCATION, CULTURE, RESEARCH, AND TECHNOLOGY
UNIVERSITAS NEGERI SURABAYA
FACULTY OF MATHEMATICS AND NATURAL SCIENCE
UNDERGRADUATE PROGRAM OF MATHEMATICS
Ketintang Campus, C8-C9 Buildings of FMIPA, Surabaya
Email: s1-mat@unesa.ac.id

Literature (primary references):	1. F. Verhulst, 2000, *Nonlinear Differential Equations and Dynamical Systems,* Springer-Verlag, Berlin. 2. S. Wiggins, 1990, *Introduction to Applied Nonlinear Dynamical Systems and Chaos*, Springer-Verlag, New York 3. Yu A. Kuznetsov, 2009, *Using MatCont for Numerical Integration of ODEs*, Tutorial Sheet, Universiteit Utrecht, The Netherlands 4. J.C. Polking, dfield dan pplane a s oftware for interactive numerical analysis of ODE http://math.rice.edu/~dfield/index.html
Notes:	*1 credit unit or *sks* in learning process = three periods consist of: (a) scheduled instruction in a classroom or laboratory (50 minutes); (b) structured activity (60 minutes); and (c) individual activity (60 minutes) according to the Regulation of Indonesia Ministry of Research, Technology, and Higher Education No. 44 Year 2015 jo. the Regulation of Indonesia Ministry of Research, Technology, and Higher Education No. 50 Year 2018.
	**1 credit unit or *sks* = 1.59 ECTS according to Rector Decree Of Universitas Negeri Surabaya No. 598/UN38/HK/AK/2019