	Universitas Negeri Surabaya **Faculty of Mathematics and Natural Sciences** **Undergraduate Mathematics Study Program**			**Document Code**	

SEMESTER LEARNING PLAN

Courses		**CODE**	**Course Family**	**Credit Weight**			**SEMESTER**	**Compilation Date**
Dynamic Systems		4420103118	Study Program Elective Courses	**T=3**	**P=0**	**ECTS=4.77**	7	July 18, 2024
AUTHORIZATION		**SP Developer**		**Course Cluster Coordinator**			**Study Program Coordinator**	
		....		....			Prof. Dr. Raden Sulaiman, M.Si.	

Learning model	**Project Based Learning**																	
Program Learning Outcomes (PLO)	**PLO study program that is charged to the course**																	
	Program Objectives (PO)																	
	PLO-PO Matrix																	
		P.O																
	PO Matrix at the end of each learning stage (Sub-PO)																	
		P.O	Week															
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Short Course Description	This course examines linear and nonlinear phenomena that exist in the universe through mathematical models, especially through systems of ordinary differential equations. Lectures will involve students in understanding planar linear systems, plane and phase portraits, system equilibrium points, stability analysis, planar nonlinear systems, high-dimensional nonlinear systems, linearization, eigenvalue analysis, and bifurcation. Methods for solving the system are carried out analytically, geometrically, topologically and numerically using software assistance.

References	**Main :**	
	1. F. Verhulst. 2000. Nonlinear Differential Equations and Dynamical Systems . Berlin: Springer-Verlag. 2. M. W. Hirsch, S. Smale, & R. L. Devaney. 2004. Differential Equations, Dynamical Systems & Introduction to Chaos. Boston, USA. Elsevier. 3. G. C. Layek. 2015. An Introduction to Dynamical Systems. New Delhi. Springer. 4. J. D. Murray. 2002 . Mathematical Biology 1, An introduction . Berlin. Springer-Verlag 5. Yu A. Kuznetsov. 2009. Using MatCont for Numerical Integration of ODEs, Tutorial Sheet . Universiteit Utrecht. The Netherlands 6. J. C. Polking. 2008. dfield dan pplane a software for interactive numerical analysis of ODE. http://math rice edu/~dfield/index html	
	Supporters:	

Supporting lecturer	Dr. Abadi, M.Sc. Dr. Dian Savitri, S.Si., M.Si. Rudianto Artiono, S.Pd., M.Si. Budi Priyo Prawoto, S.Pd., M.Si.

Week-	**Final abilities of each learning stage (Sub-PO)**	**Evaluation**		**Help Learning, Learning methods, Student Assignments, [Estimated time]**		**Learning materials [References]**	**Assessment Weight (%)**
		Indicator	**Criteria & Form**	**Offline (offline)**	**Online (online)**		
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**

1	Understand dynamic systems through examples	Identify dynamic systems that exist in the universe		Lectures, Responses and Tutorials using LMS Vinesa/Google Classroom with the Synchronus method using the video conference platform (google meet) 3 x 50 minutes 3 X 50			0%
2	Understand linear planar dynamic systems	1. Identify planar linear dynamical systems 2. Determining the equilibrium solution for a planar linear dynamic system		Lectures, Responses and Tutorials using LMS Vinesa/Google Classroom with the Synchronus method using the video conference platform (google meet) 3 x 50 minutes 9 X 50			0%
3							0%
4							0%
5	Understand the equilibrium point and its types in linear planar dynamic systems	Determine critical points and their types in planar linear dynamic systems		Lectures, Responses and Tutorials using LMS Vinesa/Google Classroom with the Synchronus method using the video conference platform (google meet) 3 x 50 minutes 9 X 50			0%
6							0%
7							0%
8	UTS			3 X 50			0%
9	Understanding periodic solutions of a nonlinear dynamical system	1. Identifying nonlinear dynamic systems 2. Determining the periodic solution of a nonlinear dynamical system		Lectures, Responses and Tutorials using LMS Vinesa/Google Classroom with the Synchronus method using the video conference platform (google meet) 3 x 50 minutes 6 X 50			0%

10	Understanding periodic solutions of a nonlinear dynamical system	1. Identifying nonlinear dynamic systems 2. Determining the periodic solution of a nonlinear dynamical system		Lectures, Responses and Tutorials using LMS Vinesa/Google Classroom with the Synchronus method using the video conference platform (google meet) 3 x 50 minutes 6 X 50			0%
11	Understand the theory of stability of a nonlinear dynamic system	Determining the stability of a nonlinear dynamic system		Lectures, Responses and Tutorials using LMS Vinesa/Google Classroom with the Synchronus method using the video conference platform (google meet) 3 x 50 minutes 3 X 50			0%
12	Understand the theory of stability of a nonlinear dynamic system	Determining the stability of a nonlinear dynamic system		Lectures, Responses and Tutorials using LMS Vinesa/Google Classroom with the Synchronus method using the video conference platform (google meet) 3 x 50 minutes 3 X 50			0%
13	Understand bifurcation of dynamic system solutions and its types	1. Determining the bifurcation of dynamic system solutions 2. Determine the types of bifurcation		Lectures, Responses and Tutorials using LMS Vinesa/Google Classroom with the Synchronus method using the video conference platform (google meet) 3 x 50 minutes 3 X 50			0%
14	Understand bifurcation of dynamic system solutions and its types	1. Determining the bifurcation of dynamic system solutions 2. Determine the types of bifurcation		3 X 50			0%
15	Understanding bifurcation through discussion of dynamic systems taken from journal articles	Determine the type of bifurcation in journal articles		3 X 50			0%
16	UAS			3 X 50			0%

Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage

	0%

Notes

1. **Learning Outcomes of Study Program Graduates (PLO - Study Program)** are the abilities possessed by each Study Program graduate which are the internalization of attitudes, mastery of knowledge and skills according to the level of their study program obtained through the learning process.
2. **The PLO imposed on courses** are several learning outcomes of study program graduates (CPL-Study Program) which are used for the formation/development of a course consisting of aspects of attitude, general skills, special skills and knowledge.
3. **Program Objectives (PO)** are abilities that are specifically described from the PLO assigned to a course, and are specific to the study material or learning materials for that course.
4. **Subject Sub-PO (Sub-PO)** is a capability that is specifically described from the PO that can be measured or observed and is the final ability that is planned at each learning stage, and is specific to the learning material of the course.
5. **Indicators for assessing** ability in the process and student learning outcomes are specific and measurable statements that identify the ability or performance of student learning outcomes accompanied by evidence.
6. **Assessment Criteria** are benchmarks used as a measure or measure of learning achievement in assessments based on predetermined indicators. Assessment criteria are guidelines for assessors so that assessments are consistent and unbiased. Criteria can be quantitative or qualitative.
7. **Forms of assessment:** test and non-test.
8. **Forms of learning:** Lecture, Response, Tutorial, Seminar or equivalent, Practicum, Studio Practice, Workshop Practice, Field Practice, Research, Community Service and/or other equivalent forms of learning.
9. **Learning Methods:** Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, and other equivalent methods.
10. **Learning materials** are details or descriptions of study materials which can be presented in the form of several main points and sub-topics.
11. **The assessment weight** is the percentage of assessment of each sub-PO achievement whose size is proportional to the level of difficulty of achieving that sub-PO, and the total is 100%.
12. TM=Face to face, PT=Structured assignments, BM=Independent study.