Module Description of Control Theory

Module Name	:	Control Theory
Module Level	:	Bachelor
Code, if applicable	:	23H01130803
Subtitle, if applicable	:	-
Courses, if applicable	:	Control Theory
Semester(s) in which the module is taught	:	5 (Fifth Semester)
Module coordinator(s)	:	Dr. Firman, S.Si.,M.Si.
Lecturer(s)	:	Dr. Firman, S.Si.,M.Si.
Language	:	Bahasa (Indonesian language)
Relation to curriculum	:	Elective course in third year for Bachelor degree in Mathematics
Type of teaching/teaching method	:	Case Study, Cooperative Learning, Project-Based 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 SKS (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 have completed and taken the exams for Basic Mathematics I, Linear Algebra I
Module objectives/intended learning outcomes	:	After completion of this module, students are able to: CLO 1. recognize various problems in control systems CLO 2. understand the basic principles of control theory CLO 3. understand the concept of feedback control design to analyze the stability of the control system CLO 4. apply methods in control theory to real problems The following is the mapping of the ILO and the CO of this course:
Content	:	The course provides eight main groups of study materials, state space representation of a scalar differential equation, transformation of state space equations into scalar differential equations, solution of

	ILO 1	ILO 2	ILO 3	ILO 6
CLO 1	X			
CLO 2	X	X	X	
CLO 3		X		X
CLO 4			X	X

<table>
<tr><td></td><td></td><td>the state space equation, control and observation of the linear control system, stability analysis of linear and nonlinear systems, input-output linearization in nonlinear control systems (input-output linearization in nonlinear control systems), optimal control based on the calculus of variations, and Pontryagin Principle (The Pontryagin Principle).</td></tr>
<tr><td>Study and examination requirements</td><td></td><td>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.</td></tr>
<tr><td>Exams and assessment formats</td><td></td><td>Participants are marked based on their performance in theory: Presentation (5%), Assignments (10%), Written Exam (30%), and Report (55%).

Assignments assess student's ability to apply concepts independently. Presentations evaluate oral communication, organization of ideas, and confidence in delivering academic material. 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></td></tr>
<tr><td>Reading list</td><td></td><td>State Space Analysis of Control Systems. Katsuhiko Ogata.
Introduction to Mathematical Control Theory, S. Barnett & R. G. Cameron,
3Nonlinear Systems. Hassan K. Khalil
Sugeng, K.A., Barack, Z.Z., Hinding, N., Simanjuntak, R,</td></tr>
</table>

		Modular Irregular Labeling on Double-Star and Friendship Graphs, *Journal of Mathematics*, 2021, 2021, 4746609. 4. Firman, et.al. 2022. Modification of the Trajectory Following Method for Asymptotic Stability in a System of Nonlinear Control.Nonlinear Dynamics and Systems Theory, 22 (2). p. 169–177
Last revision date		July 28th, 2025