

Biomatics and Applied Artificial Intelligence Institute			Semester 3. of the curriculum 2025-26-2							
Name of the subject:	Code of the subject:	Credits:	Weekly hours:							
				lec	sem	lab				
System Theory	NIXRE1EBNE	5	full-time	2	1	0				
Responsible person for the subject: Levente KOVÁCS PhD, DSc			Classification: Professor							
Subject lecturer(s): Dr. Stephen Kimathi										
Prerequisites:	NMXAN2EBNE	Calculus II								
Way of the assessment:	Exam									

Course description

Goal:	The students will become familiar with the foundations of system theory. The subject focuses on the description and analysis of linear dynamic systems. It provides an overview about the description of the linear dynamic systems in the time domain, frequency domain and complex frequency domain, investigates the connection between these domains and their applications.
Course description:	Introduction to control theory, basic terms, mathematical foundations, differential equations, Laplace-transformation, transfer function. Stability. Time domain description, common inputs, transient response. Frequency domain description, characteristic functions, steady states. Stability in frequency domain, Bode-plots, Nyquist-diagram. Block diagram and connectivity of systems, stability of the closed loop. Discrete systems, difference equations, fixed points, sampling, Shannon's theorem, z-transformation.

Lecture schedule

Education week	Topic
1.	Introductory lecture
2.	Mathematical foundations (System's modelling)
3.	Transfer functions, Stability of continuous time systems
4.	Time domain analysis
5.	Time domain analysis, system response
6.	Homework & Classroom test
7.	Frequency domain descriptions
8.	Stability in frequency (Bode-plots, Nyquist-diagram)
9.	Closed-loop systems
10.	Block diagram manipulation and reduction
11.	Classroom test
12.	Discrete time systems (Sampling, Difference equations)
13.	Stability of discrete time systems
14.	Replacement test

Mid-term requirements

Conditions for obtaining a mid-term grade/signature	Student participation in the lectures and seminars is required. One homework assignment will be given during the semester, which must be solved independently and submitted by the given deadline.
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Signature requirement: Submission of the homework before the deadline, and a minimum of 50% score in the midterm tests and homework.													
Assessment schedule													
Education week	Topic												
6.	Homework												
14.	Replacement test												
Method used to calculate the <i>mid-term grade</i> (to be filled out only for subjects with mid-term grades)													
-													
Type of the replacement													
Type of the replacement of written test/mid-term grade/signature	In the case if the mid-term test does not reach 50%, the student can replace the test in the form of re-take test(s) in the 14th week. Replacement of the signature: once in the first 10 working days of the examination period.												
Type of the exam (to be filled out only for subjects with exams)													
Written exam													
Calculation of the exam mark (to be filled only for subjects with exams)													
Test result needs to exceed 51%.													
Final grade calculation methods:													
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 5px;">Midterm tests</td><td style="padding: 5px;">20 points</td></tr> <tr> <td style="padding: 5px;">Homework</td><td style="padding: 5px;">10 points</td></tr> <tr> <td style="padding: 5px;">Final Exam</td><td style="padding: 5px;">20 points</td></tr> <tr> <td style="padding: 5px;">Total</td><td style="padding: 5px;">50 points</td></tr> </table>		Midterm tests	20 points	Homework	10 points	Final Exam	20 points	Total	50 points				
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Total	50 points												
The final grade will be calculated using the following scale:													
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="padding: 5px;">Achieved result</th><th style="padding: 5px;">Grade</th></tr> </thead> <tbody> <tr> <td style="padding: 5px;">87% - 100%</td><td style="padding: 5px;">excellent (5)</td></tr> <tr> <td style="padding: 5px;">75% - 86%</td><td style="padding: 5px;">good (4)</td></tr> <tr> <td style="padding: 5px;">64% - 74%</td><td style="padding: 5px;">satisfactory (3)</td></tr> <tr> <td style="padding: 5px;">51% - 63%</td><td style="padding: 5px;">pass (2)</td></tr> <tr> <td style="padding: 5px;">0 - 50 %</td><td style="padding: 5px;">failed (1)</td></tr> </tbody> </table>		Achieved result	Grade	87% - 100%	excellent (5)	75% - 86%	good (4)	64% - 74%	satisfactory (3)	51% - 63%	pass (2)	0 - 50 %	failed (1)
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References													
Obligatory:	<ul style="list-style-type: none"> • Lecture notes (download from https://elearning.uni-obuda.hu/) 												
Recommended:	<ul style="list-style-type: none"> • W. Levine; Control System Fundamentals, K. Ogata; Modern Control Engineering, 												
Other references:	<ul style="list-style-type: none"> • R. Burns; Advanced Control Engineering 												