

Identification	Subject (Code, title, credits)	ETR390, Control Systems Engineering, 6 ECTS
	Department	Physics and Electronics
	Program	Undergraduate
	Term	Spring 2026
	Instructor	MSc, MIET, Alim Huseynov
	E-mail:	Alim.Huseynov@gmail.com
	Phone:	
	Classroom/hours	11 Mehseti str. (Neftchilar campus)
	Office hours	Monday-Friday, from 9:00 to 18:00
Prerequisites	-	
Language	English	
Compulsory/ Elective	Elective	
Required textbooks and course materials	Textbooks: 1. Practical process control, Cecil L. Smith, 2009 2. Modern Control Technology: Components & Systems, Kilian, 2007 3. Introduction to Mechatronics and Measurement Systems, David G. Alciatore & Michael B. Hstand, 2011 4. Control Systems Engineering, 7th edition, Nise, 2014 5. Mechatronics-Electronic control systems in mechanical and electrical engineering, 6th Edition William Bolton, 2014 6. Control Systems Engineering – <i>Norman S. Nise</i> , 8th Edition, 2019 7. Control Systems: An Introduction – <i>Hassan K. Khalil</i> , 2023	
Course description	<p>This course of control system describes fundamental components of industrial control systems, difference between manual and automatic control systems, basics of modeling and transfer function representation, basic properties of feedback, PID controller, input elements like different sensors and output elements like actuators and motors.</p> <p>The role of control systems in green engineering will continue to expand as the global issues facing us require ever increasing levels of automation and precision. This course allows drawing and analyzing the block diagram of open loop and closed loop control systems, to recognize elements control system such as instrumentation devices, Programmable Logic Controllers and end devices such as actuator.</p>	
Course objectives	<ul style="list-style-type: none"> ▪ Understand the basic principles and types of control systems, including open-loop and closed-loop systems. ▪ Explain the role of feedback, external disturbances, and plant variations in control system performance. ▪ Analyze dynamic response and steady-state accuracy of control systems. ▪ Understand the concept of control loop stability and its importance in safe and reliable operation. ▪ Explain and apply Proportional (P), Integral (I), and Derivative (D) control modes. ▪ Analyze and implement PID control strategies for basic industrial control problems. ▪ Apply common PID controller tuning methods and evaluate their impact on system behavior. ▪ Distinguish between analog and digital signals used in control and automation systems. 	

	<ul style="list-style-type: none"> ▪ Understand and apply signal conditioning techniques in measurement and control applications. ▪ Explain the principles and operation of ADC and DAC systems. ▪ Identify and explain the operation of industrial sensors and transmitters for pressure, flow, level, temperature, and position. ▪ Understand the role and operation of final control elements, such as control valves and motors, in control loops. 		
Learning outcomes	<p>By the end of the course, students will be able to:</p> <ul style="list-style-type: none"> • Describe the basic structure and types of control systems, including open-loop and closed-loop systems. • Explain the effects of feedback, disturbances, and plant variations on control system performance. • Analyze dynamic response and steady-state behavior of control systems. • Assess basic control loop stability and identify unstable system behavior. • Apply Proportional, Integral, and Derivative (P, I, D) control modes to simple control problems. • Implement PID control strategies for basic industrial applications. • Select and apply appropriate PID tuning methods based on system requirements. • Differentiate between analog and digital signals used in control systems. • Apply signal conditioning techniques for sensor and measurement signals. • Explain the operating principles of ADC and DAC systems. • Identify and select suitable industrial sensors and transmitters for pressure, flow, level, temperature, and position measurements. • Explain the function of final control elements such as valves and motors within a control loop. 		
Teaching methods	Case analysis		x
	Group discussion		x
	Lecture		x
	Simulation		x
Evaluation Criteria	Methods	Date/deadlines	Percentage (%)
	Midterm Exam		30
	Attendance	At each lesson	5
	Quiz	4 quizzes during the semester	20
	Activity	During the semester	5
	Final Exam		40
	Total		100
Class Policy	<ul style="list-style-type: none"> ▪ Preparation for class The structure of this course makes your individual study and preparation outside the class extremely important. The lecture material will focus on the major points introduced in the text. Reading the assigned chapters and having some familiarity with them before class will greatly assist your understanding of the lecture. After the lecture, you should study your notes and work on relevant problems and cases from the end of the chapter and sample exam questions. ▪ Withdrawal (pass/fail) 		

	<p>This course strictly follows the grading policy of the School of Science and Engineering. Thus, a student is expected to achieve a mark of at least 60% to pass. In case of failure, he/she will be required to repeat the course the following term or year.</p> <ul style="list-style-type: none"> ▪ Cheating/plagiarism Cheating or other plagiarism during the Quizzes, Midterm, and Final Examinations will lead to paper cancellation. In this case, the student will automatically get zero (0) without consideration. ▪ Professional behavior guidelines The students shall behave in a way to create a favorable academic and professional environment during class hours. Unauthorized discussions and unethical behavior are strictly prohibited. ▪ Attendance Students who attend the whole classes will get 5 marks. for three absence student loses 1 mark. ▪ Quizzes There will be 4 quizzes during the semester. The quizzes will be announced in the classroom two weeks before and will relate to homework. ▪ Activity Students who will be active during discussion of past lessons will be awarded with one activity mark.
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Tentative Schedule			
Weeks	Date/Day	Topics	Reference to textbooks
1.	10.02.2026	Introduction to control system: types of control system. Closed loop and open loop control system Solve exercises	[2] p.1-24 [4] p. 1-32
2.	17.02.2026	Feedback control, External disturbance inputs, Plant variations, Dynamic response, Steady-state accuracy, Non-linearity. Solve exercises	[2] p. 453-510 [4] p. 1-32
3.	24.02.2026	Control loop stability. Quiz 1	[1] p. 69-110 [2] p. 453-510
4.	03.03.2026	Proportional Mode control Solve exercises	[1] p. 138-172 [2] p. 453-510
5.	10.03.2026	Integral Mode Control Solve exercises	[1] p. 174-210 [2] p. 453-510
6.	17.03.2026	PID Control Quiz 2	[1] p. 212-241 [2] p. 453-510
7.	31.03.2026	PID Controller Tuning Solve exercises	[1] p. 243-283
8.	07.04.2026	Transfer function of control system components, Mathematical modeling of control system Solve exercises	[4] p.33-380
9.	14.04.2026	Mid term exam	
10.	21.04.2026	Types of signals analog and digital, Signal conditioning techniques. Solve exercises	[2] p.59-114 [5] p.69 - 111

11.	28.04.2026	ADC and DAC techniques. Types and implementation. Seminar 11. Solve exercises	[3] p. 346 – 363 [5] p. 95-112
12.	05.05.2026	PLC, DCS and SCADA. Programming concepts, industrial standards and applications. Quiz 3	[2] p. 511-563 [5] p. 349 - 376
13.	12.05.2026	Position, Pressure and Level sensing techniques and sensors. Solve exercises	[2] p.221-265 [3] p.375 - 406 [5] p.29-56
14.	19.05.2026	Flow and Temperature sensing techniques and sensors. Solve exercises	[2] p. 265-278 [3] p. 408-414 [5] p. 54-61
15.	26.05.2026	End elements: valves and motors. Solve exercises	[3] p. 431-477 [5] p. 165-239
		Final Exam	

This syllabus is a guide for the course and any modifications to it will be announced in advance.

