Identification	**Subject (Code, title, credits)**	ETR470, Industrial automation and programmable logic controllers (PLC), 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. Programmable Logic Controllers - W.Bolton 2013 2. Programmable Logic Controllers - F.Petruzella 2011 3. Programmable Logic Controllers - D.Hanssen 2016	
Course description	This course gives Physics and Electronics department students necessary knowledge and understanding of PLC (Programmable Logic Controllers) that are widely used in the industrial field. This course deals with some fundamentals of PLC-based control systems without which technician field, namely factory automation domain cannot exist. This PLC course is designed to equip the novice with no prior PLC programming experience with the basic tools required to create a complete PLC program using ladder logic and structured text common to most current platforms. Using Codesys PLC software, we will be covering such topics as general controls, digital and analog IO, ladder logic programming, alarm/notification handling, emulation, best practices and more. The student will write, enter, and execute application programs using the programmable controller's simulation.	
Course objectives	The purpose of this course is to provide students with a thorough understanding of industrial automation systems and the critical role of Programmable Logic Controllers (PLCs) in controlling and optimizing modern industrial processes. Students will develop the ability to analyze, design, and implement PLC-based control solutions for various manufacturing and process applications. The course emphasizes both theoretical concepts—such as automation principles, system components, sensors, actuators, and industrial communication protocols—and practical skills, including PLC programming, system simulation, troubleshooting, and real-world problem-solving. By the end of the course, students will be capable of developing efficient, reliable, and safe automated systems that enhance productivity and support the evolving needs of modern industry.	
Learning outcomes	• Describe typical components of a Programmable Logic Controller. • Explain the basic concepts of a Programmable Logic Controller. • State basic PLC terminology and their meanings. • Explain and apply the concept of electrical ladder logic, its history, and its relationship to programmed PLC instruction. • Use ladder language and structured text programming for real cases. • Explain the concept of basic digital electronics and data manipulation. • Learn the difference between digital and analog signals and how to bring them into	

<table>
<tr><td></td><td colspan="3">a PLC, process them and send them back out.
• Use latch, timer, counter, and other intermediate programming functions.
• Design and program basic PLC circuits for entry-level PLC applications.
• Design and program a small, automated industrial production line.
• By the end of this practice, students will be able to create a PLC program from scratch and find some solutions for real-time industrial automation problems.</td></tr>
<tr><td rowspan="4">Teaching methods</td><td colspan="2">Case analysis</td><td>x</td></tr>
<tr><td colspan="2">Group discussion</td><td>x</td></tr>
<tr><td colspan="2">Lecture</td><td>x</td></tr>
<tr><td colspan="2">Simulation</td><td>x</td></tr>
<tr><td rowspan="8">Evaluation Criteria</td><td>Methods</td><td>Date/deadlines</td><td>Percentage (%)</td></tr>
<tr><td>Midterm Exam</td><td></td><td>30</td></tr>
<tr><td>Attendance</td><td>At each lesson</td><td>5</td></tr>
<tr><td>Quiz</td><td>4 quizzes during the semester</td><td>20</td></tr>
<tr><td>Activity</td><td>During the semester</td><td>5</td></tr>
<tr><td>Final Exam</td><td></td><td>40</td></tr>
<tr><td>Total</td><td></td><td>100</td></tr>
<tr><td>Class Policy</td><td colspan="3">▪ 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)
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.
▪ 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.</td></tr>
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Tentative Schedule

Weeks	Date/Day	Topics	Reference to textbooks
1.	10.02.2026	PLC Overview, selection. Components and working principles. Conduction of oral and written survey. Problem solving	[1] – p 7-26 [2] – p 1-45 [3] – p 1-19
2.	17.02.2026	Number Systems & Codes, Input and output devices, wiring diagram. Conduction of oral and written survey. Problem solving	[1] – p 26-63 [2] – p 46-60 [3] – p 20-78
3.	24.02.2026	PLC Programming, Programming Logic Gate Functions Conduction of oral and written survey. Problem solving	[1] – p 114-221 [2] – p 61-130 [3] – p 79-131
4.	03.03.2026	PLC Timer Instructions Conduction of oral and written survey. Problem solving	[1] – p 221-241 [2] – p 131-156 [3] – p 210
5.	10.03.2026	PLC Counter Instructions Discussion of project progress.	[1] – p 241-262 [2] – p 156-184 [3] – p 211
6.	17.03.2026	Math Instructions Conduction of oral and written survey. Problem solving	[2] – p 234 - 252 [3] – p 187 - 206
7.	31.03.2026	Compare, Jump & MCR Instructions Conduction of oral and written survey. Problem solving	[2] – p 184-207
8.	07.04.2026	Midterm exam	
9.	14.04.2026	Function Implementation and definition Conduction of oral and written survey. Problem solving	[3] – p 214
10.	21.04.2026	Subroutine Functions, Data Handling Instructions Conduction of oral and written survey. Problem solving	[2] – p 184-207 [3] – p 218-220
11.	28.04.2026	Introduction to Structured Text Programming, comparison to LLD. Conduction of oral and written survey. Problem solving	[1] – p 163-183 [2] – p 81-83 [3] – p 278-306
12.	05.05.2026	PLC instructions in Structured Text Conduction of oral and written survey. Problem solving	[1] – p 163-183 [2] – p 81-83 [3] – p 278-306
13.	12.05.2026	Visualisation and HMI programming Conduction of oral and written survey. Problem solving	[3] – p 351-393
14.	19.05.2026	Industrial Protocols and their application Conduction of oral and written survey. Problem solving	[2] – p 305-333
15.	26.05.2026	Troubleshooting & Servicing Solving problems and ambiguities of students about the course	[2] – p 281-304
		Final Exam	

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