

**SYLLABUS**  
**“IEC 61131-3. PLC programming languages.”**  
**1 ECTS for the subject- 8 hours**

**Prerequisites**

This course is accessible for students enrolled in technical universities on the specialty link with automation and control of technical systems. Requires knowledge of the basics of building automated control systems.

**Course objectives**

- PLC programming languages. Fundamentals of programming and creating of control system on the base of PLC. This includes both theoretical and some practical aspects of the topic.
- Knowledge and skills necessary for programming and creating of control system on the base of PLC.

	<b>Topic</b>	<b>Plan</b>	<b>hours</b>
1.	PLC programming language: “Ladder Diagram”.	1. Basic functions, advantages and disadvantages of the language 2. Major operators 3. Program examples (CoDeSys, Step 7) 4. Practical work	2
2.	PLC programming language: “Functional Block Diagram”.	1. Basic functions, advantages and disadvantages of the language 2. Major operators, blocks libraries 3. Program examples, development of control system (CoDeSys, Step 7) 4. Practical work	2
3.	PLC programming language: “Structured Text”.	1. Basic functions, advantages and disadvantages of the language 2. Major operators 3. Program examples (CoDeSys, Step 7) 4. Practical work	2
4.	PLC programming language: “Instruction List”.	1. Basic functions, advantages and disadvantages of the language 2. Major operators 3. Program examples (CoDeSys, Step 7) 4. Practical work	2
5.	PLC programming language: “Sequential Function Charts”.	1. Basic functions, advantages and disadvantages of the language 2. Major operators 3. Program examples (CoDeSys, Step 7) 4. Practical work	2

## **Learning outcomes**

1. Remember the basic structure of control systems on the base of PLC and understand the purpose of its components.
2. Understanding the application of software and its role in creating a PLC-based control system.
3. Be aware the structure, main functions, fundamental modules of the CoDeSys environment
4. Be aware the structure, main functions, fundamental modules of the Step 7 environment
5. Be aware the features, advantages, disadvantages and scope of application of the main languages of the IEC 61131-3 standard
6. Be aware the main functions, basic elements of the FBD language
7. Be aware the main functions, basic elements of the LD language
8. Be aware the main functions, basic elements of the IL language
9. Be aware the main functions, basic elements of the ST language
10. Be aware the main functions, basic elements of the SFC language
11. Be able to create a control program in the main languages of the IEC 61131-3 standard.
12. Be able to create a software analog of the automated process control system by means of CoDeSys
13. Be able to create a software analog of the automated process control system by means of Step 7

## **Recommended reading**

1. Lecture notes/materials provided by the lecturer.
2. User's guide for PLC programming in CoDeSys / PC Prologue, 2006 – 453 p.
3. Visualization of CoDeSys. Supplement to the user guide for PLC programming in CoDeSys 2.3 / PC Prologue (Russian Edition), 2006 - 83s.
4. Programming languages of industrial logic controllers of IEC 61131-3 standard: the manual is intended for studying the disciplines "Industrial controllers", "Application software of control systems" / E.V. Andreev, Ministry of Education and Science of the RK, Karaganda State Technical University. - Karaganda: KSTU, 2008. - 64 p. - ISBN 9965-04-151-2
5. Programmable controller S7-300. SIMATIC. Module data. Reference Guide. SIEMENS. Electronic publication 02/2010 A5E00105505-03.
6. Programmable controller S7-300. Data CPU, CPU 31xC and CPU31x. Reference Guide. SIEMENS. Electronic publication 09/2010. A5E00105475-02.

## **Questions (test tasks)**

1. Instrumental programming environment of the PLC.
2. IEC 61131 standard.
3. IL programming language.
4. FBD programming language
5. LD programming language
6. ST programming language

7. SFC programming language
8. CoDeSys environment.
9. Step 7 environment.
10. Programming in the CoDeSys environment.
11. Programming in the Step 7 environment.