## STUDY MODULE DESCRIPTION FORM

| Name of the module/subject **Digital Control Systems** | Code **1010642221010330332** |
|---|---|

| Field of study **Mechanical Engineering** | Profile of study (general academic, practical) **(brak)** | Year /Semester **1 / 2** |
|---|---|---|

| Elective path/specialty **Mechatronics** | Subject offered in: **Polish** | Course (compulsory, elective) **obligatory** |
|---|---|---|

| Cycle of study: **Second-cycle studies** | Form of study (full-time,part-time) **full-time** |
|---|---|

| No. of hours | | | | No. of credits **3** |
|---|---|---|---|---|
| Lecture: **2** | Classes: **-** | Laboratory: **1** | Project/seminars: **-** | |

| Status of the course in the study program (Basic, major, other) **(brak)** | (university-wide, from another field) **(brak)** |
|---|---|

| Education areas and fields of science and art **technical sciences** **Technical sciences** | ECTS distribution (number and %**)** **3  100%** **3  100%** |
|---|---|

**Responsible for subject / lecturer:**

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**Prerequisites  in terms of knowledge, skills and social competencies:**

| 1 | **Knowledge** | knowledge of electronics (especially in the field of digital technique) and control theory, after passing the program of first degree study |
|---|---|---|
| 2 | **Skills** | problem solving skills with the electronics and control theory based on the existing knowledge and the ability to acquire information from shown sources |
| 3 | **Social competencies** | understanding of the need to expand their competence, readiness to cooperate within the team |

**Assumptions and objectives of the course:**

The aim of the course is to understand the construction, programming methods and typical applications of digital control systems, especially programmable logic controllers and industrial controllers. Student at the end of the course should be able to design and program systems with PLCs. The student can also choose properly the digital control system to a particular technology object.

### Study outcomes and reference to the educational results for a field of study

**Knowledge:**

1. Ma poszerzoną wiedzę z informatyki, dotyczącą programowania komputerów oraz programów do obliczeń inżynierskich w zakresie symulacji układów fizycznych, a zwłaszcza komputerowych układów sterowania. - [K2A_W05        ]

2. Has knowledge about safety and ergonomics in the design and operation of the machines  - [K2A_W08        ]

3. Has knowledge about  the risks that machines create for the environment - [K2A_W08 ]

4. Has general knowledge in the field of standardization, recommendations and EU directives, national, international and industry standards.  - [K2A_W09        ]

**Skills:**

1. Is able to program a part manufacturing technological process, including a simple program to control a machine tool.  - [K2A_U10]

2. Is able to assess potential negative impacts for the natural environment and humans, originating from the designed machine or a vehicle from the selected equipment group   - [K2A_U14]

3. Is able to develop technical description, market offer and design documentation for a complex machine from the selected equipment group  - [K2A_U16]

**Social competencies:**

1. Understands the need for lifelong learning; is able to inspire and organize the learning process of others - [K2A_K01 ]

2. Is aware of and understands the importance and impact of non-technical aspects of mechanical engineering activities and its impact on the environment, is aware of responsibility for decisions. - [K2A_K02 ]

3. Is able to interact in a group taking on the different roles. - [K2A_K03 ]

4. Is able to set priorities for realization of undertaken tasks. - [K2A_K04 ]

## Assessment methods of study outcomes

Lecture: Completion of the lecture is a written exam with a problem ? design task.

Laboratory: Assessment of laboratory requires doing the indicated exercises and preparation of reports.

## Course description

Classification and field of application of programmable controllers . PLC hardware: architecture of controller , input and output modules , functional blocks , the family of PLCs . Features and applications of typical sensors: mechanical , inductive, capacitive , ultrasonic and optical . Temperature, pressure , level, and other process parameters sensors. PLC programming according to IEC 61131 languages: . programming function blocks , ladder logic , sequential functional diagram , structured text . Implementation of the typical structures of automation. Operator panels . The analysis of algorithms used in industrial controllers . The practical issues of application and tuning controls for different facilities. Communication systems PLCs. Examples of the construction, operation and applications of selected networks : AS -i, Modbus , Profibus, HART , Ethernet Powerlink .

### Basic bibliography:

1. Lecture materials shared by the lecturer in electronic form.

2. Collins D. A., Lane E. J.: Programmable controllers, Litho Press

3. Hugh Jack, P.Eng. Michigan, USA: Automating Manufacturing Systems with PLCs (on-line access)

### Additional bibliography:

1. Technical documentation from different PLC and industrial controls manufacturers

## Result of average student's workload

| Activity | Time (working hours) |
|---|---|
| 1. Participation in lectures | 30 |
| 2. Fixing the lecture | 10 |
| 3. Consultation on the material submitted to the lectures | 6 |
| 4. Exam Preparation | 10 |
| 5. Participation in the exam | 2 |
| 6. Participation in laboratory exercises | 15 |
| 7. Preparation for laboratory exercises | 5 |
| 8. Report | 15 |
| 9. Consultation on laboratory exercises | 5 |
| 10. Preparing to pass | 15 |
| 11. Participation in completing laboratory | 2 |

## Student's workload

| Source of workload | hours | ECTS |
|---|---|---|
| Total workload | 85 | 3 |
| Contact hours | 30 | 2 |
| Practical activities | 57 | 2 |

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