COURSE DESCRIPTION CARD - SYLLABUS

Course name
Numerically Controlled Devices

Course

Field of study
Mechatronics

Year/Semester
2/3

Area of study (specialization)
Design and control of mechatronic devices

Profile of study
general academic

Level of study
Second-cycle studies

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
15

Laboratory classes

Other (e.g. online)

Tutorials
15

Projects/seminars

Number of credit points

2

Lecturers

Responsible for the course/lecturer:
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ul. Piotrowo 3, 60-965 Poznań

Responsible for the course/lecturer:

Prerequisites

Student has basic knowledge of electronics, electrical engineering, control engineering, drives, actuators and sensors from already completed subjects in the field of study. He has organized theoretical knowledge from already completed subjects in the field of study and can select appropriate components of drive systems and sensors. He knows how to search for appropriate and necessary data in the literature, scientific and technical databases, the Internet and other sources. The student has the ability to self-study and use ICT that are suitable for solving engineering problems.
He/she understands the need to learn and expand his knowledge throughout life. He/she understands the non-technical aspects and effects of engineering activities. He can work as an active part of a team.

Course objective

Presentation of the design method of numerically controlled machines and devices including the selection of individual components, in particular controll systems, engines and drive amplifiers, filters, overcurrent protection of sensors and electrical apparatus. Discussion of the construction, capabilities,

and requirements for professional NC control systems based on dedicated solutions and open solutions. Presentation of applicable standards in the design and recording of electrical equipment projects for machines. The importance of machine safety is highlighted along with the discussion of their principles for the electrical equipment of machines and protection against electric shocks.

Course-related learning outcomes

Knowledge

1. Student has extended knowledge about controlling, including description of impulse and nonlinear systems, Z-transform, impulse and nonlinear controlling, linearization methods, and methods of detection of impulse stability and nonlinear systems. He/she has basic knowledge about selection of controlling elements in impulse and nonlinear systems.
2. Sudent has extensive knowledge in mechatronics about analysis and design of complex mechatronic systems, systems engineering theory and technique, and about application of modelling and simulation in mechatronic design.
3. Student has expanded knowledge on the automation of devices and manufacturing processes, in particular involving programming advanced regulatory functions in PLC, principles of connecting PLC into an industrial network, eg PROFIBUS, MODBUS, network operations and information exchange, assurance of security of automated systems.

Skills

1. Student can obtain information from the Internet, literature, databases, and other appropriately selected sources (mostly in English) in the field of mechatronics; Student can integrate the obtained information, interpret it, draw conclusions, formulate, and justify opinions.
2. Student can prepare and present in Polish and English a presentation on a detailed design or research task and lead a discussion on the presented issues.
3. Student can design complex equipment and mechatronic systems using modeling and simulation. He/she can plan and conduct experiments, including computerized measurements and simulations, interpret the results, and draw conclusions.
4. Student can use computer systems to design and operate mechatronic devices. Can implement control systems in real-time operating system. He/she can use basic methods of image processing and analysis. Can prepare software documentation.
5. Student can program advanced control functions in the PLC, connect the controllers to the industrial network and develop software to support network operation.

Social competences

1. Student can cooperate and work in a group, taking different roles.
2. Student can appropriately set priorities for carrying out specific tasks or tasks of its own.
3. Student thinks and acts in a creative and entrepreneurial way.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Examination of theory covered in lectures as a test consisting of multiple-choice questions 10-15. Ratings: 3.0 <50%; 60%), 3.5 <60%; 70%), 4.0 <70%; 80%), 4.5 <80%; 90%), 5.0 < 90%, 100%).

Current assessment of preparation for tutorials, implementation of the tasks in groups.

Programme content

Lecture:
- Physiological effect of electricity on the human body (1h).
- Elements of electrical engineering and automation in the construction of NC machine control systems (2h).
- Components of electrical equipment for numerically controlled machines: drives, sensors, electrical apparatus, and electric shock protection (7h).
- Requirements and installation of control cabinets (1h).
- Standardization with respect to the design of electrical equipment control systems and safety for machines (4h).

Tutorials:
- Case study of selected machines and devices (e.g. milling machines, lathes) (2h).
- Examples of the implementation of electric control systems (eg milling machines, lathes) (2h).
- A case study of the risk analysis of a selected machine along with the implementation of an electrical functional safety system (2h).
- Electrical drawing in CAD software for electricians (4h).
- Independent selection of components for the design of the NC control system of a 3-axis numerically controlled machine with BOM lists, connections and terminals (5h).

Teaching methods

Lecture: presentation, films, examples of solutions to engineering problems
Tutorials: individual exercises in CAD software for electricians, tasks in groups

Bibliography

Basic

1. G. Pritschow, Technika sterowania obrabiarkami i robotami przemysłowymi, Oficyna Wydawnicza Politechniki Wrocławskiej
2. J. Przepiórkowski Silniki elektryczne w praktyce elektronika, Wydawnictwo BTC
3. T. Wróbel, Silniki skokowe, Wydawnictwo Naukowo- Techniczne
4. Current standardization documents regarding the safety of electrical equipment and functional safety of machines

Additional

1. S. Bolkowski, Elektrotechnika 4, Wydawnictwo szkolne i Pedagogiczne,
2. IGE+XAO Polska, SeeElectrical Podręcznik użytkownika V7R2, Kraków 2014,
3. Internet, dokumentacja komponentów urządzeń, branżowe portale, wyszukiwarki naukowe.

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,0
Classes requiring direct contact with the teacher	30	1,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	20	1,0

[1] delete or add other activities as appropriate