COURSE DESCRIPTION CARD - SYLLABUS

Course name
Devices Controlled Numerically

Course

Field of study Mechatronics	Year/Semester 1/2
Area of study (specialization) Mechatronic Constructions	Profile of study general academic
Level of study Second-cycle studies	Course offered in Polish
Form of study full-time	Requirements compulsory

Number of hours

Lecture 15	Laboratory classes 0	Other (e.g. online) 0
Tutorials 0	Projects/seminars 15	

Number of credit points

2

Lecturers

Responsible for the course/lecturer:
dr inż. Marcin Pelic
Institute of Mechanical Technology
Faculty of Mechanical Engineering

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 proper components of drive systems and sensors. He kmows how to searching for appropriate and necessary data in the literature, scientific and technical databases, internet and other sources. Student has ability to self-study and he use of ICT that are suitable for solving engineering problems.
He understand the need to learn and expand his knowledge throughout life. He understand 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 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. Emphasizing the importance of machine safety along with discussing their principles for electrical equipment of machines and protection against electric shock.

Course-related learning outcomes

Knowledge

1. Student has extended knowledge about controlling including description of impulse and non-linear systems, Z-transform, impulse and non-linear controlling, linearization methods and methods of detection of impulse stability and non-linear systems. He has basic knowledge about selection of controlling elements in impulse and non-linear systems.
2. Sudent has extended 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 extended knowledge about automation of devices and manufacturing processes, in particular involving programming advanced regulatory functions in PLC's, principles of connecting PLC's into an industrial network e.g. 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 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 can use the 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 think and act 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 lectures in the field 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 control of preparation for project classes, implementation of the project in groups of two.

Programme content

Lecture:
- Physiological effect of electricity on the human body.
- Elements of electrical engineering and automation in the construction of NC machine control systems.
- Components of electrical equipment for numerically controlled machines: drives, sensors, electrical apparatus and electric shock protection.
- Requirements and installation of control cabinets.
- Construction, operation and use of open control systems.
- Construction, operation and use of dedicated control systems.
- Safety of machines and devices.
- Standardization regarding the design of electrical equipment control systems for machines.

Project:
- electrical drawing in CAD software for electricians,
- NC control system design for a 3-axis numerically controlled machine with BOMs, connections and terminals.

Teaching methods

Lecture: presentation, films, examples of solutions to engineering problems
Laboratory: individual exercises in CAD software for electricians, projects in groups of two

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	1,2
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	20	0,8

[1] delete or add other activities as appropriate