COURSE DESCRIPTION CARD - SYLLABUS

Course name
Safety of machines and devices

Course

Field of study
Mechatronics
Area of study (specialization)
Design and control of mechatronic devices
Level of study
Second-cycle studies
Form of study
full-time

Year/Semester
2/3
Profile of study
general academic
Course offered in
Polish
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:
dr inż. Marcin Pelic
email: marcin.pelic@put.poznan.pl
tel: +48 61 662 22 66
Wydział Inżynierii Mechanicznej
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/she has organized theoretical knowledge from already completed subjects in the field of study and can select appropriate components of drive systems and sensors. He/she 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

The aim of the course is to present the method of designing control and drive systems of mechatronic devices with particular emphasis on the requirements for electrical equipment of machines and their functional safety in accordance with current standards. Overview of the structure, functions, and operation of functional safety systems of selected types of machines and devices. Presentation of the process of hazard identification and risk assessment, as well as selection of countermeasures. Presentation of selected components of functional safety systems with particular emphasis on guards, pressure-sensitive devices, AOPD and AOPDDR optoelectronic devices and VBPD vision devices, two-hand control, and emergency stop devices.

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:

EExamination of theory covered in lectures in a form of 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:

- The physiological effect of the current on the human body (1h).
- The essence of the issues of electrical equipment safety and functional safety of machines and devices (4h).
- Overview of the functions of safe devices (3h).
- Components of the functional safety system (5h).
- Risk assessment and determination of safety integrity levels (2h).

Tutorials:

- Case study of functional safety of selected machines and devices (e.g. milling machines, lathes, assembly line, AGV) (3h).
- Examples of implementation of functional safety electrical systems (e.g. milling machines, lathes, assembly line, AGV) (3h).
- Sistema software for security management (3h).
- Independent analysis of the functional safety of selected machines and devices by students and development of a functional safety system (6h).

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