COURSE DESCRIPTION CARD - SYLLABUS

Course name
Design of control systems of machines

Course

Field of study
Mechanical engineering

Year/Semester
2/3

Area of study (specialization)
Mechatronic Constructions

Profile of study
general academic

Level of study
Second-cycle studies

Course offered in

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
15

Other (e.g. online)

Tutorials

Projects/seminars

Number of credit points

Lecturers

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

Responsible for the course/lecturer:

Prerequisites

Knowledge about the design and selection of key components of machine drives and their dynamics. Knowledge of description and operation of basic dynamic systems. Design of drive systems, description and modeling of their mechanical parts. Searching for appropriate and necessary data in the literature, scientific and technical databases, internet and other sources. Ability to self-study. Use of ICT that are suitable for solving engineering problems. Understanding the need to learn and expand your knowledge throughout your life. Understanding the non-technical aspects and effects of engineering activities. Working as an active part of a team.

Course objective

To present in a concise and understandable way how to design control systems of machines. Description of individual machine components including motors, amplifiers, filters, sensors and electrical devices. Presentation of the already existing standards in the design and documenting of electrical design projects. Highlighting the importance of machine safety and discussing its principles for electrical equipment and shock protection.

Course-related learning outcomes

Knowledge

1. Student has a detailed knowledge of machines and technological equipment including conventional and numerical control of machine tools, universal and general-purpose machine tools, knows design, principles of operation, drives (main, feed and auxiliary) of technological machines, typical elements of technological machines and equipment and development trends: machine tools for machining, electrical discharge machining, electrochemical and abrasive blasting, foundry machines and equipment, machines and equipment for metal forming, machines for processing plastics, equipment for heat and thermo-chemical treatment, welding, CNC machine tools; knows issues of machines diagnostics in the various stages of life of technical systems and operation of machines. She/he has knowledge of machinery and equipment vibro-acoustics, vibro-acoustic diagnostics of machines and equipment, knows the principles of ergonomics, knows the principles of hydraulics including the basics of fluid technology.
2. Student has knowledge in the field of electrical engineering and electronics including issues used for design and analysis of electric drive systems and machine control systems.
3. Student has knowledge in the field of automatic control, robotics and automation of machines and technological processes including basic concepts and static and dynamic properties of elements and linear and nonlinear systems of automatic control, control systems and selection of controls, automatic control of complex systems, complex systems of production process automation, robots and manipulators: description and construction, their kinematics and dynamics, actuators, control and programming basics.
4. Student has elementary knowledge of the life cycle of mechanical equipment and systems.

Skills

1. Student can obtain information from literature, databases and other properly selected sources (also in English) in the field of mechanical engineering and other engineering and technical areas in line with the studied field; can integrate and interpret obtained information, as well as draw conclusions, formulate and justify opinions.
2. Student can work individually and in a team; knows how to estimate the time needed for the implementation of the commissioned tasks; can develop and implement such work schedule to meet deadlines.
3. Student can prepare and give a short presentation on the task results in the field of mechanics and mechanical engineering (construction, technology, organization).
4. Student can design and analyze electric power systems and control systems of machines.
5. Student can make use of automatic control systems and automatic control in technology, use the basics of PLC programming, select sensors, assemble components and measuring systems in automation, design machine control systems and manufacturing processes, select electric drive for machines, select robots to tasks in mechanical engineering, program at the basic level education and industrial robots.

Social competences

1. Student can interact and work in a group, taking up various roles.

2. Student can accurately identify priorities for implementation of tasks assigned by him/her or others.
3. Student can think and act in an entrepreneurial manner.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Laboratory final grade is based on preparation of students for classes and project of simple control system for machine in groups of two.
Exam covering theoretical aspects of this course in the form of multiple-choice test with 15-20 questions. Assessment: 3,0 <50%;60%), 3,5 <60%;70%), 4,0<70%;80%), 4,5<80%;90%), 5,0 <90%;100%).

Programme content

Program content covers topics related to:
- the division, types and operation of control systems with different information transfer systems,
- types of motors used in machines and their power supply,
- types of sensors and their role in control systems,
- principles of operation, types and the design of contact systems,
- design, operation and programming of industrial PLC controllers,
- embedded systems and computer control systems,
- architectures and strategies used in control systems and how they are selected for the task,
- safety issues related to electrical devices.

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, Wrocław 1995
2. J. Przepiórkowski. Silniki elektryczne w praktyce elektronika, Wydawnictwo BTC, Legionowo 2012
3. W. Heumann, T. Kracht, B. Petrick, H. Riege, René Wiegand Poradnik Fachowca 2013, Eaton Industries GmbH, Bon 2013
4. Poradnik: Zagadnienia Bezpieczeństwa w Maszynach i Instalacjach, Moeller

Additional

1. M. Szafarczyk, D. Śniegulska-Grądzka, R. Wypysiński, Podstawy układów sterowań cyfrowych i komputerowych, Wydawnictwo Naukowe PWN, 2007
2. S. Kacprzak, Programowanie sterowników PLC zgodnie z normą IEC61131-3 w praktyce, Wydawnictwo BTC, Legionowo - 2011
3. D. Buchczik, W. Ilewicz, J. Piotrowski, Pomiary czujniki i metody pomiarowe wybranych wielkości fizycznych i składu chemicznego, Wydawnictwo WNT, 2013

Breakdown of average student's workload

	Hours	ECTS
Total workload	60	2,0
Classes requiring direct contact with the teacher	35	1,2
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	25	0,8

[1] delete or add other activities as appropriate