COURSE DESCRIPTION CARD - SYLLABUS

Course name
Robot programming and task planning [S1AiR2P>PO10-PRiPZ]

Course

Field of study
Automatic Control and Robotics

Year/Semester
4/7

Area of study (specialization)
–

Profile of study
practical

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
15

Laboratory classes
30

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

The student starting the subject should have a basic knowledge of automatic control and robotics. One should also be able to obtain information from specified sources and be willing to cooperate as part of a team.

Course objective

The aim of the course is to familiarize students with the fundamentals of robot programming. Theoretical foundations are illustrated with examples and practical exercises using the robots Kuka KR200. The aim of the course is also to familiarize students with the basics of off-line robot programming using the ABB RobotStudio simulation software.

Course-related learning outcomes

Knowledge:
1. The graduate has an well-structured knowledge of classification, construction and kinematic structures, mathematical description, principles of operation and programming of manipulation robots.
2. The graduate knows and understands to an advanced level the theory and methods in the field of design, application and control of actuators of automatics and robotics.

3. The graduate knows and understands the basic processes occurring in the life cycle of devices and selected security systems used in automation and robotics.

Skills:
1. The graduate has basic exploitation and operator skills of industrial robos.
2. The graduate is able to create, test and run a simple motion program for an industrial manipulator; is able to solve basic tasks related to robot kinematics.
3. Can plan, prepare and simulate the operation of simple robotics system using off-line programming software.

Social competences:
1. The graduate is aware of the need for a professional approach to technical issues, meticulous familiarization with the documentation and environmental conditions.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: written exam (checking theoretical knowledge) in the basics of industrial robots programming.
Laboratory: checking practical skills in programming of Kuka robots, as well as performing off-line robot programming tasks using the RobotStudio system, evaluation of tests and report

Programme content

Lecture. Acquainting with the rules of safety at the workplace with an industrial robot. Discussion of the basics of robot programmingincluding: hardware and software of the robot controller including VxWorks real-time operating system, principles of manual control and program startup, tool calibration in various ways, controller operation modes, kinematic singularities and their consequences in manipulator motion, standard motions and their parameters, exact and approximate positioning, motion planning in the joint and cartesian space. Principles of proper planning of robot tasks. Issues of interaction with external devices through exchange of input / output signals. Work of robots dividing the work space, the principle of locking the areas. Presentation of sample production programs. Presentation of differences between the versions of the KRC and VKRC controllers operating in VW factories. Introduction to the basic functions of RobotStudio off-line robot programming software. Presentation of planning a sample task based on the geometric model of the object. Generating a program ready to be sent to the robot controller.
Laboratory: Control of industrial robot in manual mode in various coordinate systems. Calibration of the tool and the robot (mastering). Recording and running the program. Interact with external devices. Motion study with approximate positioning. Offline robots programming using the ABB RobotStudio software. Scheduling tasks based on the object's geometric model. Programming of signal exchange.

Course topics

none

Teaching methods

Lecture: multimedia presentation, illustrated with real-world examples of industrial robot applications.
Laboratory: performing exercises using industrial robots Kuka KR200.

Bibliography

Basic:
1. J.J. Craig, Wprowadzenie do robotyki. Mechanika i sterowanie, Warszawa WNT.
2. Technical documentation regarding Kuka robots.
3. Technical documentation of ABB robots and RobotStudio simulation system, https://library.abb.com/

Additional:
1. K. Kozłowski, P. Dutkiewicz, W. Wróblewski, Modelowanie i sterowanie robotów, WN PWN Warszawa

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	45	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	30	1,00