COURSE DESCRIPTION CARD - SYLLABUS

Course name
Robot programming and task planning [S1AiR1E>PO1-PRiPZ]

Course

Field of study
Automatic Control and Robotics

Year/Semester
3/5

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
English

Form of study
full-time

Requirements
elective

Number of hours

Lecture
30

Laboratory classes
30

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

5,00

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:
Knows and understands typical engineering technologies, principles and techniques of construction of simple automation and robotics systems; knows and understands the principles of selection of executive systems, computational units and measurement and control elements and devices [K1_W20 (P6S_WG)].
Is familiar with the current status and latest development trends of the field of automation and robotics

[K1_W21 (P6S_WG)].
Knows and understands the fundamental dilemmas of modern civilisation related to the development of automation and robotics [K1_W28 (P6S_WK)].
Skills:
Is able to plan, prepare and simulate the operation of simple automation and robotics systems [K1_U10 (P6S_UW)].
Is able to select the type and parameters of the measurement system, control unit and peripheral and communication modules for the selected application and integrate them in the form of the resulting measurement and control system [K1_U22 (P6S_UW)].
Is able to develop a solution to a simple engineering task and implement, test and run it in a selected programming environment on a PC for selected operating systems [K1_U26 (P6S_UW)].
Social competences:
Is aware of the importance and understands the non-technical aspects and consequences of engineering activities, including their impact on the environment and the related responsibility for decisions; is ready to care for the achievements and traditions of the profession [K1_K2 (P6S_KR)].
The graduate is aware of the need for a professional approach to technical issues, meticulous familiarization with the documentation and environmental conditions in which the equipment and its components can operate. The graduate is ready to observe the rules of professional ethics and to demand it from others, to respect the diversity of opinions and cultures [K1_K5 (P6S_KR)].

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 and ABB 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 ofsignal 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, Introduction to Robotics. Mechanics and Control, Pearson Education International.
2. Technical documentation regarding Kuka robots and the RobotStudio simulation system.

Additional:

Breakdown of average student's workload

	Hours	ECTS
Total workload	120	5,00
Classes requiring direct contact with the teacher	60	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	60	2,50