COURSE DESCRIPTION CARD - SYLLABUS

Course name
Robotics [S1AiR1E>Rob2]

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
compulsory

Number of hours

Lecture
30

Laboratory classes
0

Other (e.g. online)
0

Tutorials
30

Projects/seminars
0

Number of credit points

5,00

Coordinators

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Lecturers

Prerequisites

Knows and understands in an advanced level selected facts, objects and phenomena, as well as methods and theories explaining the complex relations between them, constituting basic general knowledge of mathematics including algebra, geometry, analysis, probabilistic and elements of discrete mathematics and logic, including mathematical methods and numerical methods necessary for: • description and analysis of linear and basic non-linear dynamic and static systems • description and analysis of complex quantities • description of control algorithms and stability analysis of dynamic systems • description, analysis and methods of signal processing in the time and frequency domain • numerical simulation of dynamic systems in the domain of continuous time and discrete time. [K1_W01 (P6S_WG)] Knows and understands in an advanced level - selected facts, objects and phenomena and their methods and theories explaining the complex relationships between them, constituting basic general knowledge in selected areas of general physics including electricity and magnetism, and solid state physics, including the knowledge necessary to understand basic physical phenomena occurring in and around automation and robotics components and systems. [K1_W02 (P6S_WG)] The graduate has an well-ordered and theoretically based knowledge of general mechanics: statics, kinematics and dynamics. The graduate knows and understands the principles of modelling and constructing simple mechanical systems. [K1_W03 (P6S_WG)]

Course objective

Assumptions and objectives of the course: Acquaintance of knowledge about robot control algorithms and about controlling robot interactions with environment .

Course-related learning outcomes

Knowledge:
Has a structured and theoretically grounded general knowledge of general mechanics: statics, kinematics and dynamics, including the knowledge necessary to understand the principles of modelling and design of simple mechanical systems [K1_W3 (P6S_WG)].
Has a structured knowledge of classification, construction, kinematic structures, mathematical description, principles of operation and programming of manipulating robots; knows and understands to an advanced extent the mathematical description, properties and principles of operation and programming of simple mobile robots [K1_W15 (P6S_WG)].
Is familiar with the current status and latest development trends of the field of automation and robotics [K1_W21 (P6S_WG)].
Knows the methods, techniques, tools and materials used in solving simple engineering tasks in the field of automation and robotics [K1_W23 (P6S_WG)].
Skills:
Can interpret with understanding the design technical documentation and simple technological diagrams of automation and robotics systems [K1_U2 (P6S_UW)].
Can determine and use models of simple electromechanical systems and selected industrial processes, and use them for analysis and design of automation and robotics systems [K1_U11 (P6S_UW)].
Has basic operational skills regarding industrial manipulative robots; can create, test and run a simple motion programme for an industrial manipulator; can solve basic robot kinematics tasks [K1_U17 (P6S_UW)].
Social competences:
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:

Learning outcomes presented above are verified as follows:
Lecture: Written test (test of theoretical knowledge) in the field of robotics
Exercises: Score points in terms of computation, programming and knowledge of dynamics and control of robots.

Programme content

Statics of robots. Robot control systems: Independent joint control. Point-to-point motion control. Path motion control. Inverse dynamics control. Computed torque feedforward control. Manipulator interaction with environment: Compliance control. Force control with inner position loop. Force control with inner velocity loop. Hybrid position/force control. Impedance control. Adaptive robot control. Basics of the trajectory planning and robot programming.
Exercises: Construction of the dynamics model of manipulators, Simulation of control with dynamic interactions, Simulation of position and force control.

Course topics

none

Teaching methods

1. Lecture: multimedia and board presentation,
2. Exercises: multimedia presentation, illustrated presentation,
examples given on the blackboard and the execution of the tasks given by the lecturer - practical exercises.

Bibliography

Basic
1. Szkodny, T: Podstawy robotyki. Wydawnictwo Politechniki Śląskiej, 2012.
2. Zdanowicz: Podstawy robotyki. Wydawnictwo Politechniki Śląskiej, 2012.
3. Buratowski, T.: Podstawy robotyki. AGH Uczelniane Wydawnictwa Naukowo-Dydaktyczne, Kraków, 2006.
4. Jezierski, E.: Dynamika robotów. WNT, Warszawa, 2006.
5. Craig, J.J.: Wprowadzenie do robotyki. Mechanika i sterowanie, WNT 1993.
Additional
1. Morecki, A., Knapczyk, J.: Podstawy robotyki. Teoria i elementy manipulatorów. WNT, Warszawa, 1999.
2. Spong, M. W., M. Vidysagar: Robot modeling and Control. John Wiley & Sons, Inc., 2006
3. McKerrow, Ph. J.: Introduction to Robotics, Addison-Wesley 1991.
4. Paul, R.P: Robot Manipulators: Mathematics, Control, and Programming, Boston MIT Press 1981.
(available on Internet)

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