COURSE DESCRIPTION CARD - SYLLABUS

Course name
Robotics

Course

Field of study
Automatic Control and Robotics

Year/Semester
2/4

Area of study (specialization)

Profile of study

Level of study
First-cycle studies

Course offered in
English

Form of study
full-time

Requirements
compulsory

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:
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Faculty of Control, Robotics and Electrical Engineering

Piotrowo 3A 60-965 Poznań

Responsible for the course/lecturer:

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

Acquaintance of knowledge about robot kinematics: Direct and Inverse kinemtics for positions and velocities of robot manipulators

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; the graduate knows and understands to an advanced level mathematical description, properties and principles of operation and programming of simple mobile robots. [K1_W07 (P6S_WG)]

2. Knows and understands to an advanced level the theory and methods of structures and operating principles of analogue and discrete control systems (open and feedback systems) as well as linear and simple, non-linear analog and digital controllers. [K1_W16 (P6S_WG)]

3. 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. [K1_W19 (P6S_WG)]

4. The graduate is familiar with the current state and the latest development trends in the field of automation and robotics. The graduate knows and understands the fundamental dilemmas of modern civilization connected with the development of automation and robotics. [K1_W21 (P6S_WG)]]

Skills

1. The graduate is able to determine and use models of simple electromechanical systems and selected industrial processes, as well as to use them for the analysis and design of automation and robotics systems. [K1_U05 (P6S_UW)]

2. The graduate has basic exploitation and operator skills of industrial robots; 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. [K1_U08 (P6S_UW)]

3. The graduate is able to select the type and parameters of the actuator system, measurement system, control unit and peripheral and communication modules for the selected application and to integrate them in the form of the final measurement and control system. [K1_U17 (P6S_UW)]

4. Can plan, prepare and simulate the operation of simple automation and robotics systems. [K1_U21 (P6S_UW)]

Social competences

1. Is ready to critically evaluate his knowledge. Understands the need and knows the possibilities of continuous learning - raising professional, personal and social competences, can inspire and organize the learning process of other people. [K1_K01 (P6S_KK)]

2. The graduate is aware of the importance and understands the non-technical aspects and effects of engineering activities, including its impact on the environment and the associated responsibility for decisions taken. The graduate is ready to take care of the achievements and traditions of the profession. [K1_K02 (P6S_KK)]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: Written test (test of theoretical knowledge) in the field of robotics

Tutorials: Score points in terms of computation, programming and knowledge of kinematics of robots

Programme content

Robot, robot automation, robot manipulator. Kinematical chains, degrees of freedom, Denavit-Hartenberg notation, main kinematic structures of robot manipulators. Robot task space and its coordinates, orientation, kinematic coordinates, homogenous coordinates and transformations. Direct and inverse problems of robot kinematics: positions, velocities, accelerations, manipulator Jacobian matrix.

Tutorials: Analysis of kinematic structures of manipulators - constructional guidelines. Position and orientation of the TCP(Tool Center Point). Solving direct and inverse kinematics tasks .

Teaching methods

Lecture: multimedia and board presentation,

2. Tutorials: multimedia presentation, illustrated presentation,

examples given on the blackboard and the execution of the tasks given by

the lecturer - practical exercises.

Bibliography

Basic

1. Lynch, K,M. and Park, F.C.: Modern Robotics Mechanics, Planning, and Control. Cambridge University Press, 2017

2. Spong, M. W., M. Vidysagar: Robot dynamics and control. John Wiley & Sons, 2008.

3. Craig, J. J. : Introduction to Robotics: Mechanics and Control, Pearson, 3rd Edition, 2005

4. Niku, S.B.: Introduction to Robotics: Analysis, Control, Applications, 3rd Edition, J.Wiley, 2019.

Additional

1. McKerrow, Ph. J.: Introduction to Robotics, Addison-Wesley 1991.

2. Siciliano, B., Sciavicco, L., Villani, L., Oriolo, G.: Robotics. Modelling, Planning and Control. Springer Verlag, 2009.

Breakdown of average student's workload

	Hours	ECTS
Total workload	55	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]	25	1,0

[1] delete or add other activities as appropriate