



## Subject card

|   |   |  |  |                                     |   |            |     |
|---|---|--|--|-------------------------------------|---|------------|-----|
| Subject name and code                       | Computer Design of Manipulators and Robots, PG_00038126   |  |  |                                     |   |            |     |
| Field of study                              | Automation, Robotics and Control Systems  |  |  |                                     |   |            |     |
| Date of commencement of studies             | October 2023  |  | Academic year of realisation of subject  |                                     | 2025/2026   |            |     |
| Education level                             | first-cycle studies   |  | Subject group  |                                     |   |            |     |
| Mode of study                               | Full-time studies   |  | Mode of delivery   |                                     | at the university   |            |     |
| Year of study                               | 3   |  | Language of instruction  |                                     | Polish  |            |     |
| Semester of study                           | 6   |  | ECTS credits   |                                     | 3.0   |            |     |
| Learning profile                            | general academic profile  |  | Assessment form  |                                     | assessment  |            |     |
| Conducting unit                             | Katedra Biomechatroniki -> Faculty of Electrical and Control Engineering  |  |  |                                     |   |            |     |
| Name and surname of lecturer (lecturers)    | Subject supervisor  |  | dr inż. Mariusz Dąbkowski  |                                     |   |            |     |
|   | Teachers  |  |  |                                     |   |            |     |
| Lesson types and methods of instruction     | Lesson type   | Lecture  | Tutorial   | Laboratory                          | Project   | Seminar    | SUM |
|   | Number of study hours   | 15.0   | 0.0  | 0.0                                 | 30.0  | 0.0        | 45  |
|   | E-learning hours included: 0.0  |  |  |                                     |   |            |     |
| Learning activity and number of study hours | Learning activity   | Participation in didactic classes included in study plan |  | Participation in consultation hours |   | Self-study | SUM |
|   | Number of study hours   | 45   |  | 4.0                                 |   | 26.0       | 75  |
| Subject objectives                          | The aim of the course is to show students, how to realize the designing process of mechatronic devices and to teach them how to do it in practice during designing robot's manipulator. |  |  |                                     |   |            |     |
| Learning outcomes                           | Course outcome  |  | Subject outcome  |                                     | Method of verification  |            |     |
|   | [K6_U08] can design and build systems and devices in the field related to mechatronics and robotics systems   |  | Student designs the mechanical and drive parts of a robot manipulator with 3 degrees of freedom. Uses CAD programs.  |                                     | [SU4] Assessment of ability to use methods and tools<br>[SU3] Assessment of ability to use knowledge gained from the subject<br>[SU2] Assessment of ability to analyse information<br>[SU1] Assessment of task fulfilment                 |            |     |
|   | [K6_K02] can work in a group taking on different roles in it  |  | Student develops technical text and drawing documentation of the mechanical and drive parts of the manipulator designed by the group.  |                                     | [SK5] Assessment of ability to solve problems that arise in practice<br>[SK4] Assessment of communication skills, including language correctness<br>[SK3] Assessment of ability to organize work<br>[SK1] Assessment of group work skills |            |     |
|   | [K6_W10] has basic knowledge related to mechatronics and robotics systems   |  | Student lists stages of designing stationary robots. Characterizes individual phases of the design process. Performs calculations for the problem of direct and inverse kinematics for a selected 3-degree-of-freedom scheme. Calculates basic strength indicators of structures. Selects drives and designs drive transmission systems. Prepares technical documentation (calculations and drawings) of the designed manipulator. He can use CAD-AutoCAD and Inventor programs. |                                     | [SW3] Assessment of knowledge contained in written work and projects<br>[SW1] Assessment of factual knowledge   |            |     |

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| Subject contents   | Lecture: Reminder knowledge about technical drawing. Issues concerning the design of robots: the design methodology (formulation of the design's task, preparation of conceptual design, preparation of constructional design, preparation of the project of realization), creating the concept of manipulator (the task of designing, drawing up a list of requirements, the synthesis of kinematic structure of manipulator, the initial calculation of kinematics and dynamics), calculations of the construction (industrial robot functional structure, mechanisms of orienting, manipulator carrier system, propelling manipulator, grippers and their accuracy of positioning). Project: Design of the robot stationary supporting structure to carry out defined task, including: a description of the kinematics and dynamics, calculation of design and construction of the mechanical system, the choice of drives and technical documentation with drawings. Design of the hardware part of the CNC system of the robot. |  |                               |
| Prerequisites and co-requisites                                | A fluent using of AutoCad environment. Knowledge of mechanical calculations of structure strength.   |  |                               |
| Assessment methods and criteria                                | Subject passing criteria   | Passing threshold  | Percentage of the final grade |
|  | Test   | 50.0%  | 25.0%                         |
|  | Project  | 100.0%   | 75.0%                         |
| Recommended reading  | Basic literature   | <div>1. Spong. M. W., Vidyasagar M.: Dynamika i sterowanie robotów. Wydawnictwa Naukowo-Techniczne. Warszawa: 1997.</div> <div>2. Morecki A, Knapczyk J.: Podstawy robotyki. Warszawa: WNT 1999.</div> <div>3. Niederliński A.: Roboty przemysłowe. Warszawa: WSiP 1981.</div> <div>4. Honczarenko J.: Roboty przemysłowe. Budowa i zastosowanie. WNT Warszawa, 2004.</div> <div>5. Dobrzański T.: Rysunek techniczny maszynowy. Wydawnictwa Naukowo-Techniczne. Warszawa: 2021.</div> |                               |
|  | Supplementary literature   | <div>1. Morecki A., Knapczyk. J.: Podstawy robotyki. Teoria i elementy manipulatorów i robotów. Wydawnictwa Naukowo-Techniczne. Warszawa: 1999.</div> <div>2. Tomaszewski K. : Roboty przemysłowe. Projektowanie układów mechanicznych. Wydawnictwa Naukowo-Techniczne. Warszawa: 1993.</div>  |                               |
|  | eResources addresses   | Adresy na platformie eNauczanie:   |                               |
| Example issues/<br>example questions/<br>tasks being completed | <div>1. principles of design process (task definition, preparation of conceptual project, preparation of constructional project, preparation of the executive project),</div> <div>2. development of the concept of the manipulator (task design, a list of requirements, the synthesis of the kinematic structure of the manipulator, kinematic and dynamic calculations),</div> <div>3. structural calculations: static and dynamic - choosing the drives.</div>   |  |                               |
| Work placement   | Not applicable   |  |                               |