# GDAŃSK UNIVERSITY OF TECHNOLOGY

## Subject card

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| Subject name and code | Robotics in space exploration, PG_00050053 |
| Field of study | Space and Satellite Technologies |

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| Date of commencement of studies | February 2024 | Academic year of realisation of subject | 2024/2025 |
| Education level | second-cycle studies | Subject group | Obligatory subject group in the field of study<br>Subject group related to scientific research in the field of study |
| Mode of study | Full-time studies | Mode of delivery | at the university |
| Year of study | 1 | Language of instruction | Polish |
| Semester of study | 2 | ECTS credits | 3.0 |
| Learning profile | general academic profile | Assessment form | assessment |

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| Conducting unit | Department Of Mechanics And Mechatronics -> Faculty Of Mechanical Engineering And Ship Technology -> Wydziały Politechniki Gdańskiej |
| Name and surname of lecturer (lecturers) | Subject supervisor | dr inż. Wiktor Sieklicki |
| | Teachers | |

### Lesson types and methods of instruction

| Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
|---|---|---|---|---|---|---|
| Number of study hours | 30.0 | 0.0 | 30.0 | 0.0 | 0.0 | 60 |
| 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 | 60 | 5.0 | 10.0 | 75 |

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| Subject objectives | The aim of this course is to provide students with a knowledge about robotics, automatics, system control, manipulators kinematics, sensors and actuators as well as to show how to design robotic devices for use in space. |

### Learning outcomes

| Course outcome | Subject outcome | Method of verification |
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| K7_W06 | Student can identify and understands working principles and design basics of robotic systems in space industry | [SW1] Assessment of factual knowledge |
| K7_U08 | Student can analyze tasks of mechanics and electronics that robots in space require. | [SU4] Assessment of ability to use methods and tools<br>[SU1] Assessment of task fulfilment |
| K7_W03 | Student can analyse and design stationary mechatronic systems | [SW3] Assessment of knowledge contained in written work and projects |
| K7_U09 | Student is able to design original devices and analyze processes occuring in space robotics | [SU4] Assessment of ability to use methods and tools |
| [K7_K03] Can analyse and implement assigned tasks while maintaining high technical standards. Is able to work and interact in a group, taking on different roles. Adheres to the principles of professional ethics and respects the diversity of views and cultures. | Student recognizes methods for designing robotic devices and signal analysis. Student can define group tasks and is able to manage designing robotic systems in group | [SK3] Assessment of ability to organize work<br>[SK1] Assessment of group work skills<br>[SK2] Assessment of progress of work |

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| Subject contents | kinematics - joints, degrees of freedom, matrices, coordinate systems definition and transformation, D-H transformation, introduction to space robotics, identification of space environment, challenges in designing for space industry, space vehicles types and measures of displacement, sensors and actuators in robotics, unmanned space crafts |
| Prerequisites and co-requisites | Mechanics and Strength of the Materials, Automatics and Control, Informatics, Mechatronics |

| Assessment methods and criteria | Subject passing criteria | Passing threshold | Percentage of the final grade |
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| | | 50.0% | 50.0% |
| | | 50.0% | 50.0% |

| Recommended reading | Basic literature | Craig J., Wprowadzenie do robotyki. Mechanika i sterowanie, WNT, Warszawa 1993Genta G., Introduction to the Mechanics of Space Robots, Springer Press, 2012Morecki A., Knapczyk J., Podstawy robotyki. Teoria i elementy manipulatorów i robotów, WNT,Warszawa 1993Giralt G., Hirzinger G., Robotic Research, Springer Press, 1996Jazar Reza, Theory of Applied Robotics, Kinematics, Dynamics and Control, Springer Press, 2010Jarzębowska E., Podstawy dynamiki mechanizmów i manipulatorów, Oficyna WydawniczaPolitechniki Warszawskiej, Warszawa 1998 |
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| | Supplementary literature | Siciliano B., Khatib O., Springer Handbook of Robotics. Berlin, Springer 2008Morecki A., Knapczyk J., Kędzior K., Teoria mechanizmów i manipulatorów, WNT, Warszawa 2002Jarzębowska E., Mechanika analityczna. Warszawa, Oficyna Wydawnicza Politechniki Warszawskiej2003Arkin R., Behavior-Bassed Robotics, MIT Press, 1998K. Kozłowski, P. Dutkiewicz, W. Wróblewski, Modelowanie i sterowanie robotów, PWN Warszawa,2003Bishop R.,The Mechatronics Handbook. CRC Press 2002Schmidt D., Mechatronika. REA, Warszawa 2011 |
| | eResources addresses | Adresy na platformie eNauczanie: |

| Example issues/ example questions/ tasks being completed | Define kinematics of SCARA manipulator, its working envelope, joints, degrees of freedom type and number, redundancy, singularities, create D-H matrix |
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| | Define differences between analog and digital signal |
| | What are accelerometers - their design, working principle. Describe a system for meaasuring a reaction force between pilot and joystick he is handling while piloting an aircraft - use a accelerometer. |
| | What are the features of robots that allow them to be used in space. |

| Work placement | Not applicable |
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