GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

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| Subject name and code | , PG_00056136 | | |
| Field of study | Mechatronics | | |
| Date of commencement of studies | October 2022 | Academic year of realisation of subject | 2024/2025 |
| 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 | 2.0 |
| Learning profile | general academic profile | Assessment form | assessment |
| Conducting unit | Department of Manufacturing and Production Engineering -> Faculty of Mechanical Engineering and Ship Technology | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | dr inż. Norbert Piotrowski | |
| | Teachers | | |

**Lesson types and methods of instruction**

| Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
|---|---|---|---|---|---|---|
| Number of study hours | 15.0 | 0.0 | 15.0 | 0.0 | 0.0 | 30 |

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 | 30 | 0.0 | 0.0 | 30 |

**Subject objectives**

Conveying basic knowledge on methods and means of production automation as well as robotisation technologies of manufacturing processes, along with the issues related to controlling the related process flow as determinants of modern economy. The development of the capability for selecting the adequate technical measures and means aimed at enhancing the operational efficiency of individual machines by robotisation and automation of related working cycless as well as the entire process flow within multi-machine systems.

**Learning outcomes**

| Course outcome | Subject outcome | Method of verification |
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| [K6_W08] knows and understands design and production processes of elements and simple mechatronic devices | The student is able to design simple robotic stations applicable in production. | [SW3] Assessment of knowledge contained in written work and projects |
| [K6_U06] is able to identify and formulate specification of simple, practical engineering tasks, distinctive for mechatronics | The student is able to solve the kinematic tasks of robots used in production systems. | [SU3] Assessment of ability to use knowledge gained from the subject |
| [K6_U05] is able to use properly choosen tools to compare design solutions of elements and mechatronics systems according to given application and economic crtierions (e.g. power demand, speed, costs) | The student is able to use the tools and techniques to optimize the processes of automation and robotization of production stations. | [SU4] Assessment of ability to use methods and tools |
| [K6_W11] has a basic knowledge about the life cycle of mechatronic systems and objects | The student has a basic knowledge of the life cycle of devices, objects and mechatronic systems. The student explains the structure and principle of operation of mechatronic systems. | [SW3] Assessment of knowledge contained in written work and projects |
| [K6_W10] has a basic knowledge about development trends in terms of engineering and technical sciences and scientific disciplines: Mechanical Engineering, Automation, Electronics and Electrical Engineering, adequate for Mechatronics curse | The student has a basic knowledge of development trends in the field technical sciences and scientific disciplines: Construction and operation of machines, Mechanics appropriate for the field of study Mechatronics. The student explains the structure and principle of operation of mechatronic systems. | [SW3] Assessment of knowledge contained in written work and projects |

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| Subject contents | Planning the composition and organisational structure of a cellular system for manufacturing elements of the fixturing equipment with variant processing solutions for the needs of simulation analysis in FlexSim® system, together with quantitative evaluation of results obtained.<br><br>Selected elements of matrix calculus and solving the task of simple kinematics and inverse kinematics of an industrial robot (IR) in Matlab© software.<br><br>Analysis of the IR manipulation space by its functional characteristics; programming the material handling cycles in the material supply subsystem of machine stands. Modelling and analysis of automated processes using graphical models, matrix notation and event networks. | |
| Prerequisites and co-requisites | Basic knowledge of manufacturing technologies as well as the structure and operation of machine tools and manufacturing equipment. | |
| Assessment methods and criteria | | |

| Subject passing criteria | Passing threshold | Percentage of the final grade |
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| Written colloquium for credit of the lectures | 56.0% | 50.0% |
| Reports related to laboratory classes | 56.0% | 50.0% |

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| Recommended reading | Basic literature | 1. Honczarenko J.: Obrabiarki sterowane numerycznie, Warszawa, WNT, 2008.<br><br>2. Honczarenko J., Roboty przemysłowe, Wydawnictwo Naukowe PWN, Warszawa 2010.<br><br>3. Kost G., Łebkowski P., Węsierski Ł. N.: Automatyzacja i robotyzacja procesów produkcyjnych. Seria: Zarządzanie i Inżynieria Produkcji, PWE, Warszawa 2013.<br><br>4. Pająk E.: Zarządzanie produkcją. Produkt, technologia, organizacja, PWN, Warszawa 2013.<br><br>5. FlexSim. 3D Simulation software, User manual, FlexSim software Products Inc., USA, 2017. |
| | Supplementary literature | 1. Grzesik W., Niesłony P., Kiszka P., Programowanie Obrabiarek CNC. Wydawnictwo Naukowe PWN, Warszawa 2020.<br><br>2. Honczarenko J.: Elastyczna automatyzacja wytwarzania. Obrabiarki i systemy obróbkowe, WNT, Warszawa 2000.<br><br>3. Kaczmarek W., Panasiuk J.: Robotyzacja procesów produkcyjnych, z cyklu: Robotyka, PWN, Warszawa 2017.<br><br>4. Mechatronika. Praca zbiorowa pod kier. D. Schmida (oprac. polskie M. Olszewski i inni), Verlag Europa - Lehrmittel Rea. Warszawa 2002. |
| | eResources addresses | |

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| Example issues/ example questions/ tasks being completed | 1. Models of concentration and diversification of manufacturing operations in the viewpoint of the productivity of the manufacturing processes.<br><br>2. Quantitative description of automation and of manufacturing process operations.<br><br>3. The concept of (total) complete machining and its realisation with the use of use of working machining centres.<br><br>4. The classification of machine tool systems in terms of part diversification and the scale of production.<br><br>5. The general purpose machine tools and machine specialisation, and the forms of production automation.<br><br>6. Functional division of the means for programmed control and the factors for related application tor specific production tasks.<br><br>7. Palletising and part supply and flow for machining centre operation in flexible manufacturing systems.<br><br>8. Typical applications of industrial robots and handling equipment for the operation of manufacturing facilities.<br><br>9. The basic parameters used in the description of atributes and operational characteristics of industrial robots.<br><br>10. Application features of machining centres (MCs)and stand-alone machining stations (SMSs).<br><br>11. The criteria and conditions determining the selection of multi-axis CNC machine tools.<br><br>12. The classification schemes of layout structures in parts manufacture with regard to automation of production processes.<br><br>13. The rationale behind and conditions (technical measures) for selecting multi-part machining operations; sketches of selected examples of applications.<br><br>14. The techniques and means used in the subsystems allocated to the parts - and tool storage meeting the demands of flexible manufacturing.<br><br>15. Techniques and means for automated inspection and measurement functions in modern manufacturing systems. |
| Work placement | Not applicable |