



Subject card

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| Subject name and code | Modelling of mechatronic systems, PG_00060475 | | | | | | |
| Field of study | Mechatronics | | | | | | |
| Date of commencement of studies | October 2024 | Academic year of realisation of subject | | | 2026/2027 | | |
| Education level | first-cycle studies | Subject group | | | Obligatory subject group in the field of study 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 | 3 | Language of instruction | | | Polish | | |
| Semester of study | 5 | ECTS credits | | | 4.0 | | |
| Learning profile | general academic profile | Assessment form | | | exam | | |
| Conducting unit | Division of Mechatronics -> Institute of Mechanics and Machine Design -> Faculty of Mechanical Engineering and Ship Technology -> Faculties of Gdańsk University of Technology | | | | | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | prof. dr hab. inż. Krzysztof Kaliński | | | | | |
| | Teachers | | | | | | |
| Lesson types | 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 | | 6.0 | | 49.0 | 100 |
| Subject objectives | Introduction to modeling of mechatronic systems. | | | | | | |

| Learning outcomes | Course outcome | Subject outcome | Method of verification |
|-------------------|---|---|--|
| | [K6_W03] has organized and theoretically supported, advanced knowledge in the field of automation and control theory of stationary, continuous and discrete mechatronic systems, mechatronic design, developments and exploitation of mechatronic systems | Student identifies phenomena accompanied functioning of mechatronic systems. Student presents a command of the methods of the stationary mechatronic systems; modelling. Student recognises the methods of modelling of as well; the mechatronic systems; structure, as; observed signals. Student elaborates physical models of mechatronic systems. Student defines group tasks of the mechatronic systems; modelling. Student designs open- and closedloop models of mechatronic systems in interdisciplinary teams. | [SW1] Assessment of factual knowledge |
| | [K6_U07] is able to design elements of mechatronic systems taking into consideration given application and economic criteria, using appropriate methods, techniques and tools | Student identifies phenomena accompanied functioning of mechatronic systems. Student presents a command of the methods of the stationary mechatronic systems; modelling. Student recognises the methods of modelling of as well; the mechatronic systems; structure, as; observed signals. Student elaborates physical models of mechatronic systems. Student defines group tasks of the mechatronic systems; modelling. Student designs open- and closedloop models of mechatronic systems in interdisciplinary teams. | [SU4] Assessment of ability to use methods and tools |
| | [K6_W09] knows and understands methods of mechatronic modelling and design of systems / stationary processes as well as utilized methods and techniques including structural modelling, modal analysis, optimal control, digital control and knows modelling languages as well as computer tools for design and simulation of systems / mechatronic processes | Student identifies phenomena accompanied functioning of mechatronic systems. Student presents a command of the methods of the stationary mechatronic systems; modelling. Student recognises the methods of modelling of as well; the mechatronic systems; structure, as; observed signals. Student elaborates physical models of mechatronic systems. Student defines group tasks of the mechatronic systems; modelling. Student designs open- and closedloop models of mechatronic systems in interdisciplinary teams. | [SW1] Assessment of factual knowledge |
| Subject contents | <p>Course content – lecture</p> <p>LECTURES. Basic terms. Creation of calculation models: Models of mechatronic systems components. Modelling of multi-body systems. Structural models. Modal models. Mathematical description: Analogies between physical environments. Dynamic equations in generalised coordinates. Control of mechatronic systems: Multidimensional control systems. Linear optimal control. Modal control. Closed-loop systems. Control systems design. Examples of modelling of mechatronic systems: Industrial robot. Chosen problems of vehicle dynamics.</p> <hr/> <p>Course content – project</p> <p>PROJECT The students perform 2 projects in their own interdisciplinary teams, at simultaneous distribution of competences between several members. The tasks depend on creation of calculation models of the mechatronic systems with diversified physical nature, and on multidimensional control systems design. The first project concerns modelling of open-loop systems, while the second one considers additionally existence of feedbacks, due to accompanying working processes. During the projects performance one ought to focus a special attention on modelling in mechatronic systems as well the structure, as the signals.</p> | | |

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| Prerequisites and co-requisites | Knowledge on Mechanics and Strength of materials. Knowledge and experience on Fundamentals of automatic control. Knowledge and experience in Informatics (sem. II, IV). Knowledge on Mechatronic systems components. | | |
| Assessment methods and criteria | Subject passing criteria | Passing threshold | Percentage of the final grade |
| | Project | 100.0% | 35.0% |
| | Written exam | 50.0% | 65.0% |
| Recommended reading | Basic literature | <ol style="list-style-type: none"> 1. Heimann B., Gerth W., Popp K.: Mechatronics. Components of the Method: Examples. Warsaw: PWN Scientific Publishing House 2001. 2. Gawrysiak M.: Mechatronics and Mechatronic Design. Białystok: Białostocka Political Publishing House 1997. (available online) 3. Cannon R. H.: Dynamics of Physical Systems. Warsaw: WNT 1973. 4. Kaliński K. J.: Supervision of Dynamic Processes in Mechanical Systems. 2nd revised edition. Gdańsk: Gdańsk University of Technology Publishing House 2026. Free e-book.. 5. Finite Element Method in Structural Dynamics. Gawroński W., Kruszewski J., Ostachowicz W., Tarnowski J., Wittbrodt E. Warsaw: Arkady 1984. 6. Kaczorek T.: Theory of Control and Systems. Warsaw: Wyd. PWN 1993. 7. Galewski M.: Materials for the laboratory of modeling of mechatronic systems. | |
| | Supplementary literature | <ol style="list-style-type: none"> 1. Mechatronics. Analysis, Design, and Testing of Selected Components and Systems. (Ed. K. Kluszczyński). Warsaw: PAK Publishing House 2013. 2. Skoczyński W.: Sensors in CNC Machine Tools. Warsaw: PWN Scientific Publishing House 2018. 3. Grzeżożek W., Adamiec-Wójcik I., Wojciech S.: Computer Modeling of Automotive Vehicle Dynamics. Cracow: Tadeusz Kościuszko Cracow University of Technology 2003. 4. Malec M. F.: Dynamic Balancing of Rigid and Bending-Prone Rotors in Theory and Practice. Influence Factor and Modal Method. 2nd ed. supplemented. Bydgoszcz: MM Publications 2026. | |
| | eResources addresses | | |
| Example issues/ example questions/ tasks being completed | <ol style="list-style-type: none"> 1. Modeling of multibody systems. Dynamics equations 2. The concept of modal models of mechatronic systems 3. Multidimensional control systems. Equations of state 4. Closed-loop systems with feedback. Modeling responses with an observer 5. Modeling of the robot's carrying system. Control modeling | | |
| Practical activities within the subject | Not applicable | | |

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