



## Subject card

|                                             |                                                                                                                                                                                                                                                                               |                                                                   |                                     |            |                                                                                                                      |         |     |
|---------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|-------------------------------------|------------|----------------------------------------------------------------------------------------------------------------------|---------|-----|
| Subject name and code                       | Mechatronics in transport, PG_00057112                                                                                                                                                                                                                                        |                                                                   |                                     |            |                                                                                                                      |         |     |
| Field of study                              | Transport and Logistics                                                                                                                                                                                                                                                       |                                                                   |                                     |            |                                                                                                                      |         |     |
| Date of commencement of studies             | February 2022                                                                                                                                                                                                                                                                 | Academic year of realisation of subject                           |                                     |            | 2021/2022                                                                                                            |         |     |
| 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                           | 1                                                                                                                                                                                                                                                                             | ECTS credits                                                      |                                     |            | 3.0                                                                                                                  |         |     |
| Learning profile                            | general academic profile                                                                                                                                                                                                                                                      | Assessment form                                                   |                                     |            | assessment                                                                                                           |         |     |
| Conducting unit                             | Department of Ship Manufacturing Technology, Quality Systems and Materials Science -> Faculty of Mechanical Engineering and Ship Technology                                                                                                                                   |                                                                   |                                     |            |                                                                                                                      |         |     |
| Name and surname of lecturer (lecturers)    | Subject supervisor                                                                                                                                                                                                                                                            | prof. dr hab. inż. Wiesław Tarełko                                |                                     |            |                                                                                                                      |         |     |
|                                             | Teachers                                                                                                                                                                                                                                                                      | prof. dr hab. inż. Wiesław Tarełko<br>mgr inż. Wojciech Olszewski |                                     |            |                                                                                                                      |         |     |
| Lesson types and methods of instruction     | Lesson type                                                                                                                                                                                                                                                                   | Lecture                                                           | Tutorial                            | Laboratory | Project                                                                                                              | Seminar | SUM |
|                                             | Number of study hours                                                                                                                                                                                                                                                         | 30.0                                                              | 0.0                                 | 15.0       | 0.0                                                                                                                  | 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                                                                | 9.0                                 |            | 21.0                                                                                                                 | 75      |     |
| Subject objectives                          | <b>The objective of the subject is:</b><br><br>- to educate students with the basic knowledge regarding the modern mechatronic systems used in transport<br><br>- to prepare students for design of specialized mechatronic systems used in a wide variety of transport units |                                                                   |                                     |            |                                                                                                                      |         |     |

| Learning outcomes | Course outcome                                                                                                                                                                                                  | Subject outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Method of verification                                                                                                                                                              |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                   | <p>[K7_W04] The student has basic knowledge of IT and telecommunication systems in transport and in the area of control in transport systems</p>                                                                | <p>Student mentions essential reasons for integration of mechanical, electronic and informatics components in order to obtain the mechatronic system<br/> Student mentions basic components of the mechatronic system<br/> Student mentions fundamental types of the mechatronic systems<br/> Student presents a general characteristic, manufacture processes, and application examples of the microelectromechanical systems MEMS<br/> Student presents a general characteristic, manufacture processes, and application examples of the nanoelectromechanical systems NEMS</p>                 | <p>[SW1] Assessment of factual knowledge<br/> [SW2] Assessment of knowledge contained in presentation</p>                                                                           |
|                   | <p>[K7_U02] The student is able to plan and carry out research experiments in selected transport issues using various research methods</p>                                                                      | <p>Student draws up a basic block scheme of the mechatronic system<br/> Student selects a physical phenomenon assured realizing the specified function by the mechatronic system sensor<br/> Student selects a physical phenomenon assured realizing the specified function by the mechatronic system actuator<br/> Student selects sensors assured realizing the specified function in the mechatronic system<br/> Student selects actuators assured realizing the specified function in the mechatronic system<br/> Student designs the mechatronic system realizing the specified function</p> | <p>[SU2] Assessment of ability to analyse information<br/> [SU4] Assessment of ability to use methods and tools<br/> [SU5] Assessment of ability to present the results of task</p> |
|                   | <p>[K7_W02] The student has an extensive knowledge of modeling transport processes, including the knowledge necessary to describe and evaluate the functioning of selected elements of the transport system</p> | <p>Student presents examples of sensors and actuators application in the mechatronic systems used in means of transport etc.<br/> Student enumerates physical phenomena used in sensors and actuators of the mechatronic systems<br/> Student defines a sensor/an actuator and presents their taxonomy according to the preferred criteria</p>                                                                                                                                                                                                                                                    | <p>[SW1] Assessment of factual knowledge</p>                                                                                                                                        |

| Subject contents                                               | <p>Introduction to Mechatronics</p> <p>Which devices can be considered as a mechatronic unit?</p> <p>Do always mechatronization have a sense?</p> <p>Mechatronic System</p> <p>Classification of mechatronic systems</p> <p>MEMS systems (general characteristics; technology; examples of applications)</p> <p>NEMS systems (general characteristics; technology; examples of applications)</p> <p>Physical phenomena used in sensors and actuators of mechatronic systems</p> <p>Mechatronic sensors - classification systems</p> <p>Mechatronic sensors used to measure mechanical parameters</p> <p>Mechatronic actuators</p> <p>Smart ships</p> <p>Selected systems of marine mechatronics (autopilots, stability and dynamic positioning systems of vessels)</p> <p>Mechatronic design inspired by nature</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |                          |                   |                               |                 |       |       |            |       |       |
|----------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------|-------------------|-------------------------------|-----------------|-------|-------|------------|-------|-------|
| Prerequisites and co-requisites                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |                          |                   |                               |                 |       |       |            |       |       |
| Assessment methods and criteria                                | <table border="1"> <thead> <tr> <th data-bbox="453 1270 794 1301">Subject passing criteria</th> <th data-bbox="799 1270 1141 1301">Passing threshold</th> <th data-bbox="1145 1270 1485 1301">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="453 1308 794 1339">lectures - test</td> <td data-bbox="799 1308 1141 1339">66.0%</td> <td data-bbox="1145 1308 1485 1339">51.0%</td> </tr> <tr> <td data-bbox="453 1346 794 1377">laboratory</td> <td data-bbox="799 1346 1141 1377">51.0%</td> <td data-bbox="1145 1346 1485 1377">49.0%</td> </tr> </tbody> </table>                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  | Subject passing criteria | Passing threshold | Percentage of the final grade | lectures - test | 66.0% | 51.0% | laboratory | 51.0% | 49.0% |
| Subject passing criteria                                       | Passing threshold                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Percentage of the final grade                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |                          |                   |                               |                 |       |       |            |       |       |
| lectures - test                                                | 66.0%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 51.0%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |                          |                   |                               |                 |       |       |            |       |       |
| laboratory                                                     | 51.0%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 49.0%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |                          |                   |                               |                 |       |       |            |       |       |
| Recommended reading                                            | <p>Basic literature</p> <p>Supplementary literature</p> <p>eResources addresses</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <p>Robert Munnig Schmidt, Georg Schitter, Adrian Rankers and Jan van Eijk, The Design of High Performance Mechatronics 2nd revised edition. IOS Press, 2014.</p> <p>Bishop, Robert H., Mechatronics: an introduction. CRC Press, 2006.</p> <p>De Silva, Clarence W., Mechatronics: an integrated approach. CRC Press, 2005</p> <p>Onwubolu, Godfrey C., Mechatronics: principles and applications. Butterworth-Heinemann, 2005.</p> <p>Rankers, Adrian M., Machine Dynamics in Mechatronic Systems. University Twente, 1997</p> |  |                          |                   |                               |                 |       |       |            |       |       |
| Example issues/<br>example questions/<br>tasks being completed |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |                          |                   |                               |                 |       |       |            |       |       |
| Work placement                                                 | Not applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |                          |                   |                               |                 |       |       |            |       |       |