



Subject card

|   |   |  |  |                                     |   |            |     |
|---|---|--|--|-------------------------------------|---|------------|-----|
| Subject name and code                       | Metrology and Measurement Systems, PG_00055412  |  |  |                                     |   |            |     |
| Field of study                              | Mechatronics  |  |  |                                     |   |            |     |
| Date of commencement of studies             | October 2024  | Academic year of realisation of subject                  |  |                                     | 2025/2026   |            |     |
| Education level                             | first-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                               | 2   | Language of instruction                                  |  |                                     | Polish  |            |     |
| Semester of study                           | 3   | ECTS credits   |  |                                     | 6.0   |            |     |
| Learning profile                            | general academic profile  | Assessment form  |  |                                     | exam  |            |     |
| 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. Michał Dobrzyński                                |  |                                     |   |            |     |
|   | Teachers  |  |  |                                     |   |            |     |
| Lesson types and methods of instruction     | Lesson type   | Lecture  | Tutorial   | Laboratory                          | Project   | Seminar    | SUM |
|   | Number of study hours   | 30.0   | 15.0   | 30.0                                | 0.0   | 0.0        | 75  |
|   | 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   | 75   |  | 6.0                                 |   | 69.0       | 150 |
| Subject objectives                          | Recognition with the basic principles of metrology and preparing to conduct measurements of mechanical sizes with the analysis of the results. Rules for determining the accuracy, tolerance and fits of machine parts. Knowledge of the methods of measurement and measuring instruments.  |  |  |                                     |   |            |     |
| Learning outcomes                           | Course outcome  |  | Subject outcome  |                                     | Method of verification  |            |     |
|   | [K6_U06] is able to identify and formulate specification of simple, practical engineering tasks, distinctive for mechatronics   |  | Student explains construction and principle of operation of measurement instruments. Student chooses suitable measuring instrument for measure given quantity. Student measures. Student analyses results of measurements. Student calculates measuring errors.  |                                     | [SU5] Assessment of ability to present the results of task<br>[SU4] Assessment of ability to use methods and tools<br>[SU2] Assessment of ability to analyse information<br>[SU1] Assessment of task fulfilment |            |     |
|   | [K6_W07] has organised knowledge in the field of metrology; knows and understands methods for measurement and processing of basic quantities that characterize mechatronic systems; knows basic methods of analogue and digital signals processing and computational methods and IT tools essential for analyses of experimental results  |  | Student recognizes mechanical quantities subject to measurement. Determine measurement methods and systems. The student has knowledge of methods, errors and measurement uncertainty, Geometrical Product Specifications (GPS) and assessment of their accuracy. |                                     | [SW1] Assessment of factual knowledge   |            |     |
| Subject contents                            | Basic concepts in metrology: measurement, units of measurement, standards and instruments. Accuracy and uncertainty. The geometrical structure of the product (Geometrical Product Specifications - GPS). Basics of tolerances, deviations and fits. Geometric tolerances. General Tolerances - Tolerances for linear and angular dimensions without individual tolerance indications. Fundamentals of measurements (repeatability and reproducibility of a measuring device). Surface texture. Metrological methods and equipment and principles of its selection. Laboratory: Measurements of external, internal, mixed and intermediate dimensions. Measurement of angles, cones, . Measurements of surface texture and contours. Measurements with the use of altimeters. 2D measurements. Coordinate measuring technique (manual and CNC measuring machines). Tutorials: Measurements and their uncertainty (Measurement errors, uncertainty, uncertainty budget and statistical analysis of measurement results). Tolerances and fits. Dimensional chains. Tolerance of component dimensions, interchangeability. Thread tolerance. |  |  |                                     |   |            |     |

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| Prerequisites and co-requisites                          | Basic knowledge of technical drawing  |   |                               |
| Assessment methods and criteria                          | Subject passing criteria  | Passing threshold   | Percentage of the final grade |
|  | Written exam  | 60.0%   | 50.0%                         |
|  | Laboratory  | 60.0%   | 30.0%                         |
|  | Tutorial  | 60.0%   | 20.0%                         |
| Recommended reading                                      | Basic literature  | 1. W. Jakubiec, J. Malinowski: Metrologia wielkości geometrycznych. WNT, Warszawa 2018. 2. S. Białas, Z. Humienny, K. Kiszka: Metrologia z podstawami specyfikacji geometrii wyrobów (GPS). Oficyna wydawnicza PW, Warszawa 2014. 3. S. Adamczak, W. Makiela: Metrologia w budowie maszyn. WNT, Warszawa 2021. 4. T. Sałaciński: Ćwiczenia laboratoryjne z metrologii. Oficyna wydawnicza PW, Warszawa 2015. 5. T. Sałaciński: Elementy metrologii wielkości geometrycznych. Przykłady i zadania. Oficyna wydawnicza PW, Warszawa 2013. |                               |
|  | Supplementary literature  | 1. E. Ratajczyk: Współrzędnościowa technika pomiarowa. OWPW, Warszawa 2005. 2. J. Jezierski: Analiza tolerancji i niedokładności pomiarów w budowie maszyn. WNT Warszawa 2003. 3. A. Boryczko: Podstawy pomiarów wielkości mechanicznych. Wydawnictwo PG, Gdańsk 2010. 4. A. Meller, P. Grudowski: Laboratorium metrologii warsztatowej i inżynierii jakości. <a href="http://www.wbss.pg.gda.pl">http://www.wbss.pg.gda.pl</a> , podręczniki (format PDF)  |                               |
|  | eResources addresses  | Adresy na platformie eNauczenie:  |                               |
| Example issues/ example questions/ tasks being completed | Types of fit machine parts and their uses? Classification of measurement errors? Presentation of measurement methods. |   |                               |
| Work placement   | Not applicable  |   |                               |

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