COURSE DESCRIPTION CARD

<table>
<tr><td colspan="10">Bialystok University of Technology
Faculty of Mechanical Engineering</td></tr>
<tr><td>Field of study</td><td colspan="6">Biomedical Engineering</td><td>Degree level and programme type</td><td>Full time study master's degree</td></tr>
<tr><td>Specialization / Diploma Path</td><td colspan="6">Common subject</td><td>Study profile</td><td>General academic</td></tr>
<tr><td rowspan="2">Course Name</td><td colspan="6" rowspan="2">Experimental planning and measurement (E)</td><td>Course Code</td><td>MYIB2S0103</td></tr>
<tr><td>Course Type</td><td>mandatory</td></tr>
<tr><td rowspan="2">Forms of classes and number of hours</td><td>L</td><td>C</td><td>LC</td><td>P</td><td>SW</td><td>FW</td><td>S</td><td>Semester</td><td>1</td></tr>
<tr><td>30</td><td></td><td>15</td><td></td><td>30</td><td></td><td></td><td>No. of ECTS credits</td><td>6</td></tr>
<tr><td>Entry requirements</td><td colspan="9">-</td></tr>
<tr><td>Course objectives</td><td colspan="9">Acquiring knowledge and skills regarding the planning of experiments in the field of biomedical engineering. Acquiring knowledge about the types, construction, principle of operation and metrological parameters of typical sensors used to measure physical quantities. Systematization and deepening of knowledge and skills regarding experimental techniques and research tools used in research in modern biomedical engineering. Familiarize students with the basic aspects of measurement systems used in biomedical engineering.</td></tr>
<tr><td>Course content</td><td colspan="9">Lecture:
Basic principles for planning a scientific experiment. Determination of the necessary sample size, missing data, outliers. Test power assessment. Empirical test size. Measurement systems are their role in biomedical engineering. Structure and organization of measurement systems. Elements of the construction of Measurement Systems. Coordinate measuring technology. Analysis of measurement signals. Selection of statistical methods. Determination of parameters in linear models and the variance-covariance matrix of these parameters. Model adequacy testing. Normalization, scaling and nonlinear transformations of data, data generation. Statistical inference.

Laboratory:
Execution of experiments based on approved project by lab supervisor within the field of biomedical engineering. Modern experimental techniques using computerised measuring systems (coordinate measuring technology, digital measuring microscope, etc.).
Specialization workshop:
Constructing a plan for experimental research. Researching the problem. Obtaining and analyzing the results of research obtained during the</td></tr>
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	experiment and comparing results with the hypothesis. Inference.	
Teaching methods	Informational lecture and case studies (multimedia presentation); laboratory (conducting experiments, solving tasks, discussion); specialization workshops (completion of research tasks).	
Assessment method	Lecture – colloquium. Laboratory - evaluation of reports, tests based on exercises. Specialization workshop – solving a given problem, defending solution.	
Symbol of learning outcome:	**Expected learning outcomes**	**Reference to learning outcomes defined for the field of study**
	Knowledge: The graduate knows and understands	
EU1	Planning stages and performing experimental research and analysis of experimental data	IB2_W05
	Skills: The graduate is able to	
EU2	plan the work of the team and manage it, ensuring the proper implementation of the tasks entrusted to the team.	IB2_U01
EU3	determine the directions of further learning, implement the process of self-education and self-improvement, as well as direct others in this area	IB2_U03
EU4	obtain information from literature, databases, use knowledge to formulate and solve complex, unusual problems	IB2_U04
EU5	plan and conduct experiments in biomedical engineering, including measurements, computer simulations and application analysis, interpret and present the results obtained and draw conclusions	IB2_U06
EU6	formulate and test hypotheses related to the design of biomechanical system components using appropriate analytical, simulation and experimental tools	IB2_U07
EU7	develop documentation of the research task, the results of the experiment, prepare a concise study containing a discussion of these results	IB2_U09
	Social competence: the graduate is ready to	
EU8	Conduct substantive analysis of data and conduct critical assessment of data	IB2_K01
Symbol of learning	**Methods of assessment of learning outcomes**	**Form of classes where verification**

outcome:		takes place
EU1	Lecture- Examination Colloquium; laboratory - evaluation of reports, tests based on preparation for laboratory classes, Project- Data analysis from specialization workshop	**L, LC, SW**
EU2	Laboratory - evaluation of reports, tests based on preparation for laboratory classes, project - report from the specialization workshop	**LC, SW**
EU3	Laboratory - evaluation of reports, tests based on preparation for laboratory classes, project - report from the specialization workshop	**LC, SW**
EU4	Laboratory - evaluation of reports, tests based on preparation for laboratory classes, project - report from the specialization workshop	**LC, SW**
EU5	Laboratory - evaluation of reports, tests based on preparation for laboratory classes, project - report from the specialization workshop	**LC, SW**
EU6	Laboratory - evaluation of reports, tests based on preparation for laboratory classes, project - report from the specialization workshop	**LC, SW**
EU7	Laboratory - evaluation of reports, tests based on preparation for laboratory classes, project - report from the specialization workshop	**LC, SW**
EU8	Laboratory - evaluation of reports, tests based on preparation for laboratory classes, project - report from the specialization workshop	**LC, SW**
Student workload (in hours)		**No. of hours**
Calculation	**Participation in lectures**	**30**
	Participation in specialization workshops	**30**
	Participation in laboratories	**15**
	Preparation for Exam	**18**
	Taking the exam	**2**
	Preparation for specialization workshops	**10**
	Preparation for laboratories	**10**
	Preparation of reports from the specialization workshops	**15**
	Preparation of laboratory reports	**15**

	Participation in consultations	**5**	
	TOTAL:	**150**	
Quantitative indicators		**HOURS**	**No. of ECTS credits**
Student workload requiring direct teacher participation		**82**	**3,3**
Student's workload related to practical activities		**100**	**4**
Basic literature	1. Creswell J.W.: Projektowanie badań naukowych. Metody jakościowe, ilościowe i mieszane. Wydawnictwo Uniwersytetu Jagiellońskiego 2013. 2. Korzyński M.: Metodyka eksperymentu. Planowanie, realizacja i statystyczne opracowanie wyników eksperymentów technologicznych, Wydawnictwo Naukowe PWN 2017. 3. Montgomery D.C.: Design and analysis of experiments, John Wiley & Sons, Arizona, USA 2005. 4. Barzykowski J., Domańska A., Kujawińska M.: Współczesna metrologia wybrane zagadnienia. Wydawnictwa Naukowo-Techniczne, Warszawa 2016. 5. Jakubiec W., Malinowski J.: Metrologia wielkości geometrycznych. WNT, Warszawa 2004.		
Supplementary Literature	1. Gołaś A., Czajka I.: Inżynierskie metody analizy numerycznej i planowanie eksperymentu, Wydawnictwa AGH 2017. 2. Gondko R., Zgirski A., Adamska M.: Biostatystyka w zadaniach, WUŁ, Łódź 2001. 3. Ratajczyk E.: Współrzędnościowa technika pomiarowa. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2005. 4. Humienny Z.: Specyfikacje geometrii wyrobów. WNT, Warszawa 2004		
Organizational unit conducting the course	Institute of Biomedical Engineering	**Date of issuing the programme**	
Program developed by	Prof. dr hab. inż. Jolanta Pauk	04.07.2022	

L – lecture, C – classes, LC – laboratory classes, P – project, SW – specialization workshop, FW - field work, S – seminar