

## COURSE DESCRIPTION CARD

Białystok University of Technology										
Faculty of Mechanical Engineering										
Field of study	Biomedical Engineering							Degree level and programme type	Full-time second degree studies	
Specialisation/ diploma path	Modern structures and technologies for medicine							Study profile	General academic	
Course name	Biosensors							Course code	MYIB2S1203	
								Course type	elective	
Forms and number of hours of educational activities	L	C	LC	P	SW	FW	S	Semester	2	
	30		15					No. of ECTS credits	3	
Entry requirements	-									
Course objectives	Familiarising students with the construction and functions of selected biosensors. Presenting the operating principle of transducers and biological sensing elements used in biosensors. Developing the rules and skills in selection of materials for biosensor construction. Acquisition of the competence of improving professional qualifications in the field of biosensors.									
Course content	<p>Lecture: Biosensors - classification, structure and functions. Operation and characteristics of selected biosensors. Principles and methods of bio-detection. Biological components of the receptor layer. Biocatalysts. Hybrid receptors. Division of biosensors by bioreceptor. Immunosensors. Transducer elements in biosensors. Transducers of electrical and non-electrical quantities used in biomedical engineering. Amperometric, potentiometric, thermal, optical and mass sensors. Immobilisation techniques of biological material on the transducer surface. Biochips - structure, functions, use. Biopotentials. Types of phenomena occurring at the electrode - tissue interface. Electron changes (anelectrotonus, catelectrotonus). Dry tests for fast medical diagnosis - construction, types, operating principle and application. Oximetry. Trends in biosensor development.</p> <p>Laboratory classes: Application of potentiometric techniques to the measurement of basic physicochemical parameters of biological fluids. Use of optical methods in detection systems of biological sensors. Studies on the influence of selected physical factors on the properties of biosensors. Application of spectrophotometry for the quantification of selected analytes.</p>									

<b>Teaching methods</b>	Informative and problem-based lecture; Laboratory exercises.	
<b>Assessment method</b>	Lecture: two written tests; Laboratory classes: evaluation of entry tests, reports, discussions and activity in classes.	
<b>Symbol of learning outcome</b>	<b>Learning outcomes</b>	<b>Reference to the learning outcomes for the field of study</b>
	<b>Knowledge: the graduate knows and understands</b>	
<b>L01</b>	biological components of the receptor layer used in biosensors	<b>IB2_W02, IB2_W06</b>
<b>L02</b>	types and operating principles of transducers used in biosensors	<b>IB2_W02, IB2_W06</b>
	<b>Skills: the graduate is able to</b>	
<b>L03</b>	select the type of bioreceptor and transducer for biosensors construction, with particular reference to the requirements of biomedical engineering	<b>IB2_U06</b>
<b>L04</b>	carry out experiments and interpret the results of measurements	<b>IB2_U06</b>
	<b>Social competence: the graduate is ready to</b>	
<b>L05</b>	critically evaluate their knowledge and the content received in the field of biosensors	<b>IB2_K01</b>
<b>Symbol of learning outcome</b>	<b>Methods of assessing the learning outcomes</b>	<b>Type of tuition during which the outcome is assessed</b>
<b>L01</b>	Lecture: two written tests.	<b>L</b>
<b>L02</b>	Lecture: two written tests.	<b>L</b>
<b>L03</b>	Laboratory classes: evaluation of entry tests, reports, discussions and activity in classes.	<b>LC</b>
<b>L04</b>	Laboratory classes: evaluation of entry tests, reports, discussions and activity in classes.	<b>LC</b>
<b>L05</b>	Laboratory classes: evaluation of entry tests, reports, discussions and activity in classes.	<b>LC</b>
<b>Student workload (in hours)</b>		<b>No. of hours</b>
<b>Calculation</b>	Lecture attendance	<b>30</b>
	Participation in laboratory classes	<b>15</b>
	Preparation for the lecture credit	<b>15</b>
	Preparation for laboratory classes	<b>10</b>
	Participation in consultations	<b>5</b>

	TOTAL:	75	
Quantitative indicators		HOURS	No. of ECTS credits
Student workload – activities that require direct teacher participation		50	2
Student workload – practical activities		30	1,2
Basic references	1. Brzózka Z., Malinowska E., Wróblewski W., Sensory chemiczne i biosensory, Wydawnictwo Naukowe PWN, Warszawa, 2022 2. Berg J.M., Stryer L., Tymoczko J.L., Gatto G.J.: Biochemia, Wydawnictwo Naukowe PWN, Warszawa, 2018. 3. Bańkowski E.: Biochemia, Wydawnictwo Urban & Partner, Wrocław, 2020. 4. Ledakowicz S.: Inżynieria biochemiczna, Wydawnictwo Naukowo-Techniczne, Warszawa, 2018. 5. Brzózka Z.: Mikrobioanalitka, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa, 2009.		
Supplementary references	1. Chen J., Lu Y., Biosensors for Single-Cell Analysis, Elsevier Science & Technology, 2021. 2. Pasquarelli A., Biosensors and Biochips, Springer Nature Switzerland AG, 2021 3. Herold K. E., Radermacher R., Klein S.A., Biosensors and Biodetection Humana Press, 2010 4. Litwack G.: Human biochemistry, Wydawnictwo Elsevier, 2021. 5. Hames B.D.: Biochemia, Wydawnictwo Naukowo-Techniczne PWN, Warszawa, 2012.		
Organisational unit conducting the course	Institute of Biomedical Engineering	Date of issuing the programme	
Author of the programme	Assoc. Prof. Joanna Mystkowska, DSc, PhD, Eng.	12.07.2022	

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