

WROCLAW UNIVERSITY OF TECHNOLOGY – PHD STUDIES

FACULTY OF FUNDAMENTAL PROBLEMS OF TECHNOLOGY	
SUBJECT CARD	
Course name in Polish Badania mikroskopowe w inżynierii biomedycznej	
Course name in English Microscopic measurements in biomedical engineering	
Course language English	
University-wide general course type: 1) basic course (mathematics, physics, chemistry, other) 2) humanity course 3) managerial skills 4) English language 5) other modern language Departmental course developing professional skills: 1) specialized course 2) interdisciplinary course 3) seminar (interdisciplinary, specialized, departmental)	
Type of course (obligatory, optional)	
Educational effects according to ZW 26/2017: P8S_W, P8S_WG, P8S_UW, P8S_UK, P8S_KO	
Subject code FTP9003	

*delete as applicable

	Lecture	Laboratory	Seminar
Number of hours of organized classes in University (ZZU)	30		
Number of hours of total student workload (CNPS)	90		
Form of crediting	Exam **	Exam / crediting with grade*	Oral presentation
Number of ECTS points	3		
including number of ECTS points for practical (P) classes			
including number of ECTS points for direct teacher-student contact (BK) classes	2		

*delete as applicable **In case of didactic courses also inspections and evaluation classes

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES	
<ol style="list-style-type: none"> 1. Basic knowledge of physics 2. Basic knowledge of medical imaging techniques 	

SUBJECT OBJECTIVES	
C1	acquire knowledge of the techniques that are used in microscopic studies of biomaterials and tissues

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C2	obtain basic knowledge of the structure and principles of the various microscopes used for imaging biomaterials and tissue
C3	Solving technical and design problems in the laboratory . Students obtain a knowledge about staining techniques used in nanoscopic measurement methods.

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:

P8S _W has knowledge at an advanced level of development trends and the most important new developments in the field of microscopy methods for the study of biological materials

P8S _WG has advanced knowledge of modern research techniques

Relating to skills:

P8S _UW able to create and lead an independent research using modern nanoscopic imaging techniques of biological materials

P8S _UK knows how to initiate and lead discussions on topics of scientific research and the interpretation of results obtained using imaging techniques

Relating to social competences:

P8S _KO understands the importance of research and teaching

PROGRAM CONTENTS

Form of classes – lecture		Number of hours
Lec1	An introduction to the newest examination methods of biological materials	2
Lec2	The application of measurement techniques in tissue engineering.	2
Lec3	The methods of stem cells characterization.	2
Lec4	The introduction to fluorescence microscopy - techniques of visualization.	2
Lec5	Preparation of the samples for microscopic examination. Methods of fixation and staining.	2
Lec6	Fluorescence microscopy: FRET, FLIC, TIRFM, FLIM.	2
Lec7	Fluorescence nanoscopy. Introduction.	2
Lec8	Fluorescence nanoscopy. STED.	2
Lec9	Fluorescence nanoscopy. PALM.	2
Lec10	Fluorescence nanoscopy. STORM.	2
Lec11	Hybrid techniques of micro- and nanoscopy part 1.	2
Lec12	Hybrid techniques of micro- and nanoscopy part 2.	2
Lec13	Techniques of nanomanipulation: optical tweezers.	2
Lec14	The application of nanomanipulation techniques for the characterization of biological materials part 1.	2
Lec15	The application of nanomanipulation techniques for the characterization of biological materials part 2.	2

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	Total hours	30
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TEACHING TOOLS USED

N1	lecture with multimedia presentation
N2	project with multimedia presentation and discussions

EVALUATION OF ACHIEVED SUBJECT EDUCATIONAL EFFECTS

Evaluation: F – forming (partial) C – concluding	Educational effect number	Way of evaluating achievement of educational effects
F1	P8S_W, P8S_WG	exam
F2	P8S_W, P8S_WG P8S_UW, P8S_UK, P8S_KO	project
P=0.75*F1+0.25*F2		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

- [1] Mikroskopia sił atomowych (AFM) - biomedyczne zastosowanie pomiarów w nanoskali. Marta Kopaczyńska. Wrocław : Oficyna Wydawnicza Politechniki Wrocławskiej, 2010.
- [2] 3D images of materials structures :processing and analysis /Joachim Ohser and Katja Schladitz. Weinheim : Wiley-VCH Verlag GmbH & Co. KGaA, cop. 2009
- [3] Advanced biomaterials :fundamentals, processing, and applications /edited by Bikramjit Basu, Dharendra Katti, and Ashok Kumar. Hoboken. : John Wiley & Sons ; [Westerville, Ohio] : The American Ceramic Society, cop. 2009.
- [4] Optical imaging techniques in cell biology. Guy Cox. Boca Raton: CRC/Taylor & Francis, cop. 2007.
- [5] Tissue engineering :essentials for daily laboratory work /W. W. Minuth, R. Strehl, K. Schumacher. Weinheim : Wiley-VCH, cop. 2005
- [6] Obrazowanie biomedyczne. Red. tomu Leszek Chmielewski, Juliusz Lech Kulikowski, Antoni Nowakowski. Warszawa : Akademicka Oficyna Wydawnicza Exit, 2003.
- [7] Systemy mikroskopii bliskich oddziaływań w badaniach mikro- i nanostruktur. Teodor Paweł Gotszalk. Wrocław : Oficyna Wydawnicza Politechniki Wrocławskiej, 2004

SECONDARY LITERATURE:

- [1] [1] Articles from journals: Science, Biomaterials, Biomolecular Engineering, Biotechnology, Bioscience, Biomechanics and Modeling in Nanotechnology, Polymer Composites, Nanotechnology, Biophysics, Molecular Imaging, Tissue Engineering

SUBJECT SUPERVISOR

(NAME AND SURNAME, E-MAIL ADDRESS)

WROCLAW UNIVERSITY OF TECHNOLOGY – PHD STUDIES

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