Course Syllabus

I. General Information

Course name in English	Advanced biotechnology
Course name in Polish	Biotechnologia – kurs zaawansowany
Programme	Bioanalytical technologies
Level of studies (BA, BSc, MA, MSc, long-cycle MA)	MSc
Form of studies (full-time, part-time)	Full-time
Discipline	Biological sciences
Language of instruction	English

Course coordinator/person responsible	Dr Artur Banach

Type of class *(use only the types mentioned below)*	Number of teaching hours	Semester	ECTS
Lecture	30	I	6
Tutorial			
Classes	30	I	
laboratory classes			
Workshops			
Seminar			
introductory seminar			
foreign language classes			
practical placement			
field work			
diploma laboratory			
translation classes			
study visit			

Course pre-requisites	Knowledge in biochemistry, basic biotechnology and bioprocess technologies, enzymology and microbiology

II. Course Objectives

C1 -To facilitate an understanding of the conduct of biotechnological processes
C2 - To understand significance of use of microbial synthesis of biological molecules
C3 - To identify the regulatory issues related to the biotechnological processes
C4 - To facilitate an understanding the rationale for using the methods learned for a specific biotechnological process

III. Course learning outcomes with reference to programme learning outcomes

Symbol	Description of course learning outcome	Reference to programme learning outcome
KNOWLEDGE		

W_01	The student has advanced knowledge of biochemistry, microbiology and biology necessary for practical use in advanced biotechnological processes used in various branches of industry.	K_W02, K_W06
W_02	The student has knowledge of the principles of planning research using advanced biotechnological research techniques and tools	K_W05, K_W07
W_03	The student has knowledge on systemic solutions of quality assurance at the stage of development, production and quality control of biotechnological products obtained in an advanced process	K_W08
SKILLS		
U_01	The student applies advanced bioanalytical techniques and research tools in biotechnology	K_U01
U_02	The student applies in practice the principles of work in the aseptic conditions during advanced biotechnological process	K_U09
U_03	The student can evaluate the environmental threats related with applied advanced technology	K_U12
U_04	The student collects and interprets experimental data and on that basis formulates appropriate conclusions on process conducted	K_U14
COMPETENCIES		
K_01	The student understands the benefits and risks using biotechnological products obtained in the laboratory by advanced biotechnology	K_K02
K_02	The student is taking care on entrusted laboratory equipment, is able to gauge danger resulting from applied advanced research methods	K_K03
K_03	The student acts in accordance with the principles of occupational health and safety in the laboratory of advanced biotechnology	K_K05

IV. Course Content

Lecture:

Introduction to advanced biotechnology.

Organization principles in biotechnological production.

Control and regulation of processes in bioreactors

Biological basics of microbiology processes: presentation of microorganisms able to provide different fermentation processes, like lactic acid fermentation, acetic acid fermentation, alcoholic fermentation

General concepts of production amino acids.

Detection methods of biotech products.

Application of organisms (microorganism and plants) for pollutants removal

Biofuels derived from living organisms: hydrogen, biogas, bioalcohols, biodiesel, electric energy.
Selected topics in advanced biotechnology.
Review of lectures and preparations for final exam
Lab classes:
Optimization of batch culture process for selected microorganisms
Analysis of composition consortium by FISH.
Production of selected polysaccharides by microorganisms.
Production single cell proteins - SCP by selected microorganisms.
Optimization production of amino acids by halophilic microorganisms.
Qualitative and analysis amino acid by GC – MS.
Generation of biohydrogen by means of microorganisms (algae and bacteria)
Biogas production by fermentation process
Electricity generation in Microbial Fuel Cells

V. Didactic methods used and forms of assessment of learning outcomes

Symbol	Didactic methods *(choose from the list)*	Forms of assessment *(choose from the list)*	Documentation type *(choose from the list)*
KNOWLEDGE			
W_01	Conventional lecture Discussion	Written test	Evaluated written test/test
W_02	Conventional lecture Discussion	Written test	Evaluated written test/test
W_03	Conventional lecture Discussion	Written test	Evaluated written test/test
SKILLS			
U_01	Laboratory classes	Observation and Report	Report printout
U_02	Laboratory classes	Observation and Report	Observation report
U_03	Practical classes	Test of practical skills	Rating card
U_04	Laboratory classes	Report	Report printout
COMPETENCIES			
K_01 K_02 K_03	Laboratory classes	Observation	Observation report

VI. Grading criteria, weighting factors

Written test to pass the lecture: 100%
Lab classes:
80% grades from written tests
10% reports
10% practical skills

Mark	**Evaluation criteria**	
Very good (5.0)	the student realizes the assumed learning	the student demonstrates knowledge of the education content at the level of 95-100%

	outcomes at a very good level	
overgood (4.5)	the student accomplishes the assumed learning outcomes an over good level	the student demonstrates knowledge of the education content at the level of 85-94 %
Good (4.0)	the student accomplishes the assumed learning outcomes at a good level	the student demonstrates knowledge of the education content at the level of 75-84%
Quite good (3.5)	the student accomplishes the assumed learning outcomes at a quite good level	the student demonstrates knowledge of the education content at the level of 65-74%
sufficient (3.0)	the student accomplishes the assumed learning outcomes necessary as prerequisite	the student demonstrates knowledge of the education content at the level of 55-64%
insufficient (2.0)	the student accomplishes the assumed learning outcomes at an insufficient level	the student demonstrates knowledge of the education content below the level of 55%

VII. Student workload

Form of activity	Number of hours
Number of contact hours (with the teacher)	69 (60 + 9 individual consultation)
Number of hours of individual student work	81

VIII. Literature

Basic literature
1. R C Dubey Advanced Biotechnology, 2014, S. Chand Publishing 2. Christoph Wittmann, James C. Liao, Sang Yup Lee, Jens Nielsen, Gregory Stephanopoulos Industrial Biotechnology: Products and Processes 1st Edition, Wiley 2017. 3. Emma Layer Environmental Biotechnology: Theory, Concepts and Applications. CALLISTO REFERENCE 2017 4. Brennan L., Owende P., 2010. Biofuels from microalgae—A review of technologies for production, processing, and extractions of biofuels and co-products. Renewable and Sustainable Energy Reviews 14, 557–577 5. Biffinger J.C., Ringeisen B.R., 2008. Engineering Microbial Fuels Cells: Recent Patents and New Directions. Recent Patents on Biotechnology 2, 150-155
Additional literature
Current scientific articles of the topic