



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Biotechnology Project - Biotransformation

### Course

Field of study

Pharmaceutical Engineering

Area of study (specialization)

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Level of study

First-cycle studies

Form of study

full-time

Year/Semester

3/5

Profile of study

general academic

Course offered in

polish

Requirements

elective

### Number of hours

Lecture

0

Laboratory classes

0

Other (e.g. online)

0

Tutorials

0

Projects/seminars

15

### Number of credit points

1

### Lecturers

Responsible for the course/lecturer:

dr inż. Wojciech Smulek

Responsible for the course/lecturer:

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### Prerequisites

The student has knowledge of the basic conceptual categories and terminology used in biotechnology and related industries (chemical, pharmaceutical and food). He knows the basics functioning of biological systems and basic characteristics of products obtained in these processes. Understands the specificity of biotechnological processes in relation to processes chemical.

The student has the skills, i.e. understands the literature on the basics of biotechnology in Polish; reads with understanding uncomplicated scientific and technical texts in a foreign language, he can obtain



information from literature, databases and other sources related to industry biotechnology, also in a foreign language, is able to integrate, interpret and draw conclusions and formulate opinions, has the ability to self-study.

In addition, in the field of social competences, he has the ability to work in a group.

### Course objective

Learning to independently incorporate biotechnology processes into a series of classic chemical processes, aimed at obtaining products as a result of biotransformation by microorganisms.

### Course-related learning outcomes

#### Knowledge

Has basic knowledge in bioreactor engineering regarding process balancing methods biochemical, transformation kinetics in bioreactors of transport processes (heat and mass exchange) running in bioreactors using automatic control elements and with the scope of machine science and apparatus used in biotechnology, knows the principles of construction, selection reactors and apparatus in the biotechnology industry (K\_W10).

Has basic knowledge in the field of apparatus and installation construction in the pharmaceutical industry and related industries (K\_W18).

Knows the basics of control and measurement systems and electronic control systems (K\_W19). Has knowledge of raw materials, products and processes used in biotechnology (incl. on obtaining biomass of microorganisms, alcohols, organic acids, amino acids, enzymes, pharmaceuticals) and on the directions of development of this branch of industry in the country and in the world (K\_W11).

Has basic knowledge of development trends in laboratory and analytical techniques and application technologies in the field of biotechnology and molecular biology (K\_W13).

Knows the rules of safe handling of chemicals as well as the selection and disposal of waste chemical and dangerous (including pathogenic microorganisms), has a basic knowledge of organization principles for biotechnology production, quality assurance, including quality management and doing business (K\_W17).

Has basic knowledge necessary to understand social, economic, legal and other non-technical conditions of engineering activities (K\_W16).

#### Skills

Is able to analyze and evaluate the functioning of basic processes and operations unitary pharmaceutical engineering (K\_U14).

Is able to formulate and solve complex engineering problems (typical and atypical) related to pharmaceutical engineering, both analytical, simulation and experimental methods (K\_U13).

Is able to design and implement the basic apparatus of the pharmaceutical industry and design and implement unit operations of pharmaceutical engineering (K\_U17)



He can choose the right way of solution and choose the right equipment for simple solutions and complex engineering tasks related to pharmaceutical engineering, can analyze and assessment of the functioning of the basic apparatus of the pharmaceutical industry (K\_U16)

Is able to prepare a well documented study in Polish and in a foreign language pharmaceutical engineering (K\_U5).

Is able to assess the economic effects of pharmaceutical engineering processes and operations as well as the impact of activities modernization effects on these effects (K\_U23).

#### Social competences

He is ready to critically assess his knowledge, understands the need for further training and supplementation specialization knowledge and raising their professional, personal and social competences, he understands importance of knowledge in solving problems and is ready to consult experts (K\_K1).

Is ready to make decisions independently and lead a team, critically evaluate activities own and team actions, accepting responsibility for the effects of these actions and also can cooperate and work in a group, inspire and integrate the professional environment (K\_K2).

Is aware of the importance of understanding non-technical aspects and effects of engineering activities, in including its impact on the environment and the associated responsibility for the decisions taken, correctly recognizes problems and makes the right choices related to the exercise of the profession, compliance with the principles of professional ethics, care for achievements and traditions of the profession (K\_K3).

#### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Public presentation of the effects of the implementation of biological stages in the entire engineering process.

Final assessment of completed projects.

#### Programme content

As part of the course - biotechnology project - students learn the principles of conducting biotechnological processes and the necessary equipment, handling substrates, products as well as with microorganisms capable of effective biotransformation of substrates into desired products. In addition, they learn ways to separate end products for further technological processes. Students will have the opportunity to perform together with the person conducting the project a technological process based on the use of culturing microorganisms using biotechnological aspects, calculating the costs of such modernization, balance of profits and losses, as well as assessing the impact on the environment.

In the final stage, the student (groups of one or two) should complete and present a design of the selected technological process in the pharmaceutical industry along with the adaptation of the appropriate biotechnological process to improve production. He should make a description, basic



balance calculations, block diagram and technical and measurement diagram. The student will present the effects of work in the form of a short presentation of the project.

### Teaching methods

Multimedia presentations, tasks for own work, consultations with the teacher, work with a computer

### Bibliography

#### Basic

1. Chmiel A. Biotechnologia - Podstawy mikrobiologiczne i biochemiczne. Wydawnictwo Naukowe PWN, 1998.
2. Christi Y., Moo-Young M.: Bioreactor design. In: Basic Biotechnology. Ed. by Retledge and Christiansen B. Cambridge University Press, 2001.
3. Libudzisz Z., Kowal K. Mikrobiologia techniczna, tom I i II. Wydawnictwo Politechniki Łódzkiej.
4. Bednarski W., Fiedurka J. Podstawy biotechnologii przemysłowej. PWN
5. McNeil B., Harvey L.M. Fermentation a practical approach. IRL Press.
6. Immobilization of Enzymes and Cells. Second edition. Ed. By. Guisan J., M. In: Methods in Biotechnology 22, Humana Press Inc, Totowa, New Jersey, 2006.
7. Grajek W., Gumienna M., Lasik M., Czarnecki Z. (2008): Perspektywy rozwoju technologii produkcji bioetanolu z surowców skrobiowych. Przemysł Chemiczny 87 (11): 1094-1101.
8. Schütte H.: Cell disruption. W: "Methods in biotechnology". Red. Schmauder H.-P. Str.153-164, Taylor & Francis e-Library, 2005.
9. Burczyk B.: Zielona chemia. Zarys, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2006.

#### Additional

Current scientific articles in the field of biotechnology as well as chemical technology and industry pharmaceutical

### Breakdown of average student's workload

	Hours	ECTS
Total workload	25	1,0
Classes requiring direct contact with the teacher	20	0,8
Student's own work (literature studies, project preparation) <sup>1</sup>	5	0,2

<sup>1</sup> delete or add other activities as appropriate