COURSE DESCRIPTION CARD - SYLLABUS

Course name
Biotechnology project - biotransformation [S1IFar2>PBbiot]

Course

Field of study
Pharmaceutical Engineering

Year/Semester
3/5

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
0

Laboratory classes
0

Other
0

Tutorials
0

Projects/seminars
15

Number of credit points

1,00

Coordinators

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Lecturers

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:

1. Student 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]
2. Student has basic knowledge in the field of apparatus and installation construction in the pharmaceutical industryand related industries. [K_W18]
3. Student knows the basics of control and measurement systems and electronic control systems. [K_W19].
4. Student 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]
5. Student has basic knowledge of development trends in laboratory and analytical techniques and application technologies in the field of biotechnology and molecular biology. [K_W13]
6. Student 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]
7. Student has basic knowledge necessary to understand social, economic, legal and other non-technical conditions of engineering activities. [K_W16]

Skills:
1. Student is able to analyze and evaluate the functioning of basic processes and operations unitary pharmaceutical engineering. [K_U14]
2. Student is able to formulate and solve complex engineering problems (typical and atypical) related to pharmaceutical engineering, both analytical, simulation and experimental methods. [K_U13]
3. Student is able to design and implement the basic apparatus of the pharmaceutical industry and design and implement unit operations of pharmaceutical engineering. [K_U17]
4. Student 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]
5. Student is able to prepare a well documented study in Polish and in a foreign language pharmaceutical engineering. [K_U5]
6. Student 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:
1. Student 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]
2. Student 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]
3. 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 results of implementing biological steps into the overall engineering proces (stationary or remote form depending on the epidemiological situation). The final grade is a weighted average of the grades from the preparation of the multimedia presentations (weight 1), the bioprocess project documentation (weight 2) and the oral defense of the project (weight 2).

Programme content

The program includes the following topics:
1. Conducting biotechnological processes.
2. Equipment in biotechnological processes.
3. Substrates, products and microorganisms capable of effective biotransformation.
4. Block diagram, technical and measurement diagram.
5. Calculation of costs, balance of profits and losses.
6. Assessment of environmental impact.

Course topics

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 Yersey, 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. Schűtte 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	30	1,00
Classes requiring direct contact with the teacher	15	0,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	15	0,50