COURSE DESCRIPTION CARD - SYLLABUS

Course name
Technological aspects of biocatalytic processes [S1Bioinf1>TAPB]

Course

Field of study
Bioinformatics

Year/Semester
3/6

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
15

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

dr hab. inż. Jakub Zdarta prof. PP
jakub.zdarta@put.poznan.pl

Lecturers

Prerequisites

Knowledge of the basic issues of organic and bioorganic chemistry and biotechnology, as well as basic knowledge of the issues related to the processes of catalysis, biocatalysis and knowledge of enzymes as natural biocatalysts and their application.

Course objective

Obtaining theoretical and practical knowledge about the processes of biocatalysis as well as about the properties and use of biocatalysts. Understanding the basic processes enabling the improvement of the properties of biocatalysts, with particular emphasis to the enzyme immobilization. Understanding the basic industrial and biotechnological processes in which biocatalysis and biocatalysts are used. Ability to select biocatalysts suitabe for technological and biotechnological processes. Consolidation of knowledge through practical exercises.

Course-related learning outcomes

Knowledge:
K_W04 The student knows the issues of chemistry useful for formulating and solving simple bioinformatics tasks, covering the basic concepts and laws of chemistry, organic chemistry and

biochemistry
K_W06 The student has knowledge of the structure of cells and functions of cell structures, biochemical basis of metabolic pathways
K_W14 The student has knowledge of selected methods used in molecular biology, including methods using high-throughput technologies
K_W20 The student knows the development trends of bioinformatics
K_W19 The student has knowledge of the techniques and methods of identifying biomolecules and biologically active compounds
K_W23 The student knows the basics of management, including quality management and running a business

Skills:
K_U01 The student is able to obtain information from literature, databases and other properly selected sources, also in English
K_U02 The student is able to integrate and interpret the information obtained, as well as draw conclusions and formulate and justify their opinions
K_U03 The student is able to use basic laboratory techniques in the synthesis, isolation and purification of chemical compounds, including biomolecules and biologically active compounds
K_U04 The student is able to use analytical methods for the quantitative and qualitative determination of biochemical compounds, assess their usefulness
K_U07 The student is able to use analytical, simulation and experimental methods to formulate and solve research tasks under the supervision of a research tutor

Social competences:
K_K01 The student is ready to learn throughout his life and improve his competences
K_K05 The student is ready to take responsibility for the decisions made
K_K07 The student is ready to think and act in an entrepreneurial manner
K_K08 The student is ready to fulfill the social role of a university graduate

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Students' skills acquired as part of the lectures and laboratory classes in both, stationary and remote (using ekursy platform) form are verified on the basis of the final test (stationary form of the test - exam (colloquium) in writing; evaluation criteria: 3 - 50.1% -70.0%, 4 - 70.1% -90.0%, 5 - from 90.1%; remote form of the test - exam (colloquium) in a multiple-choice test form using the ekursy platform; evaluation criteria: 3 - 50.1% -70.0%, 4 - 70.1% -90.0%, 5 - from 90.1%;) and on the basis of the developed and submitted documentation from the projecst and case studies carried out during the course (exercise reports).

Programme content

The lectures include:
Description and characterization of biocatalytic processes; properties and characterization of biocatalysts; review of methods for the catalytic characterization and stability of enzymes; issues related to the improvement of the properties and stability of biocatalysts, with particular emphasis to the enzyme immobilization; properties and characterization of immobilized enzymes; application of free and immobilized enzymes for the production of biosensors and the basic characteristics of biosensors; practical use of enzymes and biocatalytic processes in the production of high-purity compounds and in the pharmaceutical industry; application of enzymes in biomass conversion processes and in environmental protection.

Laboratory exercises include:
Characterization of catalytic properties of selected enzymes from different catalytic groups; preparation of immobilized enzyme systems; evaluation and comparison of thermal and chemical stability of free and immobilized enzymes; evaluation of the practical use of free and immobilized enzymes in biocatalytic reactions

Course topics

Lectures include:

1. Properties and characterization of biocatalysts.

2. Review of methods for catalytic characterization and enzyme stability

3. Issues related to improving the properties and stability of biocatalysts, with particular consideration of enzyme immobilization.

4. Properties and characterization of immobilized enzymes.

5. Application of free and immobilized enzymes for the production of biosensors and basic characterization of biosensors.

6. Practical use of enzymes and biocatalytic processes in the production of high-purity compounds and in the pharmaceutical industry

7. Application of enzymes in biomass conversion processes and in environmental protection.

8. IT tools, including AI, used in the design of biocatalytic processes.

Laboratory exercises include:

1. Characterization of catalytic properties of selected enzymes from various catalytic groups.

2. Preparation of immobilized enzyme systems.

3. Assessment and comparison of thermal and chemical stability of free and immobilized enzymes.

4. Assessment of the possibilities of practical use of free and immobilized enzymes in biocatalytic reactions.

5. Preparation of enzymatic biosensors.

Teaching methods

Lectures, laboratory excercises.

Bibliography

Basic
1. J.M. Berg, J.L. Tymoczko, L. Stryer, Biocehmia, Edycja siódma, PWN, Warszawa, 2010.
2. D.S. Sigman, Mechanisms of Catalysis, Academic Press, Cambridge, 1992.
3. P.D. Boyer, The Enzymes, Tom I-XVI, Academic Press, Cambridge, 1970.
4. T. Korzybski, Enzymy: nomenklatura i klasyfikacja, PWN, Warszawa, 1967.
Additional
1. L. Cao, Carrier-bound Immobilized Enzymes: Principles, Applications and Design, Wiley-VCH Verlag GmbH, Weinheim, 2005
2. H. Uhlig, Industral Enzymes and Their Applications, John Wiley & Sons, Inc., New York, 1998.
3. J. Zdarta, A.S. Meye, T. Jesionowski, M. Pinelo, Multi-faceted strategy based on enzyme immobilization with reactant adsorption and membrane technology for biocatalytic removal of pollutants: A critical review, Biotechnology Advances, 37, 2010, 107401.
4. Publikacje naukowe związane z tematyką wykładu

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,00
Classes requiring direct contact with the teacher	30	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	20	0,50