



COURSE SYLLABUS «Industrial biotechnology»

Degree of higher education - Bachelor
Specialization 162 «Biotechnology and bioengineering »
Educational programme «Biotechnology and bioengineering»
Academic year 3, semester 6
Form of study regulatory (full-time, part-time)
Number of ECTS credits 4
Language of instruction English (Ukrainian, English, German)

Lecturer of the course

**Boroday Vira Vitaliivna, Doctor of Agriculture Science,
Associate professor, Department of ecobiotechnology and
biodiversity, building 4, room 35,
veraboro@gmail.com**

**Contact information of the
lecturer (e-mail)**

<https://elearn.nubip.edu.ua/course/view.php?id=2302>

Course page on eLearn

day of consultation – Monday, 9.00-14.00

COURSE DESCRIPTION

The purpose of students' knowledge and ability to use basic biotechnological processes to obtain biologically active compounds, principles and methods of designing biotechnology facilities, cultivation of individual strains of industrial microorganisms, methods of selection of biological agents to obtain individual products, basics of microorganism cultivation management and quality control of the obtained product, determination of ecological safety of biotechnology products created on the basis of genetically modified microorganisms.

The task of the discipline is to manage the processes of cultivation of microorganisms in industrial conditions by collecting, processing and analyzing information, experimental development of methods of working with various industrial microorganisms in the laboratory and during training practices in research institutions and biochemical enterprises.

Competencies of the educational programme:

Integral competence (IC): The ability to solve complex tasks in the field of biology in the process of carrying out research and innovation activities,

General competences (GC): GC 03. Ability to work in an international scientific context; GC 04. Ability to communicate in a foreign language (English or another according to specifics of the specialty) in an amount sufficient to present and discuss the results of his scientific work in oral and written forms, as well as for full understanding foreign language scientific texts from the relevant specialty; GC 06. The ability to form a systematic scientific outlook. professional (special) competences (FC): Mandatory *Professional competences (PC):*

PC 01. Ability to review existing concepts of modern biotechnology in a critical way understanding and adaptation of newly created methods and technologies through generation original hypotheses; *PC 02.* The ability to perform original research, to achieve scientific results that create new knowledge in the field of biotechnology and related interdisciplinary fields directions; *PC03.* The ability to critically evaluate the obtained results, make decisions and to recommend alternative strategies for solving creation and regulation problems vital activity of biological objects; *PC 05.* Ability to develop new and improve existing biotechnologies based on understanding of modern scientific facts, concepts, theories, principles and methods of biotechnology; *PC 07.* The ability to carry out scientific and pedagogical activities in higher education, to use modern educational technologies and organize scientific research of students.

Program learning outcomes (PLO) of the educational programme: PLO 03. Knowledge and understanding of problematic issues of modern biotechnology (including on the border subject

areas) to create the latest biotechnologies; **PLO 04.** Knowledge and use of modern physiological, biochemical and genetic approaches for improvement of biological agents and regulation of biotechnological processes.

STRUCTURE OF THE DISCIPLINE

Topic/the theme of lectures	Hours (lectures / laboratory / self-work)	Learning outcomes	Tasks	Assessment
Module 1 Fermentation processes in the biotechnology industry				
Topic 1. History and achievements of industrial biotechnology. Methods of industrial biotechnology.	Lecture 1 History and achievements of industrial biotechnology. Lecture 2. Methods of Industrial Biotechnology	8/4/15	Know the main milestones in the development of industrial biotechnology. Use the main methods of industrial biotechnology used to obtain biologically active substances	Taking of laboratory work 1 Taking Individual tasks, self-control of knowledge, interview. 5
Topic 2 Upstream Processing of industrial biotechnology	Lecture 3 Upstream Processing. Raw materials for fermentation media Lecture 4. UPS. Large scale sterilization	8/4/15	Know the Upstream Processing of industrial biotechnology, the main raw materials for fermentation media Be able to prepare producers for the production process, long-term storage and maintenance of active industrial microorganisms. Apply the knowledge about Large scale sterilization	Submission of laboratory work 1 Taking Individual tasks, interview. 5
				Taking Individual tasks, interview Completing independent work 1 (including in eLearn) 15
Topic 3 _Basic Concepts of Metabolism	Lecture 5 Basic Concepts of Metabolism Lecture 6 Metabolism_Fermentation	8/4/15	Know the basic parameters and phases of periodic fermentation, the growth curve of the cell population. Understand the hemostatic and turbo-sufficient modes of cultivation of producers., The main requirements for bioreactors. Know the basic substrates and by-products used for microbiological synthesis. Be able to prepare producers for the production process, long-term storage and maintenance of active industrial microorganisms.	Submission of laboratory work 2. Doing independent work 2 Individual tasks, self-control of knowledge, interview. Completing independent work 2 (including in eLearn) 10
				35

Total from educational work of module 1					70
Module 1			Assessment of the results of learning knowledge and skills in accordance with the topics included in module 2	Test	30
Total for the module 1					100
Module. 2. Main stages of biotech process					
Topic 4. Characteristics of the main stages of biotechnological production.	Lecture 7 Microorganisms producers, isolation, improvement Lec8_Microorganisms producers, batch culture, characteristic	8/6/15	Know the requirements for industrial strains of microorganisms. Isolation of producers from natural sources. Principles of using mutagens in the selection of microorganisms. Be able to preparation and sterilization of medium, air, bioreactors, preparation of seed for surface and deep cultivation, biocatalysts, pre-treatment of raw materials. Understand ways to increase the effectiveness of inoculation.	Submission of laboratory work 3. Doing independent work Individual tasks, self-control of knowledge, interview.	10
Topic 5. Downstream Processing. Structure and types of fermentors. Classification of fermentation processes	Lec.9. Structure and types of fermentors. Classification of fermentation processes	6/6/15	Know preparation and sterilization of medium, air, bioreactors, preparation of seed for surface and deep cultivation, biocatalysts, pre-treatment of raw materials. Be able to to increase the biosynthesis of biologically active substances, technological schemes for obtaining primary and secondary metabolites	Submission of laboratory work 4. Doing independent work Individual tasks, self-control of knowledge, interview.	10
Topic 6. Downstream Processing	Lec. 10. Stages in Downstream Processing	7/4/15	Know the separation of liquid and biomass: settling, filtration, separation, centrifugation, coagulation, flotation. Understand the separation of liquid and biomass: settling, filtration, separation, centrifugation, coagulation, flotation. Be able to isolation of intra - and external - cellular products of metabolism	Submission of laboratory work 5. Doing independent work Individual tasks, self-control of knowledge, interview.	10
				Completing independent work 3 (including in eLearn)	40

Module 2		Assessment of the results of learning knowledge and skills in accordance with the topics included in module 2	Test	30
Total from educational work of module 2				70
Total for the module 2				100
Total for the semester				70
Exam				30
Total for the course				100

ASSESSMENT POLICY

<i>Policy regarding deadlines and resits:</i>	Assignments submitted after the deadline without valid reasons will be graded lower. Resitting of modules will be allowed with the permission from the lecturer and in the presence of valid reasons (e.g. medical reasons).
<i>Academic honesty policy:</i>	Cheating during tests and exams is strictly prohibited (including the use of mobile devices). Coursework and research papers must contain correct citations for all sources used.
<i>Attendance policy:</i>	Class attendance is mandatory. In case of objective reasons (such as illness or international internships), individual learning may be allowed (in online format by the approval of the dean of the faculty).

SCALE OF ASSESSMENT OF STUDENT KNOWLEDGE

Student rating, points	National grade based on exam results	
	exams	credits
90-100	excellent	passed
74-89	good	
60-73	satisfactory	
0-59	unsatisfactory	not passed

RECOMMENDED SOURCES OF INFORMATION

1. Пирог Т.П. Загальна мікробіологія: підручник / Пирог Т.П. К.: НУХТ, 2004. 471 с.
2. Пирог Т.П. Загальна біотехнологія: підручник / Т.П. Пирог, О.А. Ігнатова. К.: НУХТ, 2009. 336 с.
3. Біотехнологія мікробного синтезу: навчальний посібник. НУБіП України. Патица Т.І., Патица М.В. Вінниця: ТОВ «Нілан-ЛТД», 2018: 272.
4. Біотехнологія: Підручник / В.Г. Герасименко, М.О. Герасименко, М.І. Цвіліховський та ін.; Під общ. ред. В.Г. Герасименка. К.: Фірма «ІНКОС», 2006. 647 с.
5. Буценко Л.М., Пенчук Ю.М., Пирог Т.П. Технології мікробного синтезу лікарських засобів: навч. посіб. К.: НУХТ, 2010.- 323 с.
6. Загальна (промислова) біотехнологія: навчальний посібник/ М.Д. Мельничук, О.Л.Кляченко, В.В.Бородай, Ю.В.Коломієць. – Вінниця: ТОВ «Нілан-ЛТД», 2014. 253 с
7. Satyanarayana, U. "Biotechnology" Books & Allied (P) Ltd., 2005.
8. Balasubramanian, D. et al., "Concepts in Biotechnology" Universities Press Pvt.Ltd., 2004.
9. Ratledge, Colin and Bjorn Kristiansen "Basic Biotechnology" 2nd Edition Cambridge University Press, 2001.
10. Dubey, R.C. "A Textbook of Biotechnology" S.Chand & Co. Ltd., 2006.
11. Presscott, S.C. and Cecil G. Dunn, "Industrial Microbiology", Agrobios (India), 2005.
12. <https://galychyna.com.ua/>
13. <https://obolon.ua/ua>

14. <https://zakon.rada.gov.ua/laws/show/771/97-%D0%B2%D1%80#Text>