



SYLLABUS OF THE ACADEMIC DISCIPLINE «Objects of biotechnological production»

Degree of higher education - Bachelor
Specialization **162 «Biotechnology and bioengineering»**
Educational programme «Biotechnology and bioengineering»
Academic year 2, semester 3
Form of higher education: full-time
Number of ECTS credits 4
Language of instruction English

Lecturer of the discipline

Lecturer contact
information (e-mail)
URL of the ESC on the
educational portal of
NULES of Ukraine

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DESCRIPTION OF THE DISCIPLINE

(up to 1000 characters)

"Objects of biotechnological production" is a course aimed at studying the principles of biotechnological processes, the technical means that provide them, and ways to determine the main parameters of raw materials and products of the biotechnological process, and the objectives are to familiarize students majoring in biotechnology and bioengineering with the target group of organisms used in biotechnological production.

The goal is to study the general morphological structure of plants, the diversity of morphological structures of plant organs and their metamorphoses, the anatomical organization of plant biosystems, and to familiarize students with the systematic diversity of the plant world.

The main objectives of the course are to learn how to conduct scientific, theoretical and experimental research in accordance with the fundamental principles and provisions using computer software and modeling technologies, as well as to create an appropriate creative and psychologically favorable atmosphere in the team for the successful solution of the task.

Competencies of the discipline:

Integral competence (IC): Ability to solve complex specialized problems and practical problems characterized by complexity and uncertainty in biotechnology and bioengineering, or in the process of learning that involves the application of theories and methods of biotechnology and bioengineering.

General competencies (GC):

K05. Ability to learn and master modern knowledge.

K09. Ability to preserve and increase moral, cultural, scientific values and achievements of society based on an understanding of the history and patterns of development of the subject area, its place in the general system of knowledge about nature and society and in the development of society, technology and technology, to use various types and forms of physical activity for active recreation and healthy lifestyle.

Special (professional) competencies (SC):

K12. Ability to analyze regulatory documents necessary to ensure engineering activities in the field of biotechnology.

K13. Ability to work with biological agents used in biotechnological processes (microorganisms, fungi, plants, animals, viruses, their individual components).

Program learning outcomes (PLOs):

PLO04. To be able to apply the provisions of regulatory documents governing the procedure for product certification, production certification, requirements for the organization of

quality management systems at enterprises, rules for the preparation of technical documentation and technological process, based on the knowledge gained during practical training.

PLO 14. To be able to justify the choice of biological agent, composition of the culture medium and method of cultivation, necessary auxiliary works and the main stages of the technological process.

PO15. Based on knowledge of the laws of mechanical, hydromechanical, heat and mass transfer processes and basic design features, be able to choose the appropriate equipment in the design of biotechnological products for various purposes to ensure their maximum efficiency.

PO20. To be able to calculate the main criteria for evaluating the effectiveness of a biotechnological process (growth parameters of biological agents, synthesis rate of the target product, synthesizing ability of biological agents, economic coefficient, yield of the target product from the substrate, productivity, cost of the culture medium, etc.)

PLO21. Be able to formulate tasks for the development of automation systems for the production of biotechnological products for various purposes.

STRUCTURE OF THE ACADEMIC DISCIPLINE

Topic	Hours (lec./sem.)	Learning outcomes	Tasks	Evaluation
4 semester				
Module 1 «Morphological organization of plant organisms»				
Topic 1. Morphological structure and diversity of shoots, buds and stems	2/1	<i>To know:</i> The general concept of the shoot. Metamerism of the shoot. Classification of shoots. Main and side shoots. Vegetative, generative, reproductive and mixed shoots. Orthotropic, plagiotropic and heterotropic shoots. Types of branching shoots. Dichotomous, monopodial and sympodial branching. Growth and development of the shoot.	Get acquainted with the morphological features of shoots and constituent organs that are part of shoot metamers and prepare a report on the requirements of the electronic course.	Completion and submission of laboratory and independent work, as well as Module Control in the form of tests (on eLearn) and oral/written questioning - according to the gradebook in eLearn
Topic 2. Morphological structure of leaves. Metamorphoses of leaves».	2/1	<i>To know:</i> General concept of the leaf and its structure. Abaxial and adaxial leaf surfaces. Leaf blade, petiole and stipules. Veining of leaves: simple, dichotomous, reticulate, parallel and arcuate. Types of leaves. Simple and complex leaves. Leaf series and formations.	Choose 5 species of plants that have different forms of leaves and analyze this morphological feature on a specific example in the format of an individual research task according to the sample given in	Completion and submission of laboratory and independent work, as well as Module Control in the form of tests (on eLearn) and oral/written

		Leaf placement. Functions of leaves.	the electronic course.	questioning - according to the gradebook in eLearn
Topic 3. Morphological structure and metamorphosis of the root».	2/1	<i>To know:</i> The general concept of the root and its functions. Morphological and genetic zones of young roots. Types of roots and root systems. Metamorphoses of roots.	Get acquainted with the morphological features of the morphological features of the roots, their metamorphoses and modified shoots and prepare a report on the requirements of the electronic course.	Completion and submission of laboratory and independent work, as well as Module Control in the form of tests (on eLearn) and oral/written questioning - according to the gradebook in eLearn
Topic 4. «Features of the morphological organization of the flower and inflorescence».	2/1	<i>To know:</i> General concept of a flower and its structure. Types of flowers. Formulas and diagrams of flowers.	Choose 5 species of plants that have different shapes of flowers and inflorescences and analyze this morphological feature on a specific example in the format of an individual research task according to the sample given in the e-course.	Completion and submission of laboratory and independent work, as well as Module Control in the form of tests (on eLearn) and oral/written questioning - according to the gradebook in eLearn
Topic 5. «Morphological diversity of seeds and fruits».	2/1	<i>To know:</i> General concept and structure of seeds. General concept and structure of the fruit. Parthenocarpy. Classification of fruits. Dry and juicy fruits. Ways of fruit distribution.	Choose 5 species of plants that have different forms of fruit and analyze this morphological feature on a specific example in the	Completion and submission of laboratory and independent work, as well as Module

			format of an individual research task according to the sample given in the e-course.	Control in the form of tests (on eLearn) and oral/written questioning - according to the gradebook in eLearn
Module 2 «Anatomical features of plant objects of biotechnological production»				
Topic 6. «Meristematic and integumentary tissues».	2/1	<i>To know:</i> General concept and classification of plant tissues. Meristematic fabrics. Primary and secondary meristems. Apical, lateral, intercalary and wound meristems. Covering fabrics. External and internal. Epidermis. Epidermis. Endoderm and exoderm. Periderm. Crust.	Complete tasks on the e-course.	Completion and submission of laboratory and independent work, as well as Module Control in the form of tests (on eLearn) and oral/written questioning - according to the gradebook in eLearn
Topic 7. «Basic, mechanical, conducting tissues and excretory structures of plants».	2/1	<i>To know:</i> Basic fabrics. Core parenchyma. Mesophyll. Storage parenchyma. Hydroparenchyma. Aerenchyma. Absorbent parenchyma. Mechanical (reinforcing) fabrics. Sclerenchyma. Collenchyma. Bast fibers and libriforms. Scleroids. Conductive fabrics. Xylem. Phloem.	Complete tasks on the e-course.	Completion and submission of laboratory and independent work, as well as Module Control in the form of tests (on eLearn) and oral/written questioning - according to the gradebook in eLearn
Topic 8. «Anatomical structure of the stem».	2/1	<i>To know:</i> The structure of the apex and stem growth. Primary structure of	Complete tasks on the e-course.	Completion and submission of

		the stem. Types of leading beams. Stellar theory. Secondary structure of the stem.		laboratory and independent work, as well as Module Control in the form of tests (on eLearn) and oral/written questioning - according to the gradebook in eLearn
Topic 9. «Anatomical structure of the leaf and root».	2/1	<i>To know:</i> Histological elements of leaves. Types of anatomical organization of leaves. Root apex structure and primary root structure of monocotyledonous and dicotyledonous plants. Secondary structure of the root of dicotyledonous plants.	Complete tasks on the e-course.	Completion and submission of laboratory and independent work, as well as Module Control in the form of tests (on eLearn) and oral/written questioning - according to the gradebook in eLearn
Topic 10. «Anatomy of generative organs».	2/1	Master the material: Histological elements of generative organs. Types of anatomical organization of generative organs. Anatomic structure of flowers. Anatomic structure of seeds. Anatomic structure of fruits.	Complete tasks on the e-course.	Completion and submission of laboratory and independent work, as well as Module Control in the form of tests (on eLearn) and oral/written questioning - according to the

				gradebook in eLearn
Module 3 «Diversity of plant objects of biotechnological production»				
Topic 11. «Bryophytes».	2/1	<i>To know:</i> General characteristics, peculiarities of development, distribution and main representatives of bryophytes. <i>Distinguish:</i> biotechnologically important representatives of this group.	Complete tasks on the e-course.	Completion and submission of laboratory and independent work, as well as Module Control in the form of tests (on eLearn) and oral/written questioning - according to the gradebook in eLearn
Topic 12. «Lycopodiophyta and Equisetophyta».	2/1	<i>To know:</i> General characteristics, peculiarities of development, distribution and main representatives of the phyla Lycopodiophyta and Equisetophyta. <i>Distinguish:</i> biotechnologically important representatives of these groups of plants.	Complete tasks on the e-course.	Completion and submission of laboratory and independent work, as well as Module Control in the form of tests (on eLearn) and oral/written questioning - according to the gradebook in eLearn
Topic 13. «Polypodiophyta».	2/1	<i>To know:</i> General characteristics, peculiarities of development, distribution and main representatives of the division Ferns. <i>Distinguish:</i> biotechnologically important	Complete tasks on the e-course.	Completion and submission of laboratory and independent work, as well as Module Control in the form of

		representatives of this group.		tests (on eLearn) and oral/written questioning - according to the gradebook in eLearn
Topic 14. «Pinophyta».	2/1	<i>To know:</i> General characteristics, peculiarities of development, distribution and main representatives of the division Pinophyta. <i>Distinguish:</i> biotechnologically important representatives of this group.	Complete tasks on the e-course.	Completion and submission of laboratory and independent work, as well as Module Control in the form of tests (on eLearn) and oral/written questioning - according to the gradebook in eLearn
Topic 15. «Magnoliophyta».	2/1	<i>To know:</i> General characteristics, peculiarities of development, distribution and main representatives of the order Magnoliophyta. <i>Distinguish:</i> biotechnologically important representatives of this group.	Complete tasks on the e-course.	Completion and submission of laboratory and independent work, as well as Module Control in the form of tests (on eLearn) and oral/written questioning - according to the gradebook in eLearn
Total for 3th 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
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	permission from the lecturer and in the presence of valid reasons (e.g. medical reasons).
Academic honesty policy:	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.
Attendance policy:	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

Main literature

1. Bobkova I.A., Varlakhova L.V. Botany: textbook (for universities of I-II years of study). K.: VSV "Medicine", 2015. 304 p.
2. Bolokhovska T.O., Bobruk V.P., Kryklyva S.D. Medical botany. Anatomy and morphology of plants: Methodical instructions for laboratory classes and independent work for first-year students. - Vinnytsia, 2003. - 125 p.
3. Bolokhovska T.O., Bobruk V.P., Kryklyva S.D. Medical botany. Systematics of plants: Methodical instructions for laboratory classes and independent work for second-year students. - Vinnytsia, 2004. - 78 p.
4. Bolokhovska T.O., Bobruk V.P., Kryklyva S.D. Medical botany: Study guide to field practice in medical botany for 1st year students of the Faculty of Pharmacy. - Vinnytsia, 2002. - 66 p.
5. Bryon O.V., Chykalenko V.G. Anatomy of plants. - K.: Higher school, 1992. - 272 c.
6. Goncharenko I.V. Structure of the plant organism: Textbook. - 2nd ed. Sumy: University Book Publishing House, 2004. 200 p.
7. Kryklyva SD, Kremenska LV, Bobrovska OA Pharmaceutical botany. Part I. Anatomy and morphology of plants: Study guide. - Vinnytsia - 2012. - 162 p.
8. Kryklyva SD, Kremenska LV, Bobrovska OA Pharmaceutical botany. Part II. Systematics of plants: Study guide. - Vinnytsia - 2013. - 130 p.
9. Marchyshyn S.M., Nechai R.E., Shanayda M.I. Botany. Educational field practice. - Ternopil: TSMU, 2006. - 200 p.

Supporting literature

1. Barna M.M. Botany. Terms. Concepts. Personalities. Biology. - K.: Academia Publishing Center, 1997. - 272 p.
2. Goncharenko I.V. Structure of a plant organism: Study guide. - Sumy: University Book Publishing House, 2004. - 200 c.
3. Grigora I.M., Solomakha V.A. Vegetation of Ukraine (ecological, cenotic, floristic and geographical essay) - Kyiv: Phytosociocenter, 2005. 452 p.
4. Grodzynskyi D.M. Four-language dictionary of plant names (Ukrainian-Russian-English-Latin). - Kyiv: Phytosociocentre, 2001. - 312 p.
5. Gulko R.M. Garden of medicinal plants in Lviv. Study guide. - Vinnytsia: Nova Knyha, 2006. 240 p.

6. Ivchenko I.S., Kapustian V.V. Ethnobotanical aspects of phytodiversity research on the example of woody plants of the flora of Ukraine. - Kyiv: Phytosociocenter, 2003. - 140.
7. Moroz I.V., Hryshko-Bohmenko B.K. Botany with the basics of ecology: Study guide. - K.: Higher school, 1994. - 240 p.
8. Nechytailo V.A., Badanina V.A., Hrytsenko V.V. Cultivated plants of Ukraine. Study guide. - K.: Phytosociocenter, 2005. - 351 p.