Додаток 3
до наказу від 23.03.2023 р. № 244

COURSE SYLLABUS
«GENETICS»

Degree of higher education - Bachelor
Specialization 201 Agronomy
Educational programme « Agronomy »
Academic year 2023-2024, semester 3
Form of study full-time
Number of ECTS credits 4
Language of instruction English

Lecturer of the course	**Zaika Ye.V. – senior lecturer at the Department of Genetics, Breeding and Seed Rising named after Professor Zelensky M.O.**
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Course page on eLearn	**https://elearn.nubip.edu.ua/course/view.php?id=4045**

COURSE DESCRIPTION
(up to 1000 printed characters)

Genetics is a basic discipline, the knowledge of which is necessary for a complete understanding of biological processes and phenomena in living organisms. The discipline is formed in order to consistently acquaint students with modern ideas about the laws of heredity and variability at different levels of the organization of living matter, ways of their practical use in breeding, seed risiing and applied genetics. In their work, future specialists should be oriented in such concepts as heterosis, polyploidy, induced mutagenesis, recombinogenesis, cytoplasmic male sterility. The use of modern biotechnological developments and achievements of genetic engineering is impossible without understanding the processes of storage and transmission of hereditary information. The use of molecular markers is impossible without knowledge of genetic molecular genetics occurring in the cell at the level of DNA, RNA and proteins.

Competencies of the educational programme:

Integrative competency (IC): the ability to solve complex tasks and problems in the field of agronomy during professional activity or in the learning process, which involves conducting research and implementing complex innovations.

General competencies (GC): the ability to search, process and analyze information from various sources; the ability to apply knowledge in practical situations; the ability to preserve and multiply moral, cultural, and 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; the desire to preserve the environment.

Professional (special) competencies (PC): the ability to grow, multiply agricultural crops, carry out technological operations for primary processing and storage of products, taking into account possible mutagenic factors of natural and artificial origin; the ability to predict possible variants of splits by phenotype when crossing, understanding the consequences of inbreeding depression and using the phenomenon of heterosis, the influence of chemicals applied to the soil and plants on the DNA structure of plant cells and soil biota.

Program learning outcomes (PLO) of the educational programme: *The ability to design and implement ecologically safe, economically efficient, and energy-efficient production technologies in agricultural production. The use of genetics as an element of key breeding innovations.*

COURSE STRUCTURE

Topic	Hours (lecture/practical)	Learning outcomes	Tasks	Assessment
Semester 1				
Module 1				
LECTURE 1. Subject, methods and history of genetics	2/2	Know the subject of the discipline, its tasks, and its significance. Understand the connection with other sciences and their role in the modern world. Know the main stages of the development of genetics.	Submitting laboratory or practical work Taking tests, writing essays. Completing independent work (including in eLearn)	**4**
LECTURE 2. Molecular genetic bases of heredity	4/4	Know the history of the discovery, structure, and functions of nucleic acids. Understand the concept of genetic code. Distinguish the methods of transmission of genetic information, and the processes of DNA replication, transcription, and translation. Understand the basics of gene activity regulation. Be able to work with DNA and RNA sequences.	Submitting laboratory or practical work Taking tests, writing essays. Completing independent work (including in eLearn)	**10**
LECTURE 3. Genes and chromosomes. DNA damage and repair	4/4	Know the structure and functions of chromosomes, processes of mitosis, meiosis, stages of micro- and macrogametogenesis , pollination and fertilization.	Submitting laboratory or practical work Taking tests, writing essays. Completing independent work (including in eLearn)	**8**
LECTURE 4. Regularities of traits inheritance	4/4	To know the laws of H. Mendel about the inheritance of traits. To distinguish the inheritance of traits	Submitting laboratory or practical work Taking tests, writing essays.	**8**

		in the interaction of allelic and non-allelic genes, as well as the phenomena of complementarity, epistasis, polymerization, and linked inheritance. Know the chromosomal theory of heredity, the works of T. Morgan on crossing over	Completing independent work (including in eLearn)	
Module 2				
LECTURE 5. Variability in genetics	4/4	Distinguish modification, inheritance, combinative and mutational variability, and their features. Know the main types of mutagens and their classification, types of mutations depending on their localization, and influence on the manifestation of symptoms. Distinguish gene, chromosomal, and genomic mutations and their use in practice.	Submitting laboratory or practical work Taking tests, writing essays. Completing independent work (including in eLearn)	**8**
LECTURE 6. Genetics of Populations	2/2	Understand the concept of population and the role of population in evolution of species. To know the Hardy-Weinberg law and the course of basic genetic automatic processes in populations.	Submitting laboratory or practical work Taking tests, writing essays. Completing independent work (including in eLearn)	**6**
Module 3				
LECTURE 7. Inbreeding and heterosis in plant breeding	4/4	Know the types of plant reproduction. Understand the concepts of inbreeding and inbreeding depression in cross-pollinated plant	Submitting laboratory or practical work. Taking tests, writing essays. Completing independent work	**8**

		species. Principles of creation of inbred lines. Know what heterosis is, theories of its occurrence and practical use of heterosis in breeding. To know about the phenomenon of male sterility and its use in heterosis selection.	(including in eLearn).	
LECTURE 8. Polyploidy and remote hybridization	2/2	Distinguish types of polyploids and their distribution in the natural environment. Know the peculiarities of the inheritance of traits in polyploids. To know the role of remote hybridization in the evolution of species. Methods of obtaining fertile hybrids from distant crossings.	Submitting laboratory or practical work. Taking tests, writing essays. Completing independent work (including in eLearn).	**6**
LECTURE 9. Genetics plant immunity	2/2	Distinguish the concepts of immunity, resistance, tolerance. Understand Van der Planck's theory of race-specific and non-race-specific resistance. To know the main provisions of the theory of H. Flore "gene against gene". Analyze the possibilities of using resistance genes in breeding.	Submitting laboratory or practical work. Taking tests, writing essays. Completing independent work (including in eLearn).	**6**
LECTURE 10. Genetic engineering	2/2	To know about the role of modern biotechnological methods in accelerating the breeding process. Understand the principles of creating genetic constructs and methods of their	Submitting laboratory or practical work. Taking tests, writing essays. Completing independent work (including in eLearn).	**6**

		transfer into plant cells. To know the methods of identification of transferred genetic structures. Polymerase chain reaction. Successes of genetic engineering and prospects.		
Total for 1 semester				**70**
Exam				**30**
Total for course				**100**

ASSESSMENT POLICY

Policy regarding deadlines and resits:	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).
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

1. **Brooker R. Genetics. Analisys and Principles. Second Edition. – McGraw-Hill, 2005. – 842.**
2. **Anthony J.F. Griffiths, Susan R. Wessler, Richard C. Lewontin, Sean B. Carroll: Introduction to Genetic Analysis (Introduction to Genetic Analysis Ninth (9th) Edition, 2007. – 800 p.**
3. **Michael Goldberg, Janice Fischer, Leroy Hood, Leland Hartwell, Charles (Chip) Aquadro, Lee Silver and Ann E. Reynolds Genetics: From Genes to Genomes, 7th Edition, 2021**