SYLLABUS

ACADEMIC DISCIPLINE «SELECTION AND REPRODUCTION OF MAIN FOREST-FORMING SPECIES»

Level of higher education: Second (Master's)
Specialty: 205 «Forestry»
Year of study: 2-nd, semester 3rd
Number of ECTS credits: 5 credits
Name of Department: Forestry and Horticulture
Language of instruction: English

Lecturer course	**Doctor of Science, Senior Researcher, Ihor Neyko**
Contact information of the lecturer (e-mail)	**ihor_neyko@ukr.net**

DESCRIPTION OF THE ACADEMIC DISCIPLINE

Selection and reproduction of the main forest-forming species is a mandatory component of the OPP «Forestry».

Total course duration 150 hours: lectures – 24 hours; practical classes – 18 hours, independent work – 108 hours.

Format: lectures, practical classes, consultations. Final control – exam.

When studying this discipline, knowledge obtained from the following disciplines is used: «Business foreign language», «Forest typology», «Silvicultural production technology».

The basic provisions of the educational discipline should be applied when studying the following disciplines: qualifying work.

Purpose of the academic discipline

The discipline is aimed at obtaining one of the basic and universal competencies by applicants – the formation of systemic knowledge, professional skills and practical skills among higher education applicants necessary for effective planning, organization, coordination and control of the activities of forestry enterprises in the context of sustainable development of the forest sector.

The purpose of studying the academic discipline

The purpose of teaching the academic discipline is to provide students with a modern system of knowledge in forest genetics, selection and reproduction of the main forest-forming species, which will become the main basis of their professional activities after completing their studies.

Subject objectives

The main tasks are to highlight issues related to the theoretical foundations of forest selection, genetics and reproduction, preservation and reproduction of forest genetic resources of the main forest-forming species.

LIST OF COMPETENCIES ACQUIRED BY STUDENTS WHEN STUDYING THE DISCIPLINE IN ACCORDANCE WITH THE EDUCATIONAL PROGRAM

As a result of studying the academic discipline, a higher education applicant must possess integral, general and professional competencies, in particular:

Integral competence (IC):

Ability to solve complex research and/or innovative problems in the field of forestry and hunting.

General competencies (GC):

GC 1. Ability to identify, pose, and solve problems.

GC 2. Ability to search, process and analyze information from various sources.

GC 3. Ability to use information and communication technologies.

GC 4. The ability to generate new ideas (creativity).

GC 6. Ability to evaluate and ensure the quality of work performed.

GC 7. Ability to work in an international context.

Professional (special) competencies (SC):

SC 1. The ability to critically reflect on forestry issues and related interdisciplinary problems and make effective decisions to address them.

SC 2. Ability to ensure sustainable forestry development.

SC 3. The ability to assess regional features of natural and climatic conditions for the organization of effective forestry, the performance of diverse functions by forests, and the increase in forest areas.

SC 7* The ability to organize a system of care for green plantations in accordance with the age, species composition and functional purpose of forests in green zones, to apply modern methods of genetic and breeding analysis to increase the productivity and sustainability of forest plantations.

PROGRAMME LEARNING OUTCOMES IN ACCORDANCE WITH THE EDUCATIONAL PROGRAMME

LO 1. Specialized conceptual knowledge that incorporates modern scientific achievements in the field of forestry and is the basis for original thinking, ensuring sustainable development and conducting research.

LO 3. Make effective decisions on forestry issues, including in difficult and unpredictable conditions; predict its development; identify factors affecting the achievement of set goals; analyze and compare alternatives; assess risks and likely consequences of decisions.

LO 4. Find the necessary data in scientific literature, databases and other sources, analyze and evaluate this data.

LO 6. Assess the state of forest phytocenoses, forest resources in specific forest vegetation conditions, their potential and predict possibilities for use.

LO 7. Develop and implement scientific and applied projects in the field of forestry, taking into account available resources and risks, as well as economic, legal and environmental aspects.

LO 8. Develop and improve technological and production processes, implement modern digital technologies.

LO 12. Conduct research and/or innovation activities to obtain new knowledge and create new technologies and products in forestry and hunting and in broader multidisciplinary contexts.

LO 13*. Conduct an inventory of green plantations in suburban forests, assess their sanitary condition and propose measures for care, reconstruction or renewal, use modern methods of genetic and breeding analysis to increase the productivity and sustainability of forest plantations.

Studying this discipline develops social skills (soft skills) in students, such as: communication, working with information sources, and leadership skills, which are implemented through students creating presentation materials, writing individual assignments on a given topic, and presenting and discussing individual assignments in a group.

Subject study plan

Week	Topic names	Forms of training organization and number of hours		Independent work, number of hours
		lectures	practical classes	
1	Forest Genetics – Concepts, Scope, History and Importance	2	2	8
2	Population Genetics – Gene Frequencies, Inbreeding and Forces of Evolution	2	2	8
3	Quantitative Genetics – Polygenic Traits, Heritabilities and Genetic Correlations	2	2	8
4	Gene Conservation – In Situ, Ex Situ and Sampling Strategies	2	2	8
5	Base Populations – Species, Hybrids, Seed Sources and Breeding Zones	2	2	8
6	Phenotypic Mass Selection – Genetic Gain, Choice of Traits and Indirect Response Genetic Testing – Mating Designs, Field Designs and Test Implementation	2	2	8
7	Data Analysis – Mixed Models, Variance Components and Breeding Values	2	2	8
8	Deployment – Open-pollinated Varieties, Full-sib Families and Clones	2	2	8
9	Advanced-generation Breeding Strategies – Breeding Population Size, Structure and Management	2		14
10	Gene Conservation – In Situ, Ex Situ and Sampling Strategies	2	2	8
11	Base Populations – Species, Hybrids, Seed Sources and Breeding Zones	2		14
12	Phenotypic Mass Selection – Genetic Gain, Choice of Traits and Indirect Response Genetic Testing – Mating Designs, Field Designs and Test Implementation	2		8
Total		**24**	**18**	**108**

Independent work of a higher education student

The applicant's independent work is organized by issuing an individual list of questions and practical tasks on each topic, which are not submitted for classroom study and the implementation of an individual creative task (presentation).

The applicant's independent work is one of the ways of active, purposeful acquisition of new knowledge and skills for him. It is the basis of his training as a specialist, ensures his acquisition of cognitive activity techniques, interest in creative work, and the ability to solve scientific and practical problems.

The applicant's independent work involves, if necessary, obtaining consultations or assistance from a relevant specialist. The educational material of the academic discipline, provided for by the work program of the academic discipline for the applicant's assimilation in the process of independent work, is submitted for current and final control along with the educational material that was processed during classroom classes. The organization of independent work of applicants involves: planning the volume, content, tasks, forms and methods of control of independent work, development of educational and methodological support; implementation of planned independent work by the applicant; control and evaluation of results, their systematization, evaluation of the effectiveness of the applicant's implementation of independent work.

Individual tasks are performed by the applicant independently under the guidance of a teacher in accordance with the individual curriculum.

In the case of the implementation of the applicant's individual educational trajectory, classes can be held according to an individual schedule.

When performing educational tasks, tasks of control measures, violation of academic integrity is not allowed. Presentations and speeches must be author's and original, information about the results of one's own educational (scientific, creative) activity must be reliable; in the case of using ideas, developments, statements, information, there must be references to sources of information in compliance with the norms of the legislation on copyright and related rights.

Types of independent work

№	Type of independent work	Hours (daytime)	Deadlines	Form and method of control
1	Study of issues submitted for independent study	40	weekly	Oral and written survey
2	Preparation for lectures and practical classes	38	weekly	Oral and written survey
3	Individual creative tasks (making a presentation on a given problem topic)	15	2 times per semester	Observation of performance, discussion, presentation, oral defense
4	Preparation for tests and testing	15	2 times per semester	Testing
Разом		**108**		

12. Recommended sources of information

Basic

1. Andreeva O.Yu. Genetics and forest selection: a textbook for training specialists with the educational degree "Bachelor" in specialty 205 - "Forestry". Zhytomyr: PP «Rutan», 2016. 192 p.
2. Chenglin Li, Baochen Li, Wenxuan Zhao, Jiebei Jiang, Jieshi Tang. Forest tree breeding under the global environmental change: Challenges and opportunities. Trees, Forests and People Volume 20, June 2025, 100867.
3. Gösta Eriksson Inger Ekberg David Clapham. Genetics Applied to Forestry. An Introduction Genetic Center. Third edition. Department of Plant Biology and Forest Genetics, SLU, Sweden 2013. 207 p.
4. Neyko I.S., Mudrak G.V., Neyko O.V., Didur I.M., Matusyak M.V., Kozak Y.V. Forest genetic resources in the context of biodiversity conservation in Vinnytsia region. Vinnytsia: TVORY, 2022. 500 p.
5. Vasaitis R, Enderle R (2017). Dieback of European ash (Fraxinus spp.) - Consequences and guidelines for sustainable management. Report on European Cooperation in Science and Technology, COST Action FP1103 FRAXBACK, SLU Service/Repro, Uppsala, Sweden.
6. White, T.L., et al. Forest Genetics, CABI, 2007. ProQuest Ebook Central, http://ebookcentral.proquest.com/lib/pensu/detail.action?docID=298973.Created from pensu on 2020-01-24 09:19:00.
7. Yatsyk R.M., Gaida Y.I., Sluchyk V.M. Fundamentals of genetics and selection of forest plants. Ternopil: Textbooks and manuals, 2012. 288 p.

Additional

1. Hao et al., 2024. Genomic and phenotypic signatures provide insights into the wide adaptation of a global plant invader Plant Commun.
2. Hryb S.V. Collection of problems and exercises on genetics and breeding: solutions, answers and explanations: teaching-methodical manual for university students. Zhytomyr: "Polissya", 2019. 416 p.
3. Steffenrem A, Helmersson A (2022). Norway spruce. In: “Breeding Guidelines - Transversal Analysis”. B4EST project, Deliverable D3.5, Appendix, pp. 70-89.
4. Stejskal J, Klapste J, Cepl J, El-Kassaby YA, Lstiburek M (2022). Effect of clonal testing on the efficiency of genomic evaluation in forest tree breeding. Scientific Reports 12: 3033.
5. Stocks JJ, Metheringham CL, Plumb WJ, Lee SJ, Kelly L, Nichols RA, Buggs RJA (2019). Genomic basis of European ash tree resistance to ash dieback fungus. Nature Ecology and Evolution 3 (12): 1686-1696.
6. Strauss SH, Costanza A, Seguin A (2015). Genetically engineered trees: paralysis from good intentions. Science 349 (6250): 794-795.
7. Tiret M, Pégard M, Sánchez L (2021). How to achieve a higher selection plateau in forest tree breeding? Fostering heterozygote × homozygote relationships in optimal contribution selection in the case study of Populus nigra. Evolutionary Applications 14 (11): 2635-2646.
8. Van Frankenhuyzen K, Beardmore T (2004). Current status and environmental impact of transgenic forest trees. Canadian Journal of Forest Research 34 (6): 1163-1180.
9. Van Tassel DL, Tesdell O, Schlautman B, Rubin MJ, DeHaan LR, Crews TE, Krug AS (2021). New food crop domestication in the age of gene editing: genetic, agronomic and cultural change remain co-evolutionarily entangled. Frontiers in Plant Science 11: 789.
10. Vasin V.A., Vel'cheva L.G., Pysanets Z.G. Workshop on forest breeding. Melitopol, 2015. 107 p.
11. Villari C, Dowkiw A, Enderle R, Ghasemkhani M, Kirisits T, Kjr ED, Marčiulyniene D, McKinney LV, Metzler B, Muñoz F, Nielsen LR, Pliura A, Stener LG, Suchockas V, Rodriguez-Saona L, Bonello P, Cleary M (2018). Advanced spectroscopy-based phenotyping offers a potential solution to the ash dieback epidemic. Scientific Reports 8 (1): 81.
12. Yasodha R, Vasudeva R, Balakrishnan S, Sakthi AR, Abel N, Binai N et al. Draft genome of a high value tropical timber tree, Teak (Tectona grandis L. f): insights into SSR diversity, phylogeny and conservation. DNA Research. 2018; 25(4):409-419.

Information sourses

1. Draft Law of Ukraine On Forest Reproductive Resources. Access mode: . https://itd.rada.gov.ua/billInfo/Bills/Card/41577
2. Forest Code of Ukraine. Access mode: https://zakon.rada.gov.ua/laws/show/3852-12
3. Forest seed production guidelines.Access mode: https://ucfb.info/fileadmin/user_upload/
4. National Library named after V.I. Vernadsky. Access mode: http://www.nbuv.gov.ua/
5. Regulatory and legal framework. State organization "Ukrainian Forest Breeding Center". Acces mode: https://old.ucfb.info/informacija/pravova-baza.html

ASSESSMENT SYSTEM AND REQUIREMENTS FOR KNOWLEDGE CONTROL OF HIGHER EDUCATION STUDENTS

At the end of the semester, a higher education student can earn up to 60% of the final grade for completing all types of work performed during the semester, up to 10% for scientific, innovative, educational, and educational work and activity, and up to 30% of the final grade for the results of the final assessment.

Distribution of points by types of educational activities

	Type of educational activity	Points
	Certification 1	
1	Participation in discussions during lectures	6
2	Participation in practical classes	10
3	Completion of tests, testing	6
4	Individual and group creative tasks (performance of presentations on a given problem topic)	8
	Total for certification 1	**30**
	Certification 2	
5	Participation in discussions during lectures	6
6	Participation in practical classes	8
7	Completion of tests, testing	8
8	Individual and group creative tasks (performance of presentations on a given problem topic)	8
	Total for certification 2	**30**
	Indicators of scientific, innovative, educational, educational work and student activity	**10**
	Final testing	**30**
	Total	**100**

If a student has scored less than half of the maximum grade in a subject (less than 35 points) based on the results of tests during the semester, they will not be allowed to take the exam.

The academic discipline program provides for the results of non-formal and informal education to be taken into account as separate credits for studying academic disciplines, subject to the availability of supporting documents.

Correspondence of scales for assessing the quality of learning material

Total points for all types of learning activities	Rating ECTS	National scale score for the exam
90-100	A	excellent
82-89	B	good
75-81	C	satisfactory
66-74	D	unsatisfactory with the possibility of retaking
60-65	E	
35-59	FX	unsatisfactory with mandatory
0-34	F	re-study of the discipline