

to order of the 23.03. 2023 № 244

**NATIONAL UNIVERSITY of LIFE and
ENVIRONMENTAL SCIENCES**

Department of Botany, Dendrology and Forest Tree Breeding

“APPROVED” by
Agrobiological
faculty dean
O. Tonkha
“ ” 2023

“APPROVED”
by the meeting of the department
of Botany, Dendrology and Forest Tree Breeding
on the 15th of 05 2023, report № 11.

Head of the department of Botany, Dendrology and Forest Tree Breeding
Y. Marchuk

“CONSIDERED”
Guarantor EP Agronomy
Guarantor EP
O. Tonkha

WORKING PROGRAM OF STUDY DISCIPLINE

BOTANY

Speciality 201 Agronomy
Educational program Agronomy
Agrobiological faculty
Developer Associate Professor, PhD in Biological Sciences A. Tertyshnyi

1. The description of the study discipline “Botany”

Branch of knowledge, direction of training, study quality level		
Level of education	Bachelor	
Speciality	201 “Agronomy”	
Branch of knowlege	20 Agrarian sciences and food	
The description of the study discipline		
Form	Obligatory	
Total number of hours	150	
Number of credits ECTS	5	
Number of modules	2	
Course project (work) in the presence		
Form of control	test, exam	
Indexes of study discipline for full-time tuition and distance learning		
	full-time tuition	distance learning
Year of study	1	1
Semester	2	1
Lecture lessons	45 hours	10 hours
Practical, seminar lessons		
Laboratory lessons	60 hours	8 hours
Selfwork	45 hours	162 hours
Field practice	25 hours	
Hours per week for full-time tuition	7 hours	

2. Aim and tasks of the academic subject Botany

Aim is to study the laws of development of plants as major components of biosphere.

Tasks are

- to study botanical terminology and methods of investigation of plants that are necessary to study plants on practice; to form for student's general vision of the plant world.
- to learn, to analyze and to work with the literature and botanical objects;
- to learn a technique of experimental research of botanical objects in laboratory and in practice;
- to learn the laws of morphological and anatomical structure and development of plants and microorganisms;
- to learn a technique of identification of plants, their taxonomy;
- to learn and to analyze the botanical phenomena, changes and to form the appropriate conclusions.

As a result of teaching of academic subject the student

has to know terms, systematic and main groups of plants;

can operate on the botanical terminology and methods of investigation of plants that are necessary to study plants on practice. The variety of plants induces the study of specific features of different groups of plants, their development, phylogenetic relations and value for agriculture.

Competence acquisition:

Integral competence (IC):

The ability to solve complex specialized tasks and practical problems in agronomy, which involves the application of theories and methods of the relevant science and is characterized by the complexity and uncertainty of conditions.

General competences (GC):

GC 1. The ability to realize one's rights and responsibilities as a member of society, to realize the values of a civil (free democratic) society and the need for its sustainable development, the rule of law, the rights and freedoms of a person and a citizen in Ukraine.

GC 3. Ability to abstract thinking, analysis and synthesis.

GC 5. Ability to communicate in a foreign language.

GC 6. Knowledge and understanding of the subject area and understanding of professional activity.

GC 7. Ability to apply knowledge in practical situations.

GC 8. Skills of performing safe activities.

GC 9. Ability to search, process and analyze information from various sources.

GC 11. Efforts to preserve the environment.

Professional competences of the specialty (PC):

PC 3. Knowledge and understanding of basic biological and agrotechnological concepts, rules and theories related to the cultivation of agricultural and other plants.

PC 5. The ability to evaluate, interpret and synthesize theoretical information and practical, production and research data in the fields of agricultural production. Ability to apply methods of statistical processing of research data related to technological and selection processes in agronomy.

Program learning outcomes (PLO):

PLO 2. Strive for self-organization and self-education.

PLO 5. Conduct a literature search in Ukrainian and foreign languages and analyze the information obtained.

PLO 9. To possess at the operational level, the methods of observation, description, identification, classification, as well as the cultivation of objects and maintaining the stability of agrocenoses with the preservation of natural diversity.

PLO 16. To organize effective and safe working conditions.

3. Program and structure of the study discipline

- for full term of full-time (part-time) study.

Modules and themes	Hours													
	Full-time education							Distance learning						
	week	k	total	including					total	including				
				lec	pr	lr	ind	sw		lec	pr	lr	ind	sw
1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Theme module 1. Systematic of low plants. Non-vascular and vascular seedless plants.														
Theme 1. Introduction to botany	1	2	2		1			5	1					4
Theme 2. Propagation. Plant systematic. Introduction to systematic. LUCA, Bacteria, Arkarya	1	12	4		3		4	7,5	1		0,5			6
Theme 3. Amorphea: Fungi. Archaeplastida: Glaucophyta, Rhodophyta, Viridiplantae. Nonvascular & vascular seedless Embryophyta.	2	3	1		1		1	7,5	0,25		0,25			7

Total		17	7		5		5	20	2,25		0,75		17
Theme module 2. Seed plants. Systematic of flowering plants. Basis of phytocoenology. Basis of phytogeography.													
Theme 1. Spermatophyta, Gymnospermatophyta . General characteristic and classification of Flowering plants (Magnoliophyta, APG IV) .	2,3	22	6		8		8	14	2		2		10
Theme 2. Characteristic of Magnoliophyta families (APG IV). ANA GRADE Nymphaeales Nymphaeaceae Austrobaileyales Schisandraceae MAGNOLIIDS Piperales Aristolochiaceae Piperaceae Magnoliales Magnoliaceae Laurales Lauraceae MONOCOTS Acorales Acoraceae Alismatales Alismataceae Araceae Butomaceae Liliales Liliaceae Asparagales Amaryllidaceae Asparagaceae Iridaceae Orchidaceae Zingiberales Zingiberaceae Poales Bromeliaceae Cyperaceae Juncaceae Poaceae EUDICOTS Ranunculales Berberidaceae Papaveraceae Ranunculaceae SUPERROSIDS Saxifragales Grossulariaceae ROSIDS Vitales Vitaceae Fabales Fabaceae Rosales Cannabaceae Elaeagnaceae Moraceae Rosaceae Urticaceae Fagales	4, 5, 6, 7, 8, 9, 10	55	15		25		15	94,5	3		1,5		90

Betulaceae													
Fagaceae													
Juglandaceae													
Cucurbitales													
Cucurbitaceae													
Malpighiales													
Euphorbiaceae													
Myrtales													
Lythraceae													
Sapindales													
Rutaceae													
Malvales													
Malvaceae													
Brassicales													
Brassicaceae													
Resedaceae													
Theme 3. Characteristic of families (APG IV). SUPERASTERIDS Caryophyllales Amaranthaceae Caryophyllaceae Polygonaceae Portulacaceae ASTERIDS Ericales Actinidiaceae Ericaceae Gentianales Apocynaceae Boraginales Boraginaceae Solanales Solanaceae Lamiales Lamiaceae Oleaceae Orobanchaceae Pedaliaceae Asterales Asteraceae Dipsacales Adoxaceae Caprifoliaceae. Apiales Apiaceae	10, 11, 12, 13	38	11		16		11	23	2		2		19
Theme 4. Elements of Phytocenology	13, 14	9	3		3		3	17,75	0,5		0,25		17
Theme 5. Elements of Phytogeography	15	9	3		3		3	10,75	0,5		0,25		10
Total	15	133	38		55		40	160	8		6		146
All hours per year		150	45		60		45	180	10		8		162

4. Themes of laboratory works

№	Themes of laboratory works	Hours
1	Bacteria, Viruses, Algae	2
2	Fungi. Chytridomycota, Chytridiomycetes. Oomycota, Oomycetes. Zygomycota. Ascomycota, Ascomycetes. Basidiomycota, Basidiomycetes. Lichens.	2
3	Bryophyta, Equisetophyta, structure, life cycle.	1
4	Magnoliophyta. Main peculiarities and classification.	2
5	Flower morphology. Formula and diagram of flower. Types of inflorescences. Anatomy of	4

	flower. Structure of stamen, ovary and seed embryo.	
6	Seed formation. Seed structure of monocots and dicots plants.	2
7	Fruit formation. Structure and classification of fruits. Collective fruit.	2
8	Methodology of herbarization. Plan of morphological analysis. Plant identifying.	2
9	Plant identifying of family Ranunculaceae	2
10	Plant identifying of family Berberidaceae, Papaveraceae, Portulacaceae, Caryophyllaceae	2
11	Plant identifying of family Amaranthaceae, Polygonaceae	2
12	Plant identifying of family Betulaceae, Juglandaceae	2
13	Plant identifying of family Actinidiaceae, Ericaceae	2
14	Plant identifying of family Cucurbitaceae, Brassicaceae, Resedaceae	2
15	Plant identifying of family Moraceae, Cannabaceae, Urticaceae, Euphorbiaceae	2
16	Plant identifying of family Lythraceae, Adoxaceae	2
17	Plant identifying of family Fabaceae, Rutaceae, Elaeagnaceae	2
18	Plant identifying of family Vitaceae, Apiaceae, Caprifoliaceae	2
19	Plant identifying of family Boraginaceae, Solanaceae, Pedaliaceae	2
20	Plant identifying of family Lamiaceae, Asteraceae	2
21	Plant identifying of family Iridaceae, Liliaceae	2
22	Plant identifying of family Amaryllidaceae	2
23	Plant identifying of family Asparagaceae, Orchidaceae, Bromeliaceae	2
24	Plant identifying of family Zingiberaceae, Juncaceae, Cyperaceae	2
25	Plant identifying of family Poaceae	4
26	Flora. Main ecological factors. Plant distribution.	3
27	Elements of Phytocenology	4
28	Total	60

5. Themes of selfwork

№	Themes of selfwork	Hours
1	Theme 1. Introduction to botany	2
2	Theme 2. Propagation. Plant systematic. Introduction to systematic. LUCA, Bacteria, Arkarya	2
3	Theme 3. Amorphea: Fungi. Archaeplastida: Glaucophyta, Rhodophyta, Viridiplantae. Nonvascular & vascular seedless Embryophyta.	1
4	Theme 1. Spermatophyta, Gymnospermatophyta . General characteristic and classification of Flowering plants (Magnoliophyta, APG IV) .	8
5	Theme 2. Characteristic of Magnoliophyta families (APG IV). ANA GRADE Nymphaeales Nymphaeaceae Austrobaileales Schisandraceae MAGNOLIIDS Piperales Aristolochiaceae Piperaceae Magnoliales Magnoliaceae Laurales Lauraceae MONOCOTS Acorales Acoraceae Alismatales Alismataceae Araceae Butomaceae Liliales Liliaceae Asparagales Amaryllidaceae Asparagaceae Iridaceae Orchidaceae Zingiberales Zingiberaceae Poales Bromeliaceae Cyperaceae Juncaceae Poaceae EUDICOTS Ranunculales Berberidaceae Papaveraceae Ranunculaceae SUPERROSIDS Saxifragales Grossulariaceae ROSIDS Vitales Vitaceae Fabales Fabaceae Rosales Cannabaceae Elaeagnaceae Moraceae Rosaceae Urticaceae Fagales Betulaceae Fagaceae Juglandaceae Cucurbitales Cucurbitaceae Malpighiales Euphorbiaceae Myrtales Lythraceae Sapindales Rutaceae Malvales Malvaceae Brassicales Brassicaceae Resedaceae	15
6	Theme 3. Characteristic of families (APG IV). SUPERASTERIDS Caryophyllales Amaranthaceae Caryophyllaceae Polygonaceae Portulacaceae ASTERIDS Ericales Actinidiaceae Ericaceae Gentianales Apocynaceae Boraginales Boraginaceae Solanales Solanaceae Lamiales Lamiaceae Oleaceae Orobanchaceae Pedaliaceae Asterales	11

	Asteraceae Dipsacales Adoxaceae Caprifoliaceae Apiales Apiaceae	
7	Theme 4. Elements of Phytocenology	3
8	Theme 5. Elements of Phytogeography	3
9	Total	45

6. Samples of control questions, tests to determine the level of knowledge acquisition by students

Part 1. Comprehensive questions

1. Androceum and gynoecium. Structure of the stamen, pollen grain, Carpel, and seed embryo.
2. Bundle type of the anatomical structure of the dicot plant stem.
3. Bundle type of the anatomical structure of the monocot plant stem.
4. Characteristic of the higher spore plants and its evolution.
5. Double fertilization of the flower plants and its biological meaning.
6. Fruit. Forming of angiosperm fruit. Structure of the fruit. Types of fruits.
7. Leaf. Anatomical structure of the leaf depending on its functions.
8. Main tissues. Characteristic and functions.
9. Mechanical tissues. Characteristic and functions.
10. Peculiarities of the anatomical structure of the root.
11. Seed. Formation of the seed in the Angiosperms. Structure and types of the seeds.
12. Types of the Forest Steppe vegetation of Ukraine.
13. Ways of the substance penetration to the plant organs.
14. Flower. Flowering, pollination, fertilization in the Angiosperms.
15. Anatomical structure of the fibre plants exemplified in the *Linum* and *Cannabis* Examination questions
16. Areal and its types. Flora and vegetation.
17. Family Apiaceae. Botanical characteristic. Meaning of the members of the family for the agriculture. 18. Family Asteraceae. Botanical characteristic. Meaning of the members of the family for the agriculture.
19. Family of Amaranthaceae. Botanical characteristic of the family. Meaning of the members of the family for the agriculture. Examination questions
20. Family of Cucurbitaceae. Botanical characteristic of the family. Meaning of the members of the family for the agriculture. Examination questions
21. Family of Orchidaceae. Botanical characteristic of the family. Meaning of the members of the family for the agriculture. Examination questions
22. Family Poaceae. Botanical characteristic. Meaning of the members of the family for the agriculture. Examination questions
23. Family Solanaceae. Botanical characteristic. Meaning of the members of the family for the agriculture.
24. Signs of the plant communities. Examination questions
25. The life cycle of *Pinus sylvestris* L. Examination questions
26. Theories of the origin of the flower. Examination questions
27. Transitional type of the anatomical structure of the stem. Examination questions
28. Family Fabaceae. Botanical characteristic. Meaning of the members of the family for the agriculture.
29. Family Lamiaceae. Botanical characteristic. Meaning of the members of the family for the agriculture.
30. Chemical structure of the cell wall and its modifications.
31. Conduction tissues. Phloem and xylem. Types of the vascular bundles.
32. Family Brassicaceae. Botanical characteristic. Meaning of the members of the family for the agriculture.
33. Family Caryophyllaceae Botanical characteristic. Meaning of the members of the family for the agriculture.
34. Family Ericaceae. Botanical characteristic. Meaning of the members of the family for the agriculture.
35. Family Euphorbiaceae. Botanical characteristic. Meaning of the members of the family for the agriculture.
36. Family of Amaryllidaceae. Botanical characteristic of the family. Meaning of the members of the family for the agriculture. Examination questions
37. Family of Boraginaceae. Botanical characteristic of the family. Meaning of the members of the family for the agriculture. Examination questions
38. Family of Cyperaceae. Botanical characteristic of the family. Meaning of the members of the family for the agriculture. Examination questions
39. Family of Liliaceae. Botanical characteristic of the family. Meaning of the members of the family for the agriculture. Examination questions
40. Family of Ranunculaceae. Botanical characteristic of the family. Meaning of the members of the family for the agriculture.
41. Family of Scrophulariaceae. Botanical characteristic of the family. Meaning of the members of the family for the agriculture. Examination questions
42. Family Papaveraceae. Botanical characteristic. Meaning of the members of the family for the agriculture.
43. Family Primulaceae. Botanical characteristic. Meaning of the members of the family for the agriculture.
44. Family Rosaceae. Botanical characteristic. Meaning of the members of the family for the agriculture.
45. Green algae. Characteristic. Relationship of the plants to water and to the soil trophic. Examination questions
46. Leaf, its structure, functions. Morphological types of the leaves.

47. Meiosis. Biological meaning.
 48. Mitochondria. Structure and functions.
 49. Mitosis. Biological meaning.
 50. Nucleus. Structure and functions.

Part 2. Test questions

1. A fruit

1	is the seed-bearing structure in flowering plants (conifer seeds are borne in a cone).
2	is the spore-bearing structure in flowering plants (conifer seeds are borne in a cone).
3	is the seed-bearing structure in flowering plants (conifer seeds are borne in an antheridium).

2. A seed

1	develops from an ovule
2	develops from a spore;
3	develops from a bud

3. In Monocotyledons

1	Embryo, when differentiated, always with one cotyledon.
2	Embryo, when differentiated, always with two cotyledons.
3	Embryo, when differentiated, always with three cotyledons

4. Phytocenosis differs by such parameters:

1	floristic composition
2	living strategy
3	type of interaction
4	occurring of specie

5. What cells of the embryo sac are diploid?

1	Egg cell
2	Synergids
3	Central cell
4	antipodes

6. What vegetative body of plant consists of additional roots, stem and fronds?

1	Mosses
2	Club-mosses
3	Horse-tail
4	Ferns

7. On what family depends *Chelidonium majus* L.

1	Ranunculaceae
2	Papaveraceae
3	Caryophyllaceae
4	Amaranthaceae

8. Biocenosis consist of:

1	ecotope
2	biotope
3	noosphere
4	biosphere

9. On what family depends *Melilotus officinalis* (L.) Pall.

1	Crassulaceae
2	Rosaceae
3	Onagraceae
4	Fabaceae

10. What plants from what family have tubular flowers with such formula $C_5C_0(5)A(5)G(2)$

1	Scrophulariaceae
2	Plantaginaceae
3	Lamiaceae
4	Asteraceae

Part 3. Exam questions.

NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES			
LE Bachelor Speciality – 201 “Agronomy”	Department of Botany, Dendrology and Forest Tree Breeding 2023–2024 study	EXAMINATION TASK Variant №1 Botany	Approved by Chief of the department _____ Y. Marchuk “ _____ ” _____ 2023

	year		
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Examination questions

1. Vegetative reproduction of plants. Ways of Vegetative reproduction of plants.
2. Family of *Ranunculaceae*. Botanical characteristic of the family. Meaning of the members of the family for the agriculture.

TEST TASKS

2. To what tissues depends the water parenchyma?

1	Main
2	Dermal
3	Forming
4	Secretory

2. Root which grows from the root is called(write the the right answer).

3. What tissue of the leaf does the function of the photosynthesis

1	Aerenchyma
2	Sclerenchyma
3	Chlorenchyma
4	Epidermis

4. What inflorescence depends on the cymose inflorescence?

1	bunch
2	umbrella
3	cyme
4	Dichasium

5. What cells of the embryo sac are diploid?

1	Egg cell
2	Synergids
3	Central cell
4	antipodes

6. What vegetative body of plant consists of additional roots, stem and fronds?

1	Mosses
2	Club-mosses
3	Horse-tail
4	Ferns

7. On what family depends *Chelidonium majus* L.

1	Ranunculaceae
2	Papaveraceae
3	Caryophyllaceae
4	Amaranthaceae

8. What members of the family have the right monosexual with simple inflorescence and have five elements?

1	Brassicaceae
2	Malvaceae
3	Cannabaceae
4	Fabaceae

9. On what family depends *Melilotus officinalis* (L.) Pall.

1	Crassulaceae
2	Rosaceae
3	Onagraceae
4	Fabaceae

10. What plants from what family have tubular flowers with such formula $C_5C_0(5)A(5)G(2)$

1	Scrophulariaceae
2	Plantaginaceae
3	Lamiaceae
4	Asteraceae

Develoer, PhD

A.P. Tertyshnyy

7. Study methods

Word methods, practical methods, experimental methods

8. Forms of control

previous, current, module, final.

Progress of the student is determined his knowledge which are demonstrated in the test form during the current and final control and also skills which are the result of the systematic work with objects on the laboratory works and the right fulfilling biological picture. To allow to take the examinations the students are without the missed laboratory works.

The students who miss more than 50% of the laboratory works without reasonable excuses in the semester to working off of the missed lessons do not allow.

9. Distribution of the marks which are received by students.

The student's knowledge is assessed on a 100-point scale and translated into national assessments according to the table. 1 "Regulations on examinations and assessments at NUBiP of Ukraine" https://nubip.edu.ua/sites/default/files/u284/polozh_ekzameni_zaliki_z_dopovnenniam_2023_na_savyt.pdf (order on implementation dated 26.04.2023, protocol No. 10)

Table 1

A scale for evaluating students' knowledge

Sum of marks for all types of activity	National evaluation due to results of exams and tests	
	Exams	Tests
90-100	very good	Pass
74-89	good	
60-73	satisfactory	
0-59	unsatisfactory	Do not pass

For defining of the student rating of the discipline knowledge **Rdis** (till 100 marks) the received rating of the certification **Rcer** (till 30 marks) is summed up to the study work rating of the student **Rsw** (till 70 marks): **Rdis = Rsw + Rcer**.

10. Educational and methodological support

Syllabus (work program of credit modules);

Textbooks in accordance with the syllabus of the academic discipline;

Study guides for various types of work in the discipline: laboratory work, lectures, educational practice;

Educational content – didactic and demonstration materials for educational classes (tasks for practical classes, multimedia presentations, posters, layouts, models, handbooks, albums, diagrams, video and audio recordings, etc., intended to support the educational process);

Photos and schematic images of higher plants using presentations and Internet resources.

11. Recommended sources of information

- basic:

1. Berg L.R. Introductory botany: Plants, people, and the environment. 2nd edition, Thompson Brooks/Cole, 2008.
2. Simpson M. G. Plant Systematics. 3rd Edition, Academic Press, 2019.
3. Singh G. Plant Systematics: An integrated approach. 3rd edition, Enfield, N.H.: Science Publishers, 2010.
4. Tertyshnyi A.P. Botany. Part 1: tutorial. Kyiv: Lira-K, 2020, 250 p.
5. Верхогляд І.М. Introductory Plant Science course. Навчальний посібник. Київ: Фітосоціоцентр. 2010. 216 с.
6. Верхогляд І.М. Plant Biology (Cytology, Botany and Biodiversity), словник. Київ: Фітосоціоцентр. 2010. 88 с.
7. Верхогляд І.М. Plant Cytology and Botany, англ. Словник. Київ: Вид-во НАУ. 2006. 92 с.
8. Верхогляд І.М. Цитологія рослин. Поняття і терміни (Українсько-англійський тлумачний словник наукових термінів). К: Вид-во НАУ, 2006. 66 с.
9. Верхогляд І.М., Алейніков І.М. Цитологія рослин. Поняття і терміни (україно-англійський тлумачний словник наукових термінів). Навчальний посібник для студентів агробіологічного профілю. Словник. – Київ: Вид-во НАУ. 2003. 62 с.
10. Верхогляд І.М., Алейніков І.М., Якубенко Б.Є. Курс лекцій з цитології рослин. К., Фітосоціоцентр, 2010. 179 с.
11. Верхогляд І.М., Стефановська Т.Р. Botany. Biodiversity and Plant Cytology. Словник. Київ: Видавничий центр НАУ. 2004. 87 с.
12. Верхогляд І.М., Шабарова С.І., Алейніков І.М., Якубенко Б.Є. Морфологія рослин. Навчальний посібник для університетів. К.: Фітосоціоцентр, 2010. 231 с.
13. Григора І.М. Якубенко Б.Є. Алейніков І.М. та ін. Практикум з ботаніки. Навчальний посібник. К.: Вид. НАУ, 2003. 291 с.
14. Григора І.М., Алейніков І.М., Лушпа В.І., Якубенко Б.Є. Курс загальної ботаніки. Підручник. 2-е видання перероблене й виправлене. К.: Фітосоціоцентр, 2008. 535 с.

15. Григора І.М., Алейніков І.М., Лушпа В.І., Якубенко Б.Є. Курс загальної ботаніки. Підручник. 3-є видання перероблене й виправлене. К.: Фітосоціоцентр, 2010. 535 с.
 16. Григора І.М., Соломаха В.А. Рослинність України. К.: Фітосоціоцентр, 2005. 452 с.
 17. Григора І.М., Якубенко Б.Є. Алейніков І.М. та ін. Ботаніка. Практикум. За ред. Якубенка Б.Є. Вид. 6-е доповн. і переробл. К.: Арістей, 2006. 339 с.
 18. Григора І.М., Якубенко Б.Є. та ін. Навчально-методичний посібник до виконання лабораторних робіт з ботаніки для студентів аграрних вузів. К.: Аграрна освіта, 2000. 53 с.
 19. Григора І.М., Якубенко Б.Є., Алейніков І.М., Шабарова І., Лушпа В.І. Ботаніка. Програма для вищих аграрних закладів освіти III-IV рівнів акредитації. Київ: Аграрна освіта, 2000. 15 с.
 20. Григора І.М., Якубенко Б.Є., Алейніков І.М., Лушпа В.І., Шабарова С.І., Царенко П.М., Пидюра О.І. Ботаніка. Практикум. За редакцією Б.Є.Якубенка. К.: Арістей, 2008. 340 с.
 21. Григора І.М., Якубенко Б.Є., Мельничук М.Д. Геоботаніка. Навчальний посібник. К.: Арістей, 2006. 448 с.
 22. Григора І.М., Шабарова С.І., Алейніков І.М. Ботаніка. Підручник. К.: Фітосоціоцентр, 2004. 476 с.
 23. Дядюша Л.М. Botany. Part 1. Anatomy of flowering plants. Київ: Вид-во НАУ. 2009. 35 с.
 24. Машковська С.І., Якубенко Б.Є., Шабарова С.І. Ботанічна термінологія латинською мовою. Методичні рекомендації для самостійної роботи студентів вищих навчальних закладів. Тернопіль: Медобори, 2009. 100 с.
 25. Машковська С.П., Шабарова С.І., Якубенко Б.Є. Ботанічна термінологія латинською мовою. Методичні рекомендації для самостійної роботи студентів. К.: Вид-во НАУ, 2006. 103 с.
 26. Машковська С.П., Шабарова С.І., Якубенко Б.Є. Ботанічна термінологія латинською мовою. Методичні рекомендації для самостійної роботи студентів. К.: Вид-во НАУ, 2008. 103 с.
 27. Тертишний А.П. Покритонасінні рослини Лісостепу України. Частина 1: Навчальний посібник. Київ: Видавництво Ліра-К, 2021. 706 с.
 28. Тертишний А.П. Покритонасінні рослини Лісостепу України. Частина 2: Навчальний посібник. Київ: Видавництво Ліра-К, 2022. 312 с.
 29. Якубенко Б.Є., Григора І.М. Польовий практикум з ботаніки. Навчальний посібник. 2-є видання, перероблене та доповнене. К.: Арістей, 2008. 260 с.
 30. Якубенко Б.Є., Алейніков І.М., Верхогляд І.М., Машковська С.П., Дядюша Л.М., Тертишний А.П. Ботаніка. Зошит для лабораторних занять студентів агробіологічного профілю. К.: Арістей, 2010. 100 с.
 31. Якубенко Б.Є., Алейніков І.М., Григора І.М. та ін. Ботанічні терміни (словник). К.: Вид-во НАУ, 2001. 103 с.
 32. Якубенко Б.Є., Григора І.М. Екологія рослин і фітоценозу. К.: Вид-во НАУ, 2001. 35с.
 33. Якубенко Б.Є., Григора І.М. Навчальна практика з ботаніки. К.: Вид-во НАУ, 2004. 137 с.
 34. Якубенко Б.Є., Григора І.М. Навчальна практика з геоботаніки. К.: Вид-во НАУ, 2001. 63 с.
 35. Якубенко Б.Є., Григора І.М. Основи агрофітоценології. Сучасний стан перспективи. К.: Вид-во НАУ, 2001. 48 с.
 36. Якубенко Б.Є., Григора І.М., Мельничук М.Д. Геоботаніка. Навчальний посібник. К.: Арістей, 2008. 444 с.
 37. Якубенко Б.Є., Григора І.М. Польовий практикум з ботаніки. Навчальний посібник. 2-є видання, перероблене та доповнене. К.: Арістей, 2008. 260 с.
 38. Якубенко Б.Є. Алейніков І.М., Шабарова С.І., Машковська С.П. Ботаніка. Підручник (перевидання). Київ, Видавництво Ліра-К, 2021, 436 с.
 39. Якубенко Б.Є., Попович С.Ю., Григорюк І. П., Устименко П.М. Геоботаніка: тлумачний словник. Навчальний посібник. (перевидання). – К.: Ліра-К, 2021. – 485 с.
- additional:**
- Bell A.D. Plant Form: an Illustrated Guide to Flowering Plant Morphology. In: With line drawings by Alan Bryan. Portland, Oregon: Timber Press; 2008.
- Brouk V. Plants Consumed by Man. London: Academic Press; 1975.
- Ellison A.M., Adamec L. Carnivorous Plants: Physiology, Ecology, and Evolution. Oxford: Oxford University Press; 2018.
- Endress P. Diversity and Evolutionary Biology of Tropical Flowers. Cambridge: Cambridge University Press; 1994.
- Hallé F., Oldeman R.A.A., Tomlinson P.B. Tropical Trees and Forests: An Architectural Analysis. Berlin: Springer; 1978.
- Hallé F. Architecture de Plantes. Montpellier: JPC; 2004.
- Harris J.G., Harris M.W. Plant identification terminology. Spring Lake, Utah: Spring Lake Publishing; 2001.
- Hickey L.J. Classification of the architecture of dicotyledonous leaves. American Journal of Botany. 1973;60: 17–33.
- Hickey L.J., Wolf J.A. The bases of angiosperm phylogeny: vegetative morphology. Annals of the Missouri Botanical Garden. 1975; 62: 538–589.
- Hilger H.H. Ontogeny, morphology, and systematic significance of glochidiate and winged fruits of Cynoglosseae and Eritrichieae (Boraginaceae). Plant Diversity and Evolution. 2014; 131.
- Lawrence G.H.M. Taxonomy of Vascular Plants. New York: Macmillan; 1951.
- Radford A.E., Dickison W.C., Massey J.R., Bell C.R. Vascular Plant Systematics. New York: Harper & Row; 1974.
- Raunkiaer C. The Life Forms of Plants and Statistical Plant Geography. Oxford: Clarendon Press; 1934.

Rowley Gordon D. Caudiciform and Pachycaul Succulents – Pachycauls, Bottle-, Barrel- and Elephant-Trees and Their Kin: A Collector's Miscellany. Mill Valley, CA: Strawberry Press; 1987.

Tucker A.O., Maciarello M.J., Tucker S.S. A survey of color charts for biological descriptions. Taxon. 1991; 40:201–214.

Systematics Association Committee for Descriptive Terminology. II. Terminology of Simple Symmetrical Plane Shapes (Chart I). Taxon. 1962;11(5):145–156.

Weberling F. Morphology of Flowers and Inflorescences. Cambridge, United Kingdom: Cambridge University Press; 1989.

-Internet sources:

Angiosperm phylogeny website version <http://www.mobot.org/MOBOT/research/APweb/>

Eurasian Dry Grassland Group <https://edgg.org/>

European Vegetation Archive (EVA) <http://euroveg.org/eva-database>

European Vegetation Survey <http://euroveg.org/>

Global Biodiversity Information Facility (GBIF) <https://www.gbif.org>

Global Index of Vegetation-Plot Databases (GIVD) <http://www.givd.info/>

National Biodiversity Information Network <http://ukrbin.com>

National Vegetation Classification (NVC) <https://incc.gov.uk/our-work/nvc/>

Open data about biodiversity <https://www.inaturalist.org>

Society for ecological restoration (SER) <https://www.ser.org/default.aspx>

The Gymnosperm Database <https://www.conifers.org/index.php>

The International Association for Vegetation Science (IAVS) <http://iavs.org/>

The WFO <http://www.worldfloraonline.org/>

Ukrainian geobotanical site <http://geobot.org.ua/>

PROGRAM OF EDUCATIONAL PRACTICE

The content and organization of educational practice.

№	Theme	Hours
1	Excursion to the forest areas (Botanical garden of NULES).	5
2	Excursion to the field and meadow areas (Zhukiv island)	5
3	work in laboratory.	5
4	Excursion to the forest areas. (Konche- Zaspа forest)	5
5	Work in a laboratory.	5
6	Work in a laboratory, report generation, credit obtaining	
7	In total:	25

Educational practice of course “Botany” is held in spring and summer. It is the final step in exploring the theoretical part, especially section morphology and systematization of plants, aims to consolidate the knowledge gained during the laboratory and practical classes and lectures. In addition to issues of morphology and systematization of plants during practice the students focus on the study of the environmental features of the most important representatives of forest cover and the relationship of plants and plant groups to environmental conditions, soil fertility, and the extent of the moisture and others.

The program of educational practice of botany provides: a study of forest grass cover composition on different categories of forest areas (under the tent of forest, on cleared areas, forest areas); collection, morphological analysis and determination of plants; book-mark of registration areas for determination of character of forest grass cover, determination with the help of plant-indicators of environmental terms; editing of herbarium by system of Armen L. Takhtajan. Educational practice is conducted in a laboratory excursion method by groups of 2–3 students. The conducting of practice according to a curriculum takes 25 hours.

Tasks of educational practice.

1. Studying of basic plant-indicators of different types of forest terms.
2. Fixing of program material in morphology and systematizations of plants.
3. Capturing a method and technique of herbarization of plants.
4. Capturing morphological analysis of plants and by method of their determination with the help of existing determinants.
5. Capturing geobotanical method of description of forest phytocoenoses.
6. Collecting and studying of plant-indicators of different types forest terms, of forest nurseries and forest cultures.

Method of conducting educational practice.

Educational practice begins with conducting of botanical excursions during which students study: different types of forest terms, the most important indicators of types of forest and their adjusted to the terms of environment and agricultural value; rare and vanishing types of local flora and measures are on their guard. For an output on an excursion the students must have a certain equipment, it is needed to have on a brigade: folder of herbarium with the

complete set of newspapers, writing devices, magnifying glass, roulette or cord, forms of description of trial areas. During working on the collected material in a laboratory students have such tasks: to fasten the method of morphological analysis of plants, description of families, able to use a determinant and define collected plants.

For the period of three practice excursions it is conducted.

1. Excursion for the study of plants of forest cover of the coniferous forests and half-cleared areas.
2. Excursion for the study of plants of field and meadow areas and description of phytocenosis.
3. An excursion for the study of wild forest grass nurseries and forest cultures and bog plants.
4. An excursion for the study of herb to the experimental allotment.
5. An excursion to the Botanical garden for studying biodiversity of different natural area of Ukraine.

Working plan of educational practice.

The first and the second day of practice.

Excursions are in the forest and to the field and meadow areas. Purpose of excursions: to familiarize with the floristic elements of the forest; the field and meadow to learn and to collect the herbarium of forest and meadow plant cover of the coniferous forests and; to learn the terms of life of plants on these territories and their adjustment to the sphere of dwelling. During excursions attention is on composition of forest vegetation, that unites plants of different systematic groups: lichens, mosses, horse-tails, ferns, gymnosperms, angiosperms; different vital forms: one- and long-term herbage, bushes.

The third day of practice.

The work in laboratory. Students bring the collected material, do the morphological analysis of most typical representatives of forest cover of the coniferous forests on one of every family, conduct determination of plants, design the clean labels of herbarium, fix up names of plants and plant characteristics.

The fourth day of practice.

An excursion in the forest. Purpose of excursion: study the character of forest grass cover of oak forests and half-cleared and cleared areas and forest cultures. Study and collection of herbarium of wild grass forest with the help of a teacher, making of geobotanical description of certain area of the forest and field and meadow areas are conducted, and the collected plants are herbarized. During an excursion attention applies on that floristic composition of oak and half-cleared areas which are very rich, consist mainly of megatrophs and mesotrophs, many-tier, have a difficult structure.

The fifth day of practice.

The work in laboratory. Students bring the collected material, do the morphological analysis of most typical representatives of forest cover of the coniferous forests on one of every family, conduct determination of plants, design the clean labels of herbarium, fix up names of plants and plant characteristics.

The sixth day practice.

Work is in a laboratory. Working of materials, collected during an excursion, equipping with modern amenities of herbarium, preparation to handing over of test.

Report on passing the practice.

On a test from educational practice students must present:

1. Diary of practice, where every day of work is fixed: a theme of excursions, collected plants, their biological and ecological descriptions.
2. Form of geobotanical description of trial area of the forest.
3. A list of the collected plants in an amount 120 different species, placed in a systematic order.
4. Collected and herbarized plants are designed according standards.

Absolute knowledge of the Ukrainian and Latin names of plants and families which they belong to, and also their economic and indicator value.



**SYLLABUS OF DISCIPLINE
“BOTANY”**

Degree of higher education – Bachelor
Speciality – 201 “Agronomy”
Branch of knowledge – 20 Agrarian sciences and food
Study year – 1, semester – 2
The form of study – full-time
The number of ECTS credits – 5
The language of teaching – English

Lecturer of Discipline

Anatolii P. Tertyshnyi, Phd in Biology, Associate Professor,
Department of Botany, Dendrology and Forest Tree
Breeding, 03041, Ukraine, Kyiv, str. Henerala Rodimtseva 2,
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tertyshnyy@ukr.net
Course page on the Moodle platform
<https://elearn.nubip.edu.ua/enrol/index.php?id=1085>

DESCRIPTION OF THE DISCIPLINE

The study of educational materials of the discipline “Botany” helps future bachelors of Speciality 201 “Agronomy” to obtain the appropriate level of theoretical knowledge, formation and development of special skills, practical skills using the laws of development of plants as major components of biosphere.

Competences of EP:

Integral competence (IC):

The ability to solve complex specialized tasks and practical problems in agronomy, which involves the application of theories and methods of the relevant science and is characterized by the complexity and uncertainty of conditions.

General competences (GC):

GC 1. The ability to realize one's rights and responsibilities as a member of society, to realize the values of a civil (free democratic) society and the need for its sustainable development, the rule of law, the rights and freedoms of a person and a citizen in Ukraine.

GC 3. Ability to abstract thinking, analysis and synthesis.

GC 5. Ability to communicate in a foreign language.

GC 6. Knowledge and understanding of the subject area and understanding of professional activity.

GC 7. Ability to apply knowledge in practical situations.

GC 8. Skills of performing safe activities.

GC 9. Ability to search, process and analyze information from various sources.

GC 11. Efforts to preserve the environment.

Professional competences of the specialty (PC):

PC 3. Knowledge and understanding of basic biological and agrotechnological concepts, rules and theories related to the cultivation of agricultural and other plants.

PC 5. The ability to evaluate, interpret and synthesize theoretical information and practical, production and research data in the fields of agricultural production. Ability to apply methods of statistical processing of research data related to technological and selection processes in agronomy.

Program learning outcomes (PLO):

PLO 2. Strive for self-organization and self-education.

PLO 5. Conduct a literature search in Ukrainian and foreign languages and analyze the information obtained.

PLO 9. To possess at the operational level, the methods of observation, description, identification, classification, as well as the cultivation of objects and maintaining the stability of agrocenoses with the preservation of natural diversity.

PLO 16. To organize effective and safe working conditions.

STRUCTURE OF DISCIPLINE

Theme	Hours (lectures/practical works)	Results of study	Tasks	Evaluation
Semester 2				
Module 1				
Theme 1. Introduction to botany	2/1	Has to know terms, systematic and main groups of	Laboratory works, tests	5
Theme 2. Propagation. Plant systematic.	4/3			10

Introduction to systematic. LUCA, Bacteria, Arkarya		plants; Can operate on the botanical terminology and methods of investigation of plants that are necessary to study plants on practice.		
Theme 3. Amorphea: Fungi. Archaeplastida: Glaucophyta, Rhodophyta, Viridiplantae. Nonvascular & vascular seedless Embryophyta.	1/1	The variety of plants induces the study of specific features of different groups of plants, their development, phylogenic relations and value for agriculture.		5
Module 2				
Theme 4. Spermatophyta, Gymnospermatophyta . General characteristic and classification of Flowering plants (Magnoliophyta, APG IV) .	6/8	Has to know terms, systematic and main groups of plants; Can operate on the botanical terminology and methods of investigation of plants that are necessary to study plants on practice.	Laboratory works, tests	5
Theme 5. Characteristic of Magnoliophyta families (APG IV). ANA GRADE Nymphaeales Nymphaeaceae Austrobaileyales Schisandraceae MAGNOLIIDS Piperales Aristolochiaceae Piperaceae Magnoliales Magnoliaceae Laurales Lauraceae MONOCOTS Acorales Acoraceae Alismatales Alismataceae Araceae Butomaceae Liliales Liliaceae Asparagales Amaryllidaceae Asparagaceae Iridaceae Orchidaceae	15/25	The variety of plants induces the study of specific features of different groups of plants, their development, phylogenic relations and value for agriculture.		25

<p>Zingiberales Zingiberaceae</p> <p>Poales Bromeliaceae Cyperaceae Juncaceae Poaceae</p> <p>EUDICOTS</p> <p>Ranunculales Berberidaceae Papaveraceae Ranunculaceae</p> <p>SUPERROSIDS</p> <p>Saxifragales Grossulariaceae</p> <p>ROSIDS</p> <p>Vitales Vitaceae</p> <p>Fabales Fabaceae</p> <p>Rosales Cannabaceae Elaeagnaceae Moraceae Rosaceae Urticaceae</p> <p>Fagales Betulaceae Fagaceae Juglandaceae</p> <p>Cucurbitales Cucurbitaceae</p> <p>Malpighiales Euphorbiaceae</p> <p>Myrtales Lythraceae</p> <p>Sapindales Rutaceae</p> <p>Malvales Malvaceae</p> <p>Brassicales Brassicaceae Resedaceae</p>				
<p>Theme 6. Characteristic of families (APG IV).</p> <p>SUPERASTERIDS</p> <p>Caryophyllales Amaranthaceae Caryophyllaceae Polygonaceae Portulacaceae</p> <p>ASTERIDS</p> <p>Ericales Actinidiaceae Ericaceae</p> <p>Gentianales Apocynaceae</p> <p>Boraginales Boraginaceae</p> <p>Solanales Solanaceae</p> <p>Lamiales Lamiaceae</p>	11/16			10

Oleaceae Orobanchaceae Pedaliaceae Asterales Asteraceae Dipsacales Adoxaceae Caprifoliaceae. Apiales Apiaceae				
Theme 7. Elements of Phytocenology	3/3			5
Theme 8. Elements of Phytogeography	3/3			5
All hours per semester				70
Exam				30
Total				100

ASSESSMENT POLICY

Deadlines and Rescheduling Policy:	Assignments that are submitted late without valid reason will receive a lower grade. Modules can be rearranged with the permission of the lecturer if there are good reasons (for example, sick leave).
Academic Integrity Policy:	Copying during tests and exams is prohibited (including using mobile devices). Term papers and essays must have correct text references to the literature used
Attendance Policy:	Attending classes is mandatory. For objective reasons (for example, illness, international internship), training can take place individually (in online form with the agreement of the dean of the faculty)

A SCALE FOR EVALUATING STUDENTS' KNOWLEDGE

Sum of marks for all types of activity	National evaluation due to results of exams and tests	
	Exams	Tests
90-100	very good	Pass
74-89	good	
60-73	satisfactory	
0-59	unsatisfactory	Do not pass

RECOMMENDED SOURCES OF INFORMATION

- Berg L.R. Introductory botany: Plants, people, and the environment. 2nd edition, Thompson Brooks/Cole, 2008.
- Simpson M. G. Plant Systematics. 3rd Edition, Academic Press, 2019.
- Singh G. Plant Systematics: An integrated approach. 3rd edition, Enfield, N.H.: Science Publishers, 2010.
- Tertyshnyi A.P. Botany. Part 1: tutorial. Kyiv: Lira-K, 2020, 250 p.
- Верхогляд І.М. Introductory Plant Science course. Навчальний посібник. Київ: Фітосоціоцентр. 2010. 216 с.
- Верхогляд І.М. Plant Biology (Cytology, Botany and Biodiversity), словник. Київ: Фітосоціоцентр. 2010. 88 с.
- Верхогляд І.М. Plant Cytology and Botany, англ. Словник. Київ: Вид-во НАУ. 2006. 92 с.
- Тертишний А.П. Покритонасінні рослини Лісостепу України. Частина 1: Навчальний посібник. Київ: Видавництво Ліра-К, 2021. 706 с.
- Тертишний А.П. Покритонасінні рослини Лісостепу України. Частина 2: Навчальний посібник. Київ: Видавництво Ліра-К, 2022. 312 с.
- Якубенко Б.Є., Григора І.М. Польовий практикум з ботаніки. Навчальний посібник. 2-е видання, перероблене та доповнене. К.: Арістей, 2008. 260 с.
- Якубенко Б.Є., Григора І.М., Мельничук М.Д. Геоботаніка. Навчальний посібник. К.: Арістей, 2008. 444 с.
- Якубенко Б.Є., Попович С.Ю., Григорюк І.П., Мельничук М.Д. Геоботаніка: тлумачний словник. За ред. д.б.н. Б.Є.Якубенка та чл.-кор. НАН України І.П.Григорюка. К.: Фітосоціоцентр, 2022. 420 с.

Internet sources

- Angiosperm phylogeny website version <http://www.mobot.org/MOBOT/research/APweb/>
- Eurasian Dry Grassland Group <https://edgg.org/>
- European Vegetation Archive (EVA) <http://euroveg.org/eva-database>
- European Vegetation Survey <http://euroveg.org/>
- Global Biodiversity Information Facility (GBIF) <https://www.gbif.org>
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Open data about biodiversity <https://www.inaturalist.org>
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The Gymnosperm Database <https://www.conifers.org/index.php>
The International Association for Vegetation Science (IAVS) <http://iavs.org/>
The WFO <http://www.worldfloraonline.org/>
U.S. National Plant Germplasm System <https://npgsweb.ars-grin.gov>
Ukrainian geobotanical site <http://geobot.org.ua/>