



MINISTRY OF HEALTH OF UKRAINE
NATIONAL UNIVERSITY OF PHARMACY
Faculty of Pharmacy
Department of Pharmacognosy and Nutriciology

PHARMACOGNOSY
WITH THE BASICS OF RESOURCE SCIENCE

WORK PROGRAM
of educational component

training for _____ the second (master's) level _____
(Higher Educational Level Name)
specialty _____ «226 Pharmacy, Industrial Pharmacy» _____
(Code and Specialty Name)
knowledge industry _____ «22 Healthcare» _____
(Code and Knowledge Field Name)
of educational program _____ «Pharmacy» _____
(Educational Program Name)

2023 year

The work program of the educational component «Pharmacognosy with the basics of resource science» in specialty 226 «Pharmacy, Industrial pharmacy» educational program «Pharmacy», (4.10д)АНГЛ for applicants for higher education years of study.

EDUCATIONAL COURSE TEAM:

KYSLYCHENKO Viktoriia, head of the Department of Pharmacognosy and Nutriciology, doctor of pharmaceutical sciences, professor; KRIVORUCHKO Olena, professor of the higher education institution of the Department of Pharmacognosy and Nutriciology of the National University of Pharmacy, Doctor of Pharmacy. Sciences, professor; TARTYNSKA Ganna, associate professor of the institution of higher education of the Department of Pharmacognosy and Nutriciology of the National University of Pharmacy, candidate of pharmacology. Science, associate professor.

Work program were reviewed at the Department of Pharmacognosy and Nutritiology meeting
Record from « 1 » of September 2023 № 1

Head of the Department



Prof. Viktoriia KYSLYCHENKO

Work program has been approved at the meeting of the Methodical Commission of chemical disciplines
session

Record from « 5 » of September 2023 № 1

Head of the Specialized Committee



Prof. Viktoriya GEORGIYANTS

1. Description of the educational component

Language of study: *English*

Status of the educational component: *compulsory*

Prerequisites for studying the educational component:

a) is based on the knowledge acquired by graduates in the study of Latin, botany, organic chemistry, biological chemistry, analytical chemistry, biophysics, physical and colloid chemistry, normal and pathological human physiology;

b) lays the foundations for the study of higher education in pharmaceutical and toxicological chemistry, pharmacology, drug technology, perfumery and cosmetics technology, clinical pharmacy, which involves the integration of teaching with these disciplines and the formation of skills to apply knowledge of pharmacognosy in further education and professional activities.

The subject of educational component study “Pharmacognosy with the basics of resource science” is the study of biological, biochemical and medicinal properties of plants, natural plant material and products from it.

Information content of the educational component. 9,0 ECTS credit 270 hours are assigned to the study of the educational component.

2. Objectives and tasks of the educational component

The purpose of teaching the educational component “Pharmacognosy with the basics of resource science” is training students to find and identify medicinal plants in nature by their morphological features, to know the periods and rational practices of collection, primary processing, drying conditions, packing, rules of MPM storage; to carry out commodity research, macroscopical, microscopical, phytochemical, luminescent and chromatographic analysis of MPM, products of its and raw material of animal origin processing, which is necessary in practical activity of a pharmacist.

The main tasks of the educational component “Pharmacognosy with the basics of resource science” are:

- to define the terms medicinal plant (MP), medicinal plant material (MPM), biologically active compounds (BAC);
- to come to understanding the identity and quality of the MPM;
- to explain the methods of collection, drying, storage of MPM depending on the group and class of BAC;
- to apply the characteristic of medicinal plants and MPM in professional activity;
- to develop a plan of procedures on rational plant material collection;
- to use the knowledge about chemical composition of MPM on collection, storage and analysis of the raw material of herbal and animal origin and medicines;
- to make a conclusion about the raw material quality based on the results of pharmacopoeial analysis;
- to interpret the correlation between the chemical structure of BAC and pharmacological activity;
- to develop information letters, report for doctors and consult the people on the questions connected with MP, raw material and medicines of natural origin.

3. Competence and planned educational outcomes

Educational component «Pharmacognosy with the basics of resource science» ensures the acquisition of applicants for higher education the following **competences**:

integral: the ability to solve typical and complex specialized problems and practical problems in professional activities in the field of health care, or in the learning process, which involves research and / or innovation and is characterized by complexity and uncertainty of conditions and requirements;

general:

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

special (professional):

PC 16. Ability to organize and conduct the procurement of medicinal plant raw materials in accordance with the rules of Good Practice of Cultivation and Collection of Raw Materials of Plant Origin (GACP), as a guarantee of the

quality of medicinal plant raw materials and medications based on it. Ability to predict and calculate ways to solve the problem of conservation and protection of thickets of wild medicinal plants, in accordance with current legislation.

PC 20. Ability to develop methods for quality control of medications, including active pharmaceutical ingredients, medicinal plant raw materials and excipients using physical, chemical, physicochemical, biological, microbiological, pharmacotechnological and pharmacorganoleptic control methods.

Integrative final **program learning outcomes** (PLO), the formation of which is facilitated by the educational component:

PLO 7. To perform professional activities using creative methods and approaches.

PLO 28. To organize and conduct rational procurement of medicinal plant raw materials. To develop and implement measures for the protection, reproduction and rational use of wild species of medicinal plants.

As a result of studying the educational component, the applicant for higher education will be *know*:

- main pharmacognostic terms, methods of pharmacognostic analysis, matter and tasks of pharmacognosy, its importance for a pharmacist's professional activity;
- major development stages of pharmacognosy, main and current directions of scientific research in the field of medicinal plants;
- characteristic of raw material base of MP (wildly grown and cultivated);
- regulatory framework of using resources of wildly grown MP at current stage;
- organization of MPM collection;
- system of rational natural resource management, protection and renewal of MP resources;
- general rules of MPM collection and measures of natural operating reserve of MP protection;
- basics of industrial MP cultivation;
- MPM standardization system;
- types of MPM classifications (chemical, pharmacological, botanical, morphological);
- nomenclature of MP, MPM and medicines of herbal and animal origin which are allowed in medical practice and usage in industrial production;
- main information about distribution and places of growth of MP used in medicine and pharmaceutical industry;
- impact of geographical and ecological factors on productivity of medicinal plants, variability of chemical composition of MP;
- macroscopical and microscopical methods of analysis of intact, cut and briquetted medicinal plant material, special aspects of analysis of species;
- morphological and anatomical features of MPM allowed for usage in medical practice and possible admixtures;
- main BAC groups of natural origin and their physical and chemical properties; major biosynthetic pathways of the main BAC groups;
- methods of extraction of BAC from MPM;
- main quality tests on different BAC groups and determination of the content of active ingredients in the MPM;
- biological standardization of MPM;
- numerical indices indicating the MPM quality and methods of their determination;
- requirements to packing, marking, transporting and storage of MPM according to quality control methods;
- system of standardization and certification of MPM, phytotherapies in Ukraine, documenting the results of MPM analysis, legal effect of the certificate;
- main ways and forms of MPM usage in pharmaceutical practice and industry;
- main directions of using medicines of herbal and animal origin in medicine;
- safety arrangements and precautions while working with MP and MPM;

be able to:

- determine MP by its morphological features in nature and on herbarium;
- carry out collection and drying, primary processing and storage of plant material;
- identify MPM based on microscopical analysis: marshmallow root and herb, greater plantain leaf, shepherd's purse herb, high bush cranberry bark, rosehip fruits, nettle leaf, bearberry leaf, cowberry leaf, fern rhizome, melilot

herb, senna leaf, buckthorn bark, rhubarb root, St. John’s wort herb, beggarticks herb, motherwort herb, water pepper herb, redshank herb, restharrow root, oak bark, great burnet root, bogbean leaf, dandelion root, peppermint leaf, sage leaf, eucalyptus leaf, calamus rhizome, elecampane rhizome and root, wormwood herb, yarrow herb, thyme herb, wild thyme herb, pot marjoram herb, anise fruits, fennel fruits, liquorice root, horsetail herb, Java tea leaf, purple foxglove leaf, Grecian foxglove leaf, lily-of-the-valley leaf, erysimum herb, belladonna leaf, stramonium leaf, henbane leaf, bush pea leaf, celandine herb;

- recognize admixtures of morphologically close species during plant material collection, acceptance and certifying;
- carry out quality and microchemical reactions based on the groups of BAC present in the MP and plant material (polysaccharides, fatty oils, flavonoids, coumarins, tannins, iridoids, essential oils, saponins, anthraquinones, cardiac glycosides, alkaloids, vitamins etc.);
- apply thin-layer chromatography for MPM analysis;
- determine the content of anthraquinones, flavonoids, coumarins, tannins, essential oils, saponins, cardiac glycosides, ascorbic acid, alkaloids etc. in the plant material using relevant quality control methods;
- carry out MPM acceptance and sample preparation necessary for its analysis according to the quality control methods;
- determine the weight loss on drying, ash and extractable matter using relevant quality control methods;
- carry out statistical processing and presenting the results of analysis.

possess:

- the technique of macro- and microscopical analysis of MPM;
- skills of identifying medicinal plant material of different morphological groups in the whole, cut and powdered state, as well as in briquettes, tablets and other forms using the field guide;
- methods of studying plants aimed to determine medicinal plants and their admixtures;
- methods of analysis of unknown raw material;
- skills of preparation of reagents, indicators and titration solutions for carrying out phytochemical analysis of MPM;
- technique of quality and microchemical reactions for the main BAC classes which are present in medicinal plants and raw material (polysaccharides, vitamins, essential oils, cardiac glycosides, saponins, anthraquinones, coumarins, flavonoids, tannins, alkaloids), physical and chemical analysis of MPM;
- methods of pharmacopoeial qualitative and quantitative analysis of MPM;
- skills of unsupervised work with SPU and the sources of educational, scientific and additional literature;
- skills of searching videos, printed and electronic sources, work with Internet resources.

4. The educational component structure

Names of content modules and topics	The amount of hours				
	full time study (4,10π)				
	the whole amount	including			
		l.	sem	lab	self-study
1	2	3	4	5	6
Content module 1. Methods of pharmacognostic analysis of MPM. MP and raw materials of plant and animal origin, which contain carbohydrates, glycosides, lipids, proteins, vitamins, organic acids and isoprenoids.					
Substantial module 1. General part of pharmacognosy. Medicinal plants and natural raw materials containing carbohydrates, thio- and cyanoglycosides, lipids, proteins, vitamins, organic acids.					
Topic 1. General part of Pharmacognosy. Pharmacognostic methods.	7,5	0,5	-	3	4
Topic 2. Carbohydrates. Glycosides.	12,5	1,5	-	6	5
Topic 3. Lipids and lipoids.	9,5	1,8	-	2,7	5

Topic 4. Proteins.	2,5	0,2	-	0,3	2
Topic 5. Vitamins.	9	1	-	3	5
Topic 6. Macro- and microelements. Organic acids.	4	0,5	-	1,5	2
Topic 7. Glucosinolates (thioglycosides) and cyanogenic glycosides.	4	0,5	-	1,5	2
Control of the substantial module 1	6	-	-	6	-
The whole amount of hours for the content module 1	55	6	-	24	25
Substantial module 2. Medicinal plants and natural raw materials that contain isoprenoids (monoterpene glycosides, bitters, essential oils, triterpenoids, steroids, saponins and cardiac glycosides).					
Topic 8. Terpenoids. Iridoids. Bitters.	8	1	-	3	4
Topic 9. Essential oils.	24	4	-	11	9
Topic 10. Diterpenoids. Resins and balsams.	4	1	-	1	2
Topic 11. Triterpenoids. Steroids. Saponins.	13	2	-	6	5
Topic 12. Cardiac glycosides.	10	2	-	3	5
Control of the substantial module 2	5	-	-	5	-
The whole amount of hours for the content module 2	64	10	-	29	25
Semester credit from the module 1	1	-	-	1	-
<i>Total for Module 1</i>	120	16	-	54	50
Content module 2. MP and MPM, which contain phenolic compounds, alkaloids and various groups of BAC, medicinal raw materials of animal origin. Merchandising analysis. Medical fees and teas. Resource science of medicinal plants.					
Substantial module 3. Medicinal plants and plant material containing phenolic compounds.					
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>
Topic 13. Phenolic compounds.	6,3	0,3	-	3	3
Topic 14. Coumarins and chromones.	1,6	0,1	-	0,5	1
Topic 15. Lignans.	10	1	-	4	5
Topic 16. Xanthones.	1,6	0,1	-	0,5	1
Topic 17. Flavonoids.	23,5	1,5	-	12	10
Topic 18. Quinones.	10	1	-	4	5
Topic 19. Tannins.	10	1	-	4	5
Control of the substantial module 3	8	-	-	8	-
The whole amount of hours for the content module 3	71	5	-	36	30
Substantial module 4. Medicinal plants and plant material containing alkaloids and different groups of BAC. Merchandising analysis of MPM. Medical fees and teas. Resource science of medicinal plants.					
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>
Topic 20. Alkaloids.	23,5	1,5	-	12	10
Topic 21. Medicinal plants and raw material containing different biologically active compounds. Tissue cultures.	5,2	0,2	-	2	3
Topic 22. Merchandising analysis of MPM.	4,2	0,2	-	1	3
Topic 23. Ways of processing medicinal plant raw materials. Analysis of medicinal fees and teas.	3,6	0,1	-	1	2,5
Topic 24. Resource science of medicinal	12	1	-	8	3

plants.					
Control of the substantial module 4	7	-	-	7	-
The whole amount of hours for the content module 4	55,5	3	-	31	21,5
Semester credit from the module 2	1	-	-	1	-
Semester exam	22,5	-	-	-	22,5
<i>Total for Module 2</i>	150	8	-	68	74
<i>The whole amount of hours for the course</i>	270	24	-	122	124

5. Content of of the educational component

Module 1. Methods of pharmacognostic analysis of MPM. MP and raw materials of plant and animal origin, which contain carbohydrates, glycosides, lipids, proteins, vitamins, organic acids and isoprenoids.

Content module 1. General part of pharmacognosy. Medicinal plants and natural raw materials containing carbohydrates, thio- and cyanoglycosides, lipids, proteins, vitamins, organic acids.

Topic 1. General part of Pharmacognosy. Pharmacognostic methods: macro- and microscopical analysis of the MPM from different morphological groups, microchemical reactions and thin-layer chromatography of some groups of BAC.

Topic 2. Carbohydrates. Glycosides. General characteristic. Chemical analysis of MPM. Determination of the swelling index of the plant material. MP and MPM containing polysaccharides: marshmallow species, plantain species, coltsfoot, flaxseed, laminaria species; glucose, honey, starch and its derivatives, inulin, pectin, gums.

Topic 3. Lipids and lipoids. General characteristic of fatty acids, fats and lipoids. Medicinal plants, raw material and products containing fats and lipoids. Analysis of fatty acids. Olive, almond, peach, castor, sunflower oil. Cod liver oil. Cocoa butter. Waxes. Products of soja processing (oil, proteins, phospholipids).

Topic 4. Proteins. General characteristic. MP and raw material of herbal and animal origin containing proteins. Beekeeping products: pollen, apilac, propolis. Bee and snake venom. Phytotoxins of mushrooms, lectins. Enzymatic medicines of herbal and animal origin. Leeches, velvet antlers.

Topic 5. Vitamins. General characteristic. MP and MPM containing vitamins. Rosehip, pot marigold, sea buckthorn, blackcurrant, rowan, nettle species, corn, shepherd's purse.

Topic 6. Macro- and microelements. Organic acids. General characteristic. MP and MPM containing organic acids, silicic acid derivatives. Pomegranate, hibiscus, cranberry.

Topic 7. Glucosinolates (thioglycosides) and cyanogenic glycosides. MP and MPM containing glycosides and non-glycosidic compounds of sulfur. Mustard species, bitter almond.

Content module 2. Medicinal plants and natural raw materials that contain isoprenoids (monoterpene glycosides, bitters, essential oils, triterpenoids, steroids, saponins and cardiac glycosides).

Topic 8. Terpenoids. Iridoids. Bitters. General characteristic of MP and MPM containing iridoids and bitters. Yellow gentian, bogbean, centaury species, dandelion, high bush cranberry, hops.

Topic 9. Essential oils. General characteristic. Analysis of essential oils. MP and MPM containing essential oils. Correlation between the chemical composition of essential oil and pharmacotherapeutic effects in aromatherapy. Coriander, lavender, melissa, peppermint, sage, eucalyptus species, common valerian, juniper, caraway, linden species, German chamomile, Roman chamomile, elecampane, wormwood, yarrow, birch species, calamus, Labrador tea, aniseed, fennel, common thyme, creeping thyme, pot marjoram, menthol, thymol, camphor.

Topic 10. Diterpenoids. Resins and balsams. General characteristic. MP and MPM containing diterpenoids, resins and balsams.

Topic 11. Triterpenoids. Steroids. Saponins. General characteristic. Methods of qualitative and quantitative analysis. MP and MPM containing saponins. Natural sources of hormones and bile acids. Liquorice species, horse chestnut, horsetail, Java tea, ginseng, Japanese angelica-tree, locoweed. Raw material for semisynthesis of

glucocorticosteroids. Yam species, puncture vine, fenugreek, maral root, agave species, Adam's needle etc.

Topic 12. Cardiac glycosides. General characteristic. Methods of qualitative and quantitative analysis. MP and MPM containing cardiac glycosides. Purple foxglove, Grecian foxglove, big-flowered foxglove, strophanthus species, spring pheasant's eye, lily-of-the-valley, erysimum.

Semester credit from the module 1

Module 2. MP and MPM, which contain phenolic compounds, alkaloids and various groups of BAC, medicinal raw materials of animal origin. Merchandising analysis. Medical fees and teas. Resource science of medicinal plants.

Content module 3. Medicinal plants and plant material containing phenolic compounds.

Topic 13. Phenolic compounds. General characteristic. Methods of qualitative and quantitative analysis. MP and MPM containing simple phenols and their glycosides. Bearberry, cowberry, rhodiola, pansy species, echinacea species.

Topic 14. Coumarins and chromones. General characteristic. Methods of qualitative and quantitative analysis. MP and MPM containing coumarins and chromones. Melilot, horse chestnut, parsnip, greater ammi, figs.

Topic 15. Lignans. General characteristic. MP and MPM containing lignans. Schizandra, eleuthero, mayapple, milk thistle.

Topic 16. Xanthenes. General characteristic. Methods of qualitative and quantitative analysis. MP and MPM containing xanthenes: Hedysarum.

Topic 17. Flavonoids. General characteristic. Methods of qualitative and quantitative analysis. MP and MPM containing flavonoids. Japanese pagoda tree, cornflower, black chokeberry, motherwort species, water pepper, redshank, knotgrass, marsh cudweed, immortelle, hawthorn species, threelobe beggarticks, liquorice, restharrow, locoweed.

Topic 18. Quinones. General characteristic. Methods of qualitative and quantitative analysis. MP and MPM containing quinones. **Anthraquinones:** alder buckthorn, common buckthorn, rhubarb, horse sorrel, aloe, Alexander and Tinnavelly senna, dyer's madder, St. John's wort species.

Topic 19. Tannins. General characteristic. Methods of qualitative and quantitative analysis. MP and MPM containing procyanidins and tannins. Smoke tree, bistort, alder species, greater burnet, oak species, tormentil, bilberry, bird cherry.

Content module 4. Medicinal plants and plant material containing alkaloids and different groups of BAC. Merchandising analysis of MPM. Medical fees and teas. Resource science of medicinal plants.

Topic 20. Alkaloids. General characteristic. Methods of qualitative and quantitative analysis. MP and MPM containing alkaloids. Belladonna, henbane, stramonium species, bush pea species, opium poppy, tulip poppy, celandine, barberry, ergot, nux vomica, rauwolfia species, Madagascar periwinkle, common periwinkle, passionflower, veratrum, Cayenne pepper, ephedra, colchicum species.

Topic 21. Medicinal plants and raw material containing different biologically active compounds. Tissue cultures. General characteristic. Isolated tissue culture. Chaga, kalanchoe. Other natural sources of BAC: microorganisms, fungi and lichens. Antibiotics.

Topic 22. Merchandising analysis. Methods of sampling, identification of MPM. Quality control methods (QCM) for the raw material of natural origin. MPM analysis according to the relevant QCM. Analysis of herbal species and teas.

Topic 23. Ways of MPM processing. Analysis of medicinal fees and teas.

Topic 24. Resource science of medicinal plants. Raw material database of medicinal plants of Ukraine. Selection of objects of resource studies. Methods of determining reserves of wild medicinal plants.

Semester credit from the module 2.

Semester exam.

6. Topics of lectures

№	Name of topic	The amount of hours
Module 1.		
1.	Topic 1. General questions of Pharmacognosy. Pharmacognostic methods.	0,5
2.	Topic 2. General characteristic of polysaccharides. MP and MPM containing polysaccharides and glycosides.	1,5
3.	Topic 3. General characteristic of lipids. MP and MPM containing lipids.	1,8
4.	Topic 4. Proteins.	0,2
5.	Topic 5. General characteristic of vitamins. MP and MPM containing vitamins.	1
6.	Topic 6. Macro- and microelements. Organic acids.	0,5
7.	Topic 7. Glucosinolates (thioglycosides) and cyanogenic glycosides.	0,5
8.	Topic 8. General characteristic of terpenoids. General characteristic of iridoids. MP and MPM containing iridoids.	1
9.	Topic 9. General characteristic of essential oil. MP and MPM containing essential oils. Diterpenoids.	4
10.	Topic 10 Resins and balsams.	1
11.	Topic 11. Triterpenoids, steroids, saponins. General characteristic of saponins. MP and MPM containing saponins.	2
12.	Topic 12. General characteristic of cardiac glycosides. MP and MPM containing cardiac glycosides.	2
Total for Module 1		16
Module 2.		
13.	Topic 13. Classification of phenolic compounds. General characteristic of simple phenols and their glycosides. MP and MPM containing simple phenols and their glycosides.	0,3
14.	Topic 14. General characteristic of lignans. MP and MPM containing lignans.	0,1
15.	Topic 15. General characteristic of coumarins, chromones. MP and MPM containing coumarins, chromones.	1
16.	Topic 16. General characteristic of xanthenes. MP and MPM containing xanthenes.	0,1
17.	Topic 17. General characteristic of flavonoids. MP and MPM containing flavonoids.	1,5
18.	Topic 18. General characteristic of quinones. MP and MPM containing quinones. General characteristic of anthracene derivatives. MP and MPM containing anthracene derivatives.	1
19.	Topic 19. General characteristic of tannins. MP and MPM containing tannins.	1
20.	Topic 20. General characteristic of alkaloids. MP and MPM containing alkaloids.	1,5
21.	Topic 21. MPM with different chemical composition. Raw material of animal origin.	0,2
22.	Topic 22. Methods of pharmacognostic analysis. Merchandising analysis.	0,2
23.	Topic 23. Ways of MPM processing. Analysis of medicinal fees and teas.	0,1
24.	Topic 24. Resource science of medicinal plants.	1
Total for Module 2		8
The whole amount of hours		24

7. Topics of seminars

Not provided for in the working curriculum.

8. Topics of Practical lessons

Not provided for in the working curriculum.

9. Topics of laboratorial lessons

№	Name of topic	The amount of hours
Module 1.		
1.	Topic 1. General questions of Pharmacognosy. Pharmacognostic methods.	3
2.	Topic 2. Chemical, morphological and anatomical analysis of MPM containing polysaccharides and glycosides.	6
3.	Topic 3. Chemical and morphological analysis of MPM containing lipids.	2,7
4.	Topic 4. Proteins.	0,3
5.	Topic 5. Chemical, morphological and anatomical analysis of MPM containing vitamins.	3
6.	Topic 6. Chemical and morphological analysis of MPM containing macro- and microelements, organic acids.	1,5
7.	Topic 7. Glucosinolates (thioglycosides) and cyanogenic glycosides.	1,5
8.	Control of the content module 1	6
9.	Topic 8. Chemical, morphological and anatomical analysis of MPM containing iridoids and other bitters.	3
10.	Topic 9. Chemical, morphological and anatomical analysis of MPM containing essential oils.	11
11.	Topic 10. Diterpenoids. Resins and balsams.	1
12.	Topic 11. Chemical, morphological and anatomical analysis of MPM containing triterpenoids, steroids and saponins.	6
13.	Topic 12. Chemical, morphological and anatomical analysis of MPM containing cardiac glycosides.	3
14.	Control of the content module 2	5
15.	Semester credit from module 1	1
Total for Module 1		54
Module 2.		
16.	Topic 13. Chemical, morphological and anatomical analysis of MPM containing simple phenols and their glycosides.	3
17.	Topic 14. Chemical, morphological and anatomical analysis of MPM containing lignans.	0,5
18.	Topic 15. Chemical, morphological and anatomical analysis of MPM containing coumarins and chromones.	4
19.	Topic 16. Chemical, morphological and anatomical analysis of MPM containing xanthenes.	0,5
20.	Topic 17. Chemical, morphological and anatomical analysis of MPM containing flavonoids.	12
21.	Topic 18. Chemical, morphological and anatomical analysis of MPM containing quinones.	4
22.	Topic 19. Chemical, morphological and anatomical analysis of MPM containing tannins.	4
23.	Control of the content module 3	8
24.	Topic 20. Chemical, morphological and anatomical analysis of MPM containing alkaloids.	12
25.	Topic 21. MP and raw material containing different groups of BAC. Tissue culture.	2
26.	Topic 22. Merchandising analysis of MPM.	1
27.	Topic 23. Ways of MPM processing. Analysis of medicinal fees and teas.	1
28.	Topic 24. Resource science of medicinal plants.	8
29.	Control of the content module 4	7
30.	Semester credit from module 2	1

№	Name of topic	The amount of hours
Total for Module 2		68
The whole amount of hours		122

10. Self-study work

№	Name of topic	The amount of hours
Module 1.		
1.	Topic 1. General questions of Pharmacognosy. Pharmacognostic methods.	4
2.	Topic 2. MP and MPM containing polysaccharides and glycosides.	5
3.	Topic 3. MP and MPM containing lipids.	5
4.	Topic 4. General characteristics. MP and MPM and animal origin, containing proteins and proteins.	2
5.	Topic 5. MP and MPM containing vitamins.	5
6.	Topic 6. MP and MPM containing macro- and microelements, organic acids.	2
7.	Topic 7. General characteristics of glucosinolates (thioglycosides) and cyanogenic glycosides. MP and MPM, which contains glucosinolates (thioglycosides) and cyanogenic glycosides. MP and raw materials containing glycosides and non-glycosidic sulfur compounds.	2
8.	Topic 8. MP and MPM containing iridoids.	4
9.	Topic 9. MP and MPM containing essential oils.	9
10.	Topic 10. General characteristics of diterpenoids, resins and balms. MP and raw materials that contain diterpenoids, resins and balms.	2
11.	Topic 11. MP and MPM containing saponins. Ecdysteroids.	5
12.	Topic 12. MP and MPM containing cardiac glycosides.	5
Total for Module 1		50
Module 2.		
13.	Topic 13. MP and MPM containing simple phenols and their glycosides.	3
14.	Topic 14. MP and MPM containing lignans.	1
15.	Topic 15. MP and MPM containing coumarins, chromones.	5
16.	Topic 16. MP and MPM containing xanthenes.	1
17.	Topic 17. MP and MPM containing flavonoids.	10
18.	Topic 18. MP and MPM containing quinones, anthracene derivatives.	5
19.	Topic 19. MP and MPM containing tannins.	5
20.	Topic 20. MP and MPM containing alkaloids.	10
21.	Topic 21. MPM with different chemical composition. Medicinal raw material of animal origin: sources of allantoin (cucumber, types of comfrey, types of beans), types of pumpkin, prickly iron, wormwood, pyrethrum, lovage. Culture of isolated tissues.	3
22.	Topic 22. Methods of quality control of raw materials of natural origin.	3
23.	Topic 23. Ways of MPM processing: powdered, briquetted, tableted, cut-pressed (granules).	2,5
24.	Topic 24. Resource science of medicinal plants.	3
Total for Module 2		74
Total amount of hours		124

Tasks for Self-study work

Topic 1. General part of Pharmacognosy. Pharmacognostic methods: macro- and microscopical analysis of the MPM from different morphological groups, microchemical reactions and thin-layer chromatography of some groups of BAC:

- determination of pharmacognosy as a science and an education discipline; main terms of the subject: MP, MPM, medicinal raw material of animal origin, BAC, MPM standardization, identity, purity, quality; nomenclature of MP and MPM; tasks of pharmacognosy; methods of pharmacognostic analysis; ways and forms of exploitation of medicinal raw material of plant and animal origin; integration of pharmacognosy with basic and profile subjects; importance of pharmacognosy in practical activity of a pharmacist;

- short historical background of development of pharmacognosy; major historical stages of using and studying medicinal plants in world medicine;

- raw materials base of medicinal plants; import and export of medicinal plant material; prospects of using the plant material base: introduction of deficient medicinal plants into the culture; tissue culture;

- chemical composition of medicinal plant material; main groups of BAC; active and accompanying compounds; primary and secondary metabolites; systems of classification of MP and MPM: chemical, morphological, botanical, pharmacological;

- basics of the MPM collection;

- standardization of MPM; standardization system in Ukraine; quality control methods of MPM;

- main directions of scientific research of MP.

Topic 2. Carbohydrates. Glycosides. *Objects for independent study:* cotton species; plant sources of starch (potato, wheat, corn, rice), inulin (Jerusalem artichoke, dandelion, chichory, elecampane, coneflower species), gums (apricot, arabic, thragacanth, guar), pectins (apple, beetroot, citrus fruits, figs, plum); sources of agar and carrageenan; plant material of raspberry, common mallow, Iceland moss, fucus, linden species.

Topic 3. Lipids and lipoids. *Objects for independent study:* pumpkin seeds, peanut, flaxseed, corn embryos, evening primrose oil, coconut, palm butter; oil and freon extracts of corn embryos, walnut seeds, rosehip and black chokeberry fruits; lanolin, spermaceti, solid animal fats.

Topic 4. Proteins. *Objects for independent study:* Spirulina, alfalfa, mistletoe, black cummin, papaya, pineapple, watermelon. Spongilla. Shilajit.

Topic 5. Vitamins. *Objects for independent study:* wild strawberry, cowslip, pumpkin, carrot, cabbage, high bush cranberry.

Topic 6. Macro- and microelements. Organic acids. *Objects for independent study:* Spinach, citrus fruits, rosehip species, horsetail, knotgrass, plants of Boraginaceae and Poaceae families (borage, couch grass, oat etc.).

Topic 7. Glucosinolates (thioglycosides) and cyanogenic glycosides. *Objects for independent study:* cherry laurel, onion, garlic.

Topic 8. Terpenoids. Iridoids. Bitters. *Objects for independent study:* Plantain species, motherwort species, common valerian.

Topic 9. Essential oils. *Objects for independent study:* sources of camphor, rose species, ginger, turmeric, parsley, Siberian fir, arnica, poplar, rosemary, cinnamon species, clove, basil.

Topic 10. Diterpenoids. Resins and balsams. *Objects for independent study:* Pine, stevia, frankincense, styrax Benzoin, balsam of Tolu, balsam of Peru, myrrh.

Topic 11. Triterpenoids. Steroids. Saponins. *Objects for independent study:* Jacob's ladder, soapwort, Devil's club, English ivy, birch species, pot marigold, black cohosh, cowslip. Natural sources of bile acids, endocrine glands of animals as sources of hormones, annual nettle, fenugreek, African cherry, saw palmetto. Ecdysteroids.

Topic 12. Cardiac glycosides. *Objects for independent study:* hellebore species, squill.

Topic 13. Phenolic compounds. *Objects for independent study:* anomalous peony, artichoke, meadowsweet, willow species, fern, hemp.

Topic 14. Coumarins and chromones. *Objects for independent study:* Dill, wild carrot, khella, angelica.

Topic 15. Lignans. *Objects for independent study:* eleuthero.

Topic 16. Xanthones. *Objects for independent study:* Centaury species, St. John's wort species.

Topic 17. Flavonoids. *Objects for independent study:* buckwheat, lemon and other citrus fruits, tea, elderberry, Baical skullcap, horsetail, St. John's wort species, lespedeza species, goldenrod species, mountain knotgrass, black locust, ginkgo.

Topic 18. Quinones. *Objects for independent study:* *benzoquinones:* ubiquinone; *naphthoquinone:* walnut, round-leaved sundew, European stoneseed.

Topic 19. Tannins. *Objects for independent study:* sumach, bergenia, Chinese, turkich and pistachio galls, grape, tea.

Topic 20. Alkaloids. *Objects for independent study:* puke weed, anabasis, senecio, coca, European scopolia, water-lily, mountain club-moss, Sophora pachycarpa, cinchona, common fumitory, Stephania glabra, Securinega suffruticosa, plume poppy, ipecac, yohimbe, sources of caffeine (tea, coffee, cocoa, cola, guarana), delphinium species, monkshood species, English yew, kangaroo apple.

Topic 21. Medicinal plants and raw material containing different biologically active compounds. Tissue cultures. *Objects for independent study:* sources of allantoin (borage, comfrey species, kidney-bean species), pumpkin species, lampwick plant, mugwort, pyrethrum, lovage.

Topic 22. Merchandising analysis.

Topic 23. Ways of MPM processing. Analysis of medicinal fees and teas.

Topic 24. Resource science of medicinal plants. Raw material database of medicinal plants of Ukraine. Selection of objects of resource studies. Methods of determining reserves of wild medicinal plants.

11. Criteria and evaluation order of educational outcomes.

Scheme of accrual and distribution of points for full-time higher education applicants

Current testing and independent work Module 1															Total	
Content module 1						Content module 2									60-100	
T 1	T 2	T6, 7	T 3, 4	T5	SM1 T 1-7	T8	T 9, 10				T 11	T 12	SM2 T8-12			
-	3-5	3-5	3-5	3-5	13-19	5-11	2-4	2-4	2-4	2-4	2-4	2-4	1-3	2-4		11-13

Current testing and independent work Module 2															Total	
Content module 3							Content module 4								60-100	
T 13, 14, 16	T 15	T 17			T 18	T 19	SM3 13-19	T 20			T 21-23	T 24	SM4 T 20-24			
2-4	2-4	2-4	2-4	2-4	2-4	2-4	11-15	5-7	2-4	2-4	2-4	2-4	2-4	2-4		13-18

The criteria for evaluating the knowledge and skills of students of higher education from the educational component "Pharmacognosy with the basics of resource science" were developed in accordance with the "Regulations on the procedure for evaluating students' knowledge in the credit-modular organization of the educational process at the National University of Pharmacy". The evaluation of the success of a higher education student in the educational component is a rating, presented on a one-point scale and defined according to the ECTS system and the traditional scale adopted in Ukraine.

Evaluation of the current educational activity (carried out during each class) - test written control, control of theoretical knowledge, practical skills and abilities.

Evaluation (in points) is reflected in the calendar and thematic plans of laboratory classes.

Evaluation criteria	Points
<p>Theoretical training:</p> <ul style="list-style-type: none"> - showed in-depth knowledge of the theoretical material on the topic of the lesson, which is presented in the textbook, lecture texts and additional literature; - well completed the written homework on working out the questions and objects of independent work; - gave comprehensive answers to the questions of initial knowledge control and received "5". <p>Practical training:</p> <ul style="list-style-type: none"> - determined by morphological features MP in herbarium form, gave its full characteristics; - demonstrated a good mastery of the technique of macroscopic analysis of MPM; - recognized impurities of morphologically similar plant species; - identified MPM based on microscopic analysis; - conducted a qualitative/quantitative analysis of the main group of biologically active substances contained in MPM; - performed the reception of MPM and took the samples necessary for its analysis, according to the quality control methods; - determined the content of loss in mass during drying in MPM; ashes; extractive substances; degree of infestation by pests; - determined the morphological and anatomical characteristics of individual components, as well as the numerical indicators of official medicinal collections by methods of macro-, microscopic and phytochemical analysis. - submitted a well-designed laboratory journal to the teacher for verification. 	5
<p>Theoretical training:</p> <ul style="list-style-type: none"> - showed a good knowledge of the theoretical material on the topic of the lesson, which is presented in the textbook and lecture texts; - completed written homework on working out issues and objects of independent work; - gave incomplete answers to the questions of initial knowledge control and received "4". <p>Practical training:</p> <ul style="list-style-type: none"> - determined by morphological features MP in herbalized form, but gave an incomplete description of it; - demonstrated mastery of the technique of macroscopic analysis of MPM; - recognized impurities of morphologically similar plant species; - identified MPM based on microscopic analysis; - conducted/conducted with small errors qualitative/quantitative analysis of the main group of biologically active substances contained in MPM; - carried out MPM reception and took samples necessary for its analysis, according to quality control method; - determined / determined with small errors in MPM the content of loss in mass during drying; ashes; extractive substances; degree of infestation by pests; - determined / determined with small errors the morphological and anatomical features of individual components, as well as the numerical indicators of official medicinal collections by methods of macro-, microscopic and phytochemical analysis; - handed the prepared laboratory journal to the teacher for verification. 	4
<p>Theoretical training:</p> <ul style="list-style-type: none"> - showed knowledge of the theoretical material on the topic of the lesson in the amount that is considered necessary and sufficient to perform the practical part of the lesson; - completed a written homework on processing questions and objects of independent work with errors; 	3

<p>- gave incomplete answers to the initial knowledge control questions and received a "3".</p> <p>Practical training:</p> <ul style="list-style-type: none"> - determined by morphological features MP in herbarium form, but gave an incomplete description of it; - demonstrated not very good mastery of the technique of macroscopic analysis of MPM; - did not recognize impurities of morphologically similar plant species; - identified MPM based on microscopic analysis; - carried out qualitative/quantitative analysis of the main group of biologically active substances contained in MPM with errors; - carried out MPM reception and took samples necessary for its analysis, according to quality control method; - incorrectly determined the content of loss in mass during drying in MPM; ashes; extractive substances; degree of infestation by pests; - determined with errors the morphological and anatomical features of individual components, as well as the numerical indicators of official medicinal collections by methods of macro-, microscopic and phytochemical analysis. - handed over to the teacher for checking a laboratory journal with minor errors. 	
<p>Theoretical training:</p> <ul style="list-style-type: none"> - did not show/showed knowledge of the theoretical material on the subject of the lesson in an amount that is not considered sufficient to perform the practical part of the lesson; - did not complete / completed written homework on processing questions and objects of independent work with gross errors; - did not give/gave incomplete answers to questions 1-4 of the initial knowledge control. <p>Practical training:</p> <ul style="list-style-type: none"> - did not determine / determined with gross errors according to the morphological features of MP in the herbarium form; - did not demonstrate / demonstrated with gross errors mastery of the technique of macroscopic analysis of MPM; - did not recognize impurities of morphologically similar plant species; - did not identify /identified with gross errors of MPM based on microscopic analysis; - did not conduct / conducted with gross errors qualitative / quantitative analysis of the main group of biologically active substances contained in MPM; - did not conduct MPM reception and did not take samples necessary for its analysis, according to quality control method; - did not determine / determined with gross errors in MPM the content of loss in mass during drying; ashes; extractive substances; degree of infestation by pests; - did not determine / determined with gross errors morphological and anatomical features of individual components, as well as numerical indicators of official medicinal collections by methods of macro-, microscopic and phytochemical analysis; - handed over to the teacher for verification the laboratory journal, which was designed with major flaws. 	0-2

If a student of higher education is unprepared for a laboratory class, he can be admitted to the practical part of the class only after an individual conversation with the teacher on the subject of the class.

**Evaluation criteria
initial controls of laboratory lessons on pharmacognosy with the basics of resource science**

№ question	Evaluation criteria	Points
1	A complete definition of the concept of the BAC class, its classification with the writing of the main formulas is given. or: The physical and chemical properties of the BAC class / methods of its analysis are characterized. or: The compound is named, the MPM containing it is indicated.	5
	A complete definition of the concept of the BAC class is given. Its classification with errors in writing the main formulas is given. or: The physical and chemical properties of the BAC class / methods of its analysis with errors are characterized. or: The compound is named. The MPM containing it with errors is specified.	4
	The definition of the BAC class with errors is given. Its incomplete classification is given, or the main formulas are not given. or: The physical and chemical properties of the BAC class / methods of its analysis with errors are characterized. or: The compound or group of natural substances to which it belongs is named. The MPM containing it is not indicated, or it is indicated with errors.	3
2-6	Correct answers to 5 tests from the database "Krok-2. Pharmacy".	5
	Correct answers were provided for 4 out of 5 tests of the "Krok-2" database. Pharmacy".	3
7	The structural and logical schemes for 3 (5) types of MPM are fully compiled, the Latin and English names of MPM are given.	5
	Structural and logical schemes with errors have been compiled, the Latin / English name of MPM is incompletely given.	4
	Structural and logical schemes with errors have been compiled, the Latin / English name of the MPM is not given.	3

Evaluation criteria for content modules 1-4 in pharmacognosy with the basics of resource science

№ question	Recommended evaluation criteria for the theoretical part	Points
1	A complete definition of the concept of the BAC class is given. Their classification is given with the writing of the main formulas.	5
	A complete definition of the concept of the BAC class is given. Their classification with errors in writing the main formulas is given.	4
	The definition of the BAC class with errors is given. Their classification is incomplete, or the main formulas are not given.	3
2	The physicochemical properties of the BAC class (or methods of their analysis) and their pharmacological effects are characterized.	5
	The physicochemical properties of the BAC class (or methods of their analysis) and their pharmacological action with errors are characterized.	3-4
3	The compound is named, the class of natural substances to which it belongs, and its biological activity are indicated. Identification reactions of this compound are given.	5
	The compound is named, but the class of natural substances to which it belongs, its biological activity, is not indicated. Reactions for the identification of this compound with errors are given.	3-4
4	MPM belonging to the indicated family are selected. For MPM, which belongs to the specified family and contains the specified class of BAC, the Latin and English names	5

	are given, the chemical composition, medicinal products and applications are indicated.	
	Not all MPM that belong to the specified family and are listed are selected. For MPM, which belongs to the specified family and contains the specified class of BAC, the Latin and English names with errors are given, the chemical composition, medicinal products and applications are not fully specified.	3-4
5	The structural and logical schemes for five types of MPM are fully compiled, the Latin and English names of MPM and MP are given.	5
	Structural and logical schemes with errors have been compiled, the Latin and English names of MPM and MP are not fully given or not given.	3-4

№ question	Recommended evaluation criteria for the practical part	Points
1	MP No. 1 has been identified, the Latin and English names of MP, MPM and families are given. The main morphological diagnostic features of MP, places of plant growth and area (geographical zone of wild plant growth or cultivation areas), rules of harvesting, drying and storage of raw materials are characterized. The chemical composition of MPM, biological action and application are indicated.	5
	MP No. 1 has been identified, the Latin and English names of MP, MPM and families are given. The main morphological diagnostic features of MP, places of plant growth and range (geographical zone of wild plant growth or cultivation areas), rules of harvesting, drying and storage of raw materials with minor errors are characterized. The chemical composition of MPM, biological effect and application are not specified accurately.	4
	MP No. 1 has been identified, the Latin and English names of MP, MPM and families are given. The main morphological diagnostic features of MP, places of plant growth and area (geographical zone of wild plant growth or cultivation areas), rules of harvesting, drying and storage of raw materials with gross errors are characterized. The chemical composition of MPM, or the biological effect and application, is not specified.	3
2	MP No. 2 has been identified. The Latin and English names of the raw material, the producing plant and the family are given. The main morphological diagnostic features of MP have been characterized. The chemical composition of MPM, methods of qualitative analysis of the main class of compounds in MPM are indicated.	5
2	MP No. 2 has been identified. The Latin and English names of the raw material, the producing plant and the family are given. The main morphological diagnostic features of MP have been characterized. The chemical composition of MPM, methods of qualitative analysis of the main class of compounds in MPM with inaccuracies are indicated.	4
	MP No. 2 has been identified. Latin and English names of raw materials, producing plants and families with errors are given. The main morphological diagnostic features of MP have not been fully characterized. The chemical composition of MPM, methods of qualitative analysis of the main class of compounds in MPM with gross errors are indicated.	3
3	A sample of MPM has been identified. Latin and English names of raw materials, producing plants and families are given. The main morphological and anatomical diagnostic features of MPM have been characterized. The preparations and use of this MPM are indicated.	5
	A sample of MPM has been identified. Latin and English names of raw materials, producing plants and families are given. The main morphological and anatomical diagnostic features of MPM have not been fully characterized. The drugs and use of this MPM are indicated with errors.	4
	A sample of MPM has been identified. Latin and English names of raw materials,	3

	producing plants and families with errors are given. The main morphological and anatomical diagnostic features of MPM have not been characterized. Drugs and use of this MPM are not specified.	
4	Samples of medicinal plant raw materials from the "Collection of MPM" were identified. Their Latin and English names, main BACs and applications are given.	5
	Samples of medicinal plant raw materials from the "Collection of MPM" were identified. Their Latin and English names, main BAC and applications with errors are given.	4
	Samples of medicinal plant raw materials from the "Collection of MPM" were identified. Their Latin, English names or main BAC and applications are not given.	3

Evaluation criteria for the semester exam in pharmacognosy with the basics of resource science

№ question	Recommended evaluation criteria for the theoretical part	Scores	Points
1	A complete definition of the concept of the BAC class is given. Their classification is given with the writing of the main formulas.	18-20	5
	A complete definition of the concept of the BAC class is given. Their classification with errors in writing the main formulas is given.	16-17	4
	The definition of the BAC class with errors is given. An incomplete classification of them is given, or the main formulas are not completely given.	12-15	3
	The definition of the concept of the BAC class is not given / it is given with gross errors. Their classification is not given / incomplete classification is given, or the main formulas are not given.	0-11	0-2
2	The physical and chemical properties of the BAC class (or methods of their analysis) are characterized.	18-20	5
	The physical and chemical properties of the BAC class (or methods of their analysis) are characterized.	16-17	4
	The physical and chemical properties of the BAC class (or the methods of their analysis) have not been fully characterized.	12-15	3
	Physico-chemical properties of BAC class (or methods of their analysis) are not characterized / partially characterized.	0-11	0-2
3	The compound is named, the class of natural substances to which it belongs, and its biological activity are indicated. Identification reactions of this compound are given.	18-20	5
	The compound is named, the class of natural substances to which it belongs is indicated, and its biological activity is indicated with minor errors. Identification reactions of this compound with minor errors are given.	15-17	4
	The compound is named, but the class of natural substances to which it belongs, its biological activity, is not indicated. Reactions for the identification of this compound with errors are given.	12-14	3
	The compound is not named/named, the class of natural substances to which it belongs, its biological activity is not specified/specified. No identification reactions for this compound with gross errors are given.	0-11	0-2
4	MPM belonging to the indicated family are selected. For MPM, which belongs to the specified family and contains the specified class of BAC, the Latin and English names are given, the chemical composition, medicinal products and applications are indicated.	18-20	5
	Not all MPM that belong to the specified family and are listed are selected.	15-17	4

	For MPM, which belongs to the specified family and contains the specified class of BAC, the Latin and English names with errors are given, the chemical composition, medicinal products and applications are not fully specified.		
	Not all MPM that belong to the specified family and are listed are selected. For MPM, which belongs to the specified family and contains the specified class of BAC, the Latin and English names with errors are given, the chemical composition, medicinal products and applications are not fully specified.	12-14	3
	Not selected / not all MPM that belong to the specified family and are listed are selected. For MPM, which belongs to the specified family and contains the specified class of BAC, the Latin and English names with errors are not specified / the chemical composition, medicinal products and applications are not specified / not fully specified.	0-11	0-2
5	The structural and logical schemes for five types of MPM have been completely compiled.	18-20	5
	The structural and logical schemes for three types of MPM are drawn up correctly.	16-17	4
	Structural and logical schemes with errors have been compiled.	12-15	3
	Structural and logical diagrams with gross errors were not compiled / compiled.	0-11	0-2
Total		100	

12. Forms of progress and semester supervision of academic achievements

Current control of theoretical and practical knowledge in the form of an oral, written and test survey using standardized methods for diagnosing knowledge, abilities and skills is carried out at each laboratory session in accordance with the specific goals of the topic and during the individual work of the teacher for topics that are not included in the structure of the lesson and are developed by the student of higher education independently.

Control of content modules - control of theoretical knowledge in the form of an oral, written and test survey of applicants for higher education, as well as practical skills in determining the identity and benignity of MPM. Control refers to knowledge and skills, both acquired in classes, and objects and topics developed independently by students of higher education.

When *studying the educational component* «Pharmacognosy with the basics of resource science», students of higher education take a semester exam. The exam on pharmacognosy with the basics of resource science is conducted in written form during the exam session, according to the schedule.

Form of control - semester credit, semester exam.

13. Methodological support

1. Educational work program of educational component
2. Work program of educational component.
3. Calendar and thematic plans of lectures and laboratory lessons.
4. Textbooks, workshops, manuals, methodical recommendations, etc.
5. Materials of computer presentations of lectures.
6. Methodological recommendations for laboratory lessons, as well as independent work of students of higher education.
7. A list of theoretical questions for independent work of students of higher education.
8. List of questions and tasks for current control of knowledge and skills of higher education applicants.

9. List of theoretical questions and practical tasks for the control of meaningful modules, the exam.
10. Collection of MP herbariums and samples of MPM.

14. Reading suggestions

The main reading suggestions

1. Pharmacognosy: textbook for higher school students / V.S. Kyslychenko, L.V. Upyr, Ya.V. Dyakonova, V.Yu. Kuznetsova, I.G. Zinchenko, O.A. Kyslychenko; ed. by V.S. Kyslychenko. – Kharkiv : NUPh : GoldenPages, 2011. – 552 p.; il.
2. Pharmacognosy: textbook for students of higher / V.S. Kyslychenko, L.V. Lenchyk, I.G. Gurieva et al.; ed. by V.S. Kyslychenko. – Kharkiv : NUPh : Golden Pages, 2019. – 584 p.
3. Text book of Pharmacognosy and Phytochemistry / A. Dhole, V. Dhole, V. Yeligar, Ch. Magdum. Pharma Career Publication, 2019. – 778 p.

Supplementary reading suggestions

1. Medicinal plants resource science : handbook for students of higher schools / V.S. Kyslychenko, L.V. Upyr, I.G. Zinchenko, O.A. Kyslychenko, S.I. Stepanova; ed. by V.S. Kyslychenko. – Kharkiv : NUPh : Golden Pages, 2012. – 168 p.
2. Gokhale S. B., Kokate C. K., Purohit A. P. A textbook of Pharmacognosy. 29th Edition. 2017. 284 p.
3. Kumar N. A Textbook Of Pharmacognosy. A.I.T.B.S. Publishers, India. 2010. 502 p.
4. Shah B. N., Seth A.K. Textbook of Pharmacognosy and Phytochemistry. Elsevier. 2010. 587 p.
5. Singh A. A Textbook of Pharmacognosy. Pharma Book Syndicate. 2013. 836 p.
6. British Pharmacopoeia Commission, 2016. *British Pharmacopoeia*. London: TSO.
7. European Pharmacopoeia. 8th ed including supplements 1 (2014), 2 (2014), 3 (15), 4 (15), 5(2015). Council of Europe, Strasbourg, France. 2014.
8. Textbook of Pharmacognosy and Phytochemistry - E-Book / Shah B., Seth A. – Elsevier Health Sciences, 2012. – 620 p.

15. Electronic resources, including the Internet

1. Website of the Department of Pharmacognosy and Nutriciology – www.cnc.nuph.edu.ua
2. Website of the NUPh library – <http://lib.nuph.edu.ua>
3. Electronic archive of the NUPh – <http://dspace.nuph.edu.ua>
4. Center for Distance Technologies of the National Academy of Sciences of Ukraine – pharmel.kharkiv.edu
5. NUPh. Online tests – <http://tests.nuph.edu.ua>
6. Vernadsky National Library of Ukraine – <http://www.nbu.gov.ua>
7. V.G. Korolenko Kharkiv State Scientific Library – <http://korolenko.kharkov.com>