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

PHARMACOGNOSY WITH THE BASICS OF RESOURCE SCIENCE

THE WORKING PROGRAMME of the educational component

training the second (master's) level
(name of the higher education level)

area of knowledge «22 Health»
(cipher, name of the area of knowledge)

speciality «226 Pharmacy, Industrial Pharmacy»
(cipher, speciality name)

educational programme «Pharmacy»
(name of the educational programme)

specialisation(s)
(cipher, name of the specialisation)

2024

The work program of the educational component «Pharmacognosy with the basics of resource science» in specialty 226 «Pharmacy, Industrial pharmacy» of the educational program «Pharmacy» for higher education applicants of t 2, 3 years of study.

Developers:
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The working programme was reviewed and approved at the meeting of the Department of Pharmacognosy and Nutritiology meeting

Record from «02» of September 2024 No 15

Head of the Department _____ prof. Viktoriia KYSLYCHENKO

The working programme was approved at the meeting of the specialized Methodological Commission

Record from «03» of September 2024 № 1

Head of the specialized Commission_____ Prof. Viktoriya GEORGIYANTS

1. Description of the educational component

Language of teaching: ***English***
The 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.
The subject of study of the educational component "Pharmacognosy with the basics of resource science" is medicinal plant raw materials, less often - objects of animal origin as sources of medicinal raw materials.
The information volume of the educational component. 270 hours 9,0 ECTS credit are given to the study of the educational component.

2. The purpose and objectives 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. Competencies and planned learning outcomes

The educational component «Pharmacognosy with the basics of resource science» provides acquisition of the following ***competencies*** by higher education applicants:
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. The ability to organize and carry out the procurement of medicinal plant raw materials in accordance with the rules of the 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 medicines based on them. The ability to predict and calculate ways to solve the problem of preservation and protection of thickets of wild medicinal plants, in accordance with current legislation.

PC 20. Ability to develop methods of quality control of medicinal products, including active pharmaceutical ingredients, medicinal plant raw materials and auxiliary substances using physical, chemical, physico-chemical, biological, microbiological, pharmacotechnological and pharmaco-organoleptic control methods.

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

PLO 7. Perform professional activities using creative methods and approaches.

PLO 28. Organize and carry out rational procurement of medicinal plant raw materials. 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 BAS groups of natural origin and their physical and chemical properties; major biosynthetic pathways of the main BAS groups;
– methods of extraction of BAS from MPM;
– main quality tests on different BAS 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, phytoremedies 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 BAS 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 structure of the educational component

Names of content modules and topics	Volume in hours				
	full time form				
	total	including			
		L.	sem	lab	iw
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**	**-**
Total for Module 1	**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.					
1	*2*	*3*	*4*	*5*	*6*
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.					
1	*2*	*3*	*4*	*5*	*6*
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 plants.	12	1		8	3
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**
Total for Module 2	**150**	**8**	**-**	**68**	**74**
The whole amount of hours for the course	**270**	**24**	**-**	**122**	**124**

5. The content of the educational component programme

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, rhodiole, 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. Xanthones. General characteristic. Methods of qualitative and quantitative analysis. MP and MPM containing xanthones: 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 Tinnavely 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. Belladoona, henbane, stramonium species, bush pea species, opium poppy, tulip poppy, celandine, BACberry, 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. Lecture topics

№	Name of topic	Volume in hours
		Full-time form
	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 xanthones. MP and MPM containing xanthones.	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

№	Name of topic	Volume in hours
		Full-time form
Module 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. Seminar topics

Not provided for in the working curriculum.

8. Topics of practical classes

Not provided for in the working curriculum.

9. Topics of laboratory classes

№	Name of topic	Volume in hours
		Full-time form
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

№	Name of topic	Volume in hours
		Full-time form
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 xanthones.	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
	Total for Module 2	**68**
	The whole amount of hours	**122**

10. Individual work

№	The topic name	Volume in hours
		Full-time form
	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 xanthones.	1
17.	**Topic 17.** MP and MPM containing flavonoids.	10

№	The topic name	Volume in hours
		Full-time form
Module 1.		
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**

Theoretical questions and tasks for individual 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 cumin, 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 the procedure for assessing learning outcomes

Assessment of the acquisition of topics of the educational component during classes:

The number of the topic (lesson) of the educational component	***The maximum number of points by topic (lesson)***	***Distribution of the maximum number of points per topic (lesson) by type of work***	***Types of work for which the applicant receives points***
Module 1			
Content module 1			
Topic 1. *(topic for independent study)*	4	4	solving tasks for independent work
Topic 2.	4	2	testing
		1	oral answer
		1	solving situational tasks
Topic 3.	4	2	testing

		1	oral answer
		1	solving situational tasks
Topic 4. *(topic for independent study)*	3	3	solving tasks for independent work
Topic 5.	3	1	testing
		1	oral answer
		1	solving situational tasks
Topic 6.	4	2	testing
		1	oral answer
		1	solving situational tasks
Topic 7. *(topic for independent study)*	3	3	solving tasks for independent work
Total points for the content module 1:		***25***	
Content module 2			
Topic 8.	5	2	testing
		1	oral answer
		2	solving situational tasks
Topic 9.	5	2	testing
		1	oral answer
		2	solving situational tasks
Topic 10.	5	2	testing
		1	oral answer
		2	solving situational tasks
Topic 11.	5	2	testing
		1	oral answer
		2	solving situational tasks
Topic 12.	5	2	testing
		1	oral answer
		2	solving situational tasks
Total points for the content module 2:		***25***	
Total points for the module:		***50***	
Module 2			
Content module 3			
Topic 13.	4	2	testing
		1	oral answer
		1	solving situational tasks
Topic 14. *(topic for independent study)*	2	2	solving tasks for independent work
Topic 15.	4	2	testing
		1	oral answer
		1	solving situational tasks
Topic 16. *(topic for independent study)*	3	3	solving tasks for independent work
Topic 17.	4	2	testing
		1	oral answer
		1	solving situational tasks

Topic 18.	4	2	testing
		1	oral answer
		1	solving situational tasks
Topic 19.	4	2	testing
		1	oral answer
		1	solving situational tasks
Total points for the content module 1:		***25***	
Content module 4			
Topic 20.	5	2	testing
		1	oral answer
		2	solving situational tasks
Topic 21.	5	2	testing
		1	oral answer
		2	solving situational tasks
Topic 22. *(topic for independent study)*	5	5	solving tasks for independent work
Topic 23.	5	2	testing
		1	oral answer
		2	solving situational tasks
Topic 24.	5	2	testing
		1	oral answer
		2	solving situational tasks
Total points for the content module 2:		***25***	
Total points for the module:		***50***	

Instead of performing types of work on any topic of the educational component, the following types of work of a student of higher education may be counted:

- participation in workshops, forums, conferences, seminars, webinars on the topic of the educational component (with the preparation of essays, abstracts of reports, information messages, etc., which is confirmed by the program of the event, or abstracts of reports, or a corresponding certificate);
- participation in research and applied research on the topic of the educational component (in the development of questionnaire forms, conducting experimental studies, processing research results, preparing a report, presenting the results, etc., which is confirmed by the demonstration of relevant materials).

Evaluation of winners <u>by types of work during classes:</u>

Types of work, for which the acquirer receives points	***Maximum number of points***
testing	37
answers to theoretical questions	19
solving situational tasks	29
solving tasks for independent work	15
Total points:	***100***

Assessment during control of content modules:

Types of work, for which the acquirer receives points	***Distribution of the maximum number of points for control of the content module by types of works***	***The maximum number of points for control of the content module***
Content module 1		
testing	15	25
answers to theoretical questions	10	
Content module 2		
testing	15	25
answers to theoretical questions	10	
Total points for control of content modules:		***50***

Assessment of individual work of a higher education applicant:

during content module 1 control: tickets for content module 1 include theoretical questions and test tasks from topics 1, 4 and 7.

during content module 3 control: tickets for content module 1 include theoretical questions and test tasks from topics 14 and 16.

during content module 4 control: tickets for content module 1 include theoretical questions and test tasks from topics 22.

Evaluation scale of the semester credit:

When studying the educational component, several assessment scales are used: a 100-point scale, an undifferentiated ("passed", "not passed") two-point scale and the ECTS rating scale. The results are converted from one scale to another according to the table.

Total points by a 100-point scale	ECTS rating scale	Assessment by a four-point scale	Assessment by an undifferentiated scale
90-100	A	Excellent	passed
82-89	B	Good	
74-81	C		
64-73	D	Satisfactory	
60-63	E		
35-59	FX	Unsatisfactory	failed
1-34	F		

12. Teaching methods

- *explanatory (informational and reproductive) method:* Lecture-based learning – lectures, video materials;
- *reproductive method:* traditional practical classes;
- *problem-based teaching*: Brainstorming - method of "brainstorming"; Case-based learning - method of cases;
- *partial search method:* Game-based learning – game methods of learning (business games);
- *research method:* Research-based learning – participation in research work, preparation of theses of reports at conferences, scientific articles

13. Forms of progress and semester supervision of academic achievements

Current control:

Control of knowledge at each lesson: 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.

Conditions for admission to control of content modules: the presence of a minimum number of points for taking the content module.

Semester control:

Form of control - semester credit, semester exam.

Conditions for admission to control of substantial module: the presence of a minimum number of points for topics (lessons) of the substantial module, for control of substantial module 1 (for control of substantial module 2, 3, 4),

Conditions for admission to semester control: current rating of more than 60 points, availability of the minimum number of points for control of content modules 1, 2, 3 and 4, absence of unworked passes of practical and seminar classes, fulfillment of all requirements stipulated by the work program of the educational component.

14. Methodological support

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

15. Recommended reading

Essential reading

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. byV.S. Kyslychenko. – Kharkiv : NUPh : GoldenPages, 2011. – 552 p.; il.
2. Pharmacognosy: textbook for students of higher / V.S. Kislychenko, 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 literature:

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.

16. Information 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.nbuv.gov.ua
7. V.G. Korolenko Kharkiv State Scientific Library – http://korolenko.kharkov.com