**National Pirogov Memorial Medical University, Vinnytsya**

**"APROVE"**
Vice-rector of a Higher Education Institution from Scientific-Pedagogical and Educational Affair
Prof. of HEI
Oksana SEREBRENNIKOVA
«02» September 2022 year

**" AGREED "**
Head of the Pharmaceutical Chemistry Department
Assoc. Prof. of HEI
Tetiana YUSHCHENKO
«02» September 2022 year

# SYLLABUS
## of academic discipline
## Pharmacognosy

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| Specialty | 226 Pharmacy, Industrial Pharmacy |
| Educational level | the second (master`s) level |
| Educational programme | EPP "Pharmacy", 2022 |
| Academic year | 2022-2023 |
| Department | Pharmaceutical Chemistry Department |
| Lecturer (if lectures are given) | Associate Professor, of HEI Candidate of Pharmaceutical Sciences Marina DYCHENKO<br>Associate Professor, of HEI Candidate of Pharmaceutical Sciences Anna OCHERETNIUK |
| Contact information | *pharmchem@vnmu.edu.ua, Pirogov str., 56, tel. 55-39-54* |
| Syllabus compiler | Associate Professor, of HEI Candidate of Pharmaceutical Sciences Marina DYCHENKO<br>Associate Professor, of HEI Candidate of Pharmaceutical Sciences Anna OCHERETNIUK |

## 1. Status and structure of the discipline

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| Discipline status | Compulsory |
| Discipline code in EPP/ discipline place in EPP | CC 25/discspline of professional training |
| Course / semester | 3rd year, VI semester<br>4th year, VII semester |
| The amount of discipline (the total number of hours / number of credits ECTS) | 255 hours / 8,5 credits ECTS |
| Number of content modules | 2 modules |
| The structure of the discipline | Lectures 30 hours<br>Practical classes 140 hours<br>Independent work 85 hours |
| Language of study | English |
| Form of study | Full - time |

## 2. Description of the discipline

**Short annotation of the course, relevance.** The discipline "Pharmacognosy" belongs to the obligatory disciplines of the cycle of professionally-oriented training of specialists in the specialty 226 Pharmacy, industrial pharmacy. The study of the discipline is aimed at gaining knowledge of medicinal plants, medicinal plant raw materials (MPRM), contributes to the formation of the necessary worldview on the rational use of natural plant resources, their protection and reproduction. Promotes the formation of skills to properly and timely harvest, dry raw materials, bring it to a standard state, process into various drugs, as well as analyze them. If necessary, the applicant must be able to provide professional advice to the doctor on the selection of optimal herbal medicines.

**Prerequisites**: Discipline "Pharmacognosy":

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

b) lays the foundations for the study of pharmaceutical and toxicological chemistry, pharmacology, drug 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. As a science and academic discipline, pharmacognosy plays a leading role in solving such pressing problems as the search for plant sources and the creation of effective medicines from natural raw materials, improving the quality of medicinal plant raw materials and herbal products, rational use of natural resources and others.

**The purpose of the course and its significance for professional activities.** The purpose of the discipline is to teach students according to the morphological features to find and identify medicinal plants in nature, to know the periods and rational methods of collection, primary processing, drying conditions, packaging, storage rules of MPRM; perform commodity, macroscopic, microscopic, phytochemical, luminescent and chromatographic analysis of MPRM, products of its processing and raw materials of animal origin, which is necessary in the practice of the Master of Pharmacy.

Mastering of the discipline will allow students to acquire, in addition to integral, the following competencies:

General (GC): GC 2, GC 3, GC 4, GC 6, GC 8, GC 9, GC 11, GC 12.

Special (professional, subject): PC 7, PC 16, PC 19, PC 20.

**Postrequisites.** The knowledge and skills acquired during the study of the discipline will allow the future specialist, pharmaceutical worker at the appropriate level to solve complex problems and problems related to finding plant sources and creating effective medicines from natural raw

materials, improving the quality of medicinal plant raw materials and herbal remedies, rational use of natural resources, etc.

**3. Learning outcomes.**

To know the characteristics of medicinal plants and medicinal plant raw materials containing different groups of biologically active substances; Latin names of medicinal plants and medicinal plant raw materials; terminology, chemical and botanical nomenclature, plant taxonomy, morphology of vegetative and generative organs; regularity of accumulation of biologically active substances in medicinal plant raw materials depending on environmental factors and phases of vegetation of medicinal plants depending on the type of raw materials; physicochemical properties of the main groups of biologically active substances in medicinal plant raw materials; optimal timing of procurement of medicinal plant raw materials; frequency of operation of thickets of medicinal plants.

**4. Content and logistic of the discipline**

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| Module 1 «Methods of pharmacognostic analysis of MPRM. Medicinal plants and MPRM of plant and animal origin, containing carbohydrates, glycosides, lipids, proteins, vitamins, organic acids and isoprenoids». | VI semester<br>135 hours / 4,5 credits | Lectures № 1-9<br>Practical classes №№ 1-14<br>Topics for self- study №№ 1-14 |
| Module 2 «Medicinal plants and MPRM containing phenolic compounds, alkaloids and different groups of BAS, medicinal raw materials of animal origin. Ways of processing MPRM, medical species and teas». | VII semester<br>120 hours / 4,0 credits | Lectures № 10-15<br>Practical classes №№ 15-24<br>Topics for self- study №№ 15-24 |

The course includes 22 topics, which are divided into 2 modules.

***Module 1.*** *«Methods of pharmacognostic analysis of MPRM. Medicinal plants and MPRM of plant and animal origin, containing carbohydrates, glycosides, lipids, proteins, vitamins, organic acids and isoprenoids».*

**Topic 1. General part of pharmacognosy.** Methods of pharmacognosy: macro- and microscopic analysis of MPRM of different morphological groups, microchemical reactions and thin layer chromatography (TLC) of the most important classes of BAS. Commercial analysis. Sampling methods for analysis; determination of purity and good quality of MPRM. Methods of quality control of raw materials of natural origin.

**Topic 2. Carbohydrates.** General characteristic. Classification. Medicinal plants and medicinal plat raw materials containing polysaccharides: Starch natural sources, inulin, mucilage, gum,

pectin. Potato, Wheat, Corn, Rice, Dandelion, Chicory, Elecampane, Marshmallow, Plantain, Coltsfoot, Flax, Sea staff, Acacia and Tragacanth gum.

**Topic 3. Fats and fatty substances.** General characteristics. Classification. MP and MPRM containing fatty oils. Animal fats. Analysis of fatty oils. Almond , Persic , Peanut , Castor , Olive , Pumpkin, Sunflower, Soya-bean, Flax. Theobroma oil, Cod Liver, Beeswax, Adeps lanae, Spermaceti. Waxes. Soy processing products (oil, protein, phospholipids).

**Topic 4. Proteins.** General characteristics. MP and raw materials of plant and animal origin, containing proteins. Enzyme preparations of plant and animal origin. Raw materials of animal origin. Phytotoxins of mushrooms, lectins, bee and snake poison. Medicinal leeches. Spirulina, lucerne, mistletoe, seamy side of Damascus, tree melon, pineapple, watermelon, Bee products.

**Topic 5. Vitamins.** General characteristics. Classification. MP and MPRM containing vitamins: Marigold, European mountain Rowan, Shepherd's purse, Nettle, Dog rose, Black currant, Strawberry, Sea-buckthorn, Cranberry Tree Bush.

**Topic 6. Macro and microelements. Organic acids.** MP and MPRM containing organic acids: Pomegranate, cranberry, tamarind, garden spinach, citrus fruits, types of rose hips, hibiscus, horsetail, common knotweed, three-position plant families and cereals (borage officinal, couch grass, oat, etc.)

**Topic 7. Glucosinolates (thioglycosides) and cyanogenic glycosides. Non-glycosidic sulfur compounds.** MP and MPRM containing thioglycosides, cyanoglycosides, sulfuric compounds: Mustards, bitter almond, cherry laurel, onion garden, garlic garden.

**Topic 8. Terpenoids. Iridoids (bitters).** General characteristic. Classification. The medicinal plants and medicinal plant raw materials containing iridoids (bitters): Menyanthes, Dandelion, Common centaury, Gentian, Cranberry Tree Bush, Hops, Valerian, Absinth.

**Topic 9. Essential oils.** General characteristic of essential oils. Classification. MP and MPRM containing essential oils: Coriander, balm, Lavender, Peppermint, Sage, Gum-tree, Caraway, Valerian, Juniper, Hops, Roman and German Chamomile, American Arnica, Absinth, Yarrow, Elecampane, Calamus, Labrador tea, Dandelion, Anise, Fennel, Birch, Thyme, Wild Thyme, Pot marjoram.

**Topic 10. Diterpenoids. Resins and balsams.** General characteristics. Classification. Medicinal plants and raw materials containing resins and balsams: Scotch pine, stevia Rebo, frankincense tree (Boswellia), styrax benzoin, Commiphora myrrh, ferula smelly.

**Topic 11. Triterpenoids. Saponins. Steroids. Ecdysteroids.** General characteristics. Classification. MP and raw materials containing saponins: Liquorice, Java tea, Ginseng, Jacob's- ladder, Japanese angelica tree, Senega, Yam, Puncture, Fenugreek, False aloe, Locoweed, Planch.

**Topic 12. Cardioglycosides.** General characteristics. Classification. MP and MPRM containing cardioglycosides: Purple Foxglove, Woody Foxglove, Convallaria (lily-of-the-valley), Spring Pheasant's eye, Strophanthus, Treacle mustard, Oleander.

***Module 2.*** *«Medicinal plants and MPRM containing phenolic compounds, alkaloids and different groups of BAS, medicinal raw materials of animal origin. Ways of processing MPRM, medical species and teas».*

**Topic 13. Phenolic compounds.** General characteristics. Classification. MP and raw materials containing simple phenols: Bearberry, Cowberry, Tricolour violet, Male fern, Snowdon Rose, Peony, White willow, Artichoke.

**Topic 14. Coumarins and chromones**. General characteristics. Classification. MP and raw materials containing coumarins and chromones: Hours-chestnut, Medicinal sweet clover, Wild parsnip, Scurfy pea, Fig, Gard en Angelica, Carrot, Dill, Visnaga.

**Topic 15. Lignans.** General characteristics. Classification. MP and raw materials containing lignans: Chinese magnolia –vine, Siberian ginseng, The ripe seeds of Silybum marianum, Mayapple.

**Topic 16. Xanthones.** General characteristics. Classification. MP and raw materials containing xanthones: Common centaury, Saint-John's Wort, Tick trefoil.

**Topic 17. Flavonoids.** General characteristics. Classification. MP and raw materials containing flavonoids: Motherwort, Tricolour violet, Water pepper, Knot-Grass, Lady's thumb, Common immortelle, Tansy, St John's Wort, Cornflower, Bur marigold, Hawthorn blood-red, Ginkgo, Marsh cudweed, Field horsetail, Elder, Small-leaved lime, Rest-harrow field, Pagoda, Black Chokeberry, Skullcap, Tea.
**Topic 18. Quinones.** General characteristics. Classification. MP and raw materials containing anthraquinones: Walnut, Sundew.Indian senna, Chinese Rhubarb, Frangula, Common buckthorn, Aloes, Saint-John's Wort, Horse sorrel, Madder.
**Topic 19. Tannins.** General characteristics. Classification. MP and raw materials containing tannins: English Oak, Snakeweet, Bird cherry, Tormentil, Bilberry, Smoke tree, Greater burnet, Grey alder, common smoke tree (Sumach), Leather bergenia.
**Topic 20. Alkaloids**. General characteristics. Classification. MP and raw materials containing alkaloids: Red chillies, Ephedra, Colchicum, Henbane, Belladonna, Stramonium, Gbologi, Lobelia, Thermopsis, Club moss, Amur spoilaxc, Opium poppy, Yellow horned poppy, Plume poppy, Greater celandine, Barberry, Ipecacuanha, Indian tape- vine, Rauwolfla, Passion, Periwinkle, Ergot of Rye, Nux vomica, Coffee, Cacao, Tea, Water Lily, Aconite, Net- fruited larkspur, White Hellebore.
**Topic 21. MP and raw material containing different groups of biologically active substances:** Kalanhoe, Tinda fungus, Comfrey, French bean, Burdock, Mugwort, Creat nettle, Lovage, Scotch pine, Black poplar, Tormentil silverweed, Crassula, White bryony.
**Topic 22.** Ways of processing medicinal plant raw materials (powder, briquetted, tableted, cut-pressed (granules). Medicinal species and teas.

The topics of the lecture course reveal the problematic issues of the relevant sections of the discipline. Practical classes provide a theoretical justification of the main issues of the topic and the acquisition of the following practical skills:
**know:**
•basic concepts of pharmacognosy, methods of pharmacognostic analysis, subject and tasks of pharmacognosy, its significance for the practical activities of the master of pharmacy;
• main stages of pharmacognosy development; main and modern directions of scientific research in the field of medicinal plants;
• characteristics of the raw material base of medicinal plants (wild and cultivated);
• regulatory framework for the use of resources of wild medicinal plants at the present stage;
• organization of MPRM procurement;
• system of rational nature management, protection and reproduction of medicinal plant resources;
• general rules for harvesting MPRM and measures for the protection of natural operational thickets of medicinal plants;
• basics of industrial cultivation of medicinal plants;
• MPRM standardization system;
• types of LRS classification (chemical, pharmacological, botanical, morphological);
• nomenclature of medicinal plants, medicinal products and medicinal products of plant and animal origin, which are permitted for use in medical practice and use in industrial production;
• basic information on the distribution and places of growth of medicinal plants used in medicine and pharmaceutical production;
• the impact of geographical and environmental factors on the productivity of medicinal plants; variability of their chemical composition;
• macroscopic and microscopic methods of analysis of whole, crushed, powdered and briquetted MPRM; features of the analysis of drug fees;
• morphological and anatomical features of MPRM, approved for use in medical practice; possible impurities;

• main groups of BAS of natural origin and their physical and chemical properties; main ways of biosynthesis of the main groups of BAS;
• methods of isolation and purification of BAS from MPRM;
• the main qualitative reactions to different groups of BAS, their identification using TLC and determination of the content of active substances in MPRM; biological standardization of MPRM;
• system of standardization and certification of MPRM;
• documentation of the results of MPRM analysis; legal significance of the certificate;
• main methods and forms of application of MPRM in pharmaceutical practice and industrial production;
• the main areas of application in medicine of drugs of plant and animal origin;
• safety rules when working with medicinal plants and MPRM.

**be able to:**

• determine morphological features of medicinal plants in live and herbarium form;
• to carry out harvesting and drying, primary processing and storage of medicinal raw materials;
• identify MPRM on the basis of microscopic analysis;
• have the technique of macroscopic analysis of MPRM; to determine the identity of medicinal plant raw materials of different morphological groups in whole, crushed and powdered form, as well as in the form of briquettes, tablets and other forms using a determinant;
• recognize impurities of morphologically similar plant species during harvesting, acceptance and certification of raw materials;
• to carry out qualitative and microchemical reactions to the main groups of biologically active substances contained in medicinal plants and raw materials (polysaccharides, fatty oils, flavonoids, coumarins, tannins, iridoids, essential oils, saponins, anthracene derivatives, cardiac glycosides, alkaloids .);
• apply thin layer chromatography for MPRM analysis;
• determine the content of anthracene derivatives, flavonoids, coumarins, tannins, essential oil, saponins, cardiac glycosides, ascorbic acid, alkaloids, etc. in plant raw materials;
• to carry out statistical processing and registration of results of the analysis.

The student's independent work provides preparation for practical classes and intermediate tests,
study of topics for independent extracurricular work, writing essays, preparation of presentations, tables. The control of mastering the topics of independent extracurricular work is carried out at the intermediate control classes and the final control of the discipline.

Individual work includes the study of scientific literature, preparation of reviews on the topics provided for presentation at the meetings of the student scientific circle, the implementation of scientific and practical researches, participation in specialized competitions, scientific and practical conferences and organization of students' research works.

Thematic plans of lectures, calendar plans of practical classes, thematic plan of independent extracurricular work, volume and directions of individual work are published on the website of the department.

The route for obtaining materials: Department of Pharmaceutical Chemistry / for students / Full-time education / (specialty 226 Pharmacy, Industrial Pharmacy) / 5th course / Educational materials / or through the link https://www.vnmu.edu.ua/en/ department of Pharmaceutical Chemistry #. Access to the materials is carried out through the student's corporate account s000XXX@vnmu.edu.ua.

**5. Forms and methods of monitoring academic performance**

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| Current control in practical studies | Methods: *oral or written survey, testing, electronic survey, solving situational problems, conducting laboratory studies, interpreting them and evaluating their results (drawing up a protocol in a workbook)* |
| Control of mastering the thematic section of the discipline at intermediate control lessons | Methods: *oral or written survey, electronic testing, situational problem solving, control of practical skills* |
| Final control of the discipline - *differentiated credit* | Methods: *pre-examination testing, oral questioning* (according to the Regulation of the Academic process in National Pirogov Memorial Medical University, Vinnytsya (link https://www.vnmu.edu.ua/en/general-regulations ) |
| Learning success diagnostic tools | Theoretical questions, tests, clinically-oriented situational tasks, practical tasks, practical skills demonstration |

**6. Assessment criteria**

Knowledge assessment is carried out in accordance with the Regulations of the Academic process in National Pirogov Memorial Medical University, Vinnytsya (link https://www.vnmu.edu.ua/en/general-regulations )

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| Continuous assessment | On a four point system of traditional assessments: 5 «excellent», 4 «good»,3 «satisfactory», 2 «unsatisfactory» |
| Midpoint separation assessment | On a four-point system of traditional assessments |
| Control of practical skills | According to the four-point system of traditional assessments |
| Final control of the discipline | *Sum of points for pre-examination testing (12-20 points) and oral questioning (38-60 points) (for disciplines included in Step 1,2)*<br>Exam grade:<br>71-80 points - "excellent"<br>61-70 points - "good"<br>50-60 points - "satisfactory"<br>Less than 50 points - "unsatisfactory" / did not pass |
| Discipline assessments: | Current academic assessment - from 72 to 120 points (conversion of the average traditional assessment of practical class on a 120-point scale): 60% of the grade for the discipline<br>Final control - from 50 to 80 points: 40% of the grade for the discipline<br>Individual work - from 1 to 12 points<br>From 122 to 200 points in total. |

**Discipline Score Scale: National and ECTS**

| The sum of grades for all types of educational activities | Score ECTS | Score on a national scale | |
|---|---|---|---|
| | | For exam, course project (work), practice | for credit test |
| 180-200 | **A** | excellent | credited |

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|---|---|---|---|
| 170-179,9 | **B** | good | |
| 160-169,9 | **C** | | |
| 141-159,9 | **D** | satisfactory | |
| 122-140,99 | **E** | satisfactory | - |
| 120-140,99 | **E** | - | credited |
| 119-61 | **FX** | unsatisfactory with the possibility of reassembly | is not credited with the possibility of reassembling |
| 1-60 | **F** | unsatisfactory with a mandatory reexamination of discipline | is not credited with mandatory reexamination of discipline |

**7. Policy of discipline / course**

The student has the right to receive high-quality educational services, access to contemporary scientific and educational information, qualified advisory assistance during the study of discipline and mastering practical skills. The policy of the department during the providing of educational services is a student-centered, based on normative documents of the Ministry of Education and the Ministry of Health of Ukraine, the Statute of the University and the Procedure for the Providing of Educational Services regulated by the main principles of the organization of the educational process in National Pirogov Memorial Medical University, Vinnytsya and the principles of academic integrity ( link https://www.vnmu.edu.ua/en/general-regulations ).

**Adherence to the rules of VNMU, safety techniques in practical classes.**

**Requirements for preparation for practical classes.** Student should be present at the practical lesson on time, theoretically prepared according to the topic, adhere to the necessary for work in the laboratory form of clothing (medical gown, if necessary - hat, gloves, etc.). When performing a laboratory work, it is necessary to strictly follow the rules and safety precautions, experiments are possible only in the presence of a teacher or laboratory assistant in the classroom. Show tolerance, courtesy, tact and respect to other participants during the discussion.

**Usage of mobile phones and other electronic devices.** The use of electronic devices is allowed, but limited to individual cases. It is allowed to use these devices for testing on the Microsoft Teams platform, for mathematical calculations ("Calculator" function), for processing literary sources in electronic form (agreement with teacher is required). It is forbidden to use electronic devices during classes for photo, audio and video recording without the consent of all participants of the educational process, for entertainment purposes, as well as during an oral survey.

**Academic integrity.** When studying the discipline, the student must be guided by the Code of Academic Integrity and Corporate Ethics of National Pirogov Memorial Medical University, Vinnytsya (link: https://www.vnmu.edu.ua/en/general-regulations)/ Code of Academic Integrity). In case of violation of the norms of academic integrity during the current and final controls student receives a grade of "2" and must work it out to his teacher in the prescribed manner within two weeks after receiving an unsatisfactory assessment).

**Missed classes.** Missed classes are working out in the manner prescribed by Regulations of the Academic process in National Pirogov Memorial Medical University, Vinnytsya (link https://www.vnmu.edu.ua/en/general-regulations) at the time of work out schedule (published on the website of the department https://www.vnmu.edu.ua/ department of Pharmaceutical Chemistry #) to the teacher on duty. To work out missed lesson student must provide permission from the dean's office, pass multiple choice questions (MCQ) on a missed topic and oral questioning, work out laboratory work (if the latter is in a particular topic), draw up a laboratory report and defend it to the teacher on duty.

*Note.* To ensure the completion of the laboratory works, it is necessary to apply in advance to the laboratory assistant of pharmaceutical chemistry department and indicate the topic and specific date of rework to prepare the necessary reagents, laboratory utensils, etc.
The reworks of missed lectures are carried out to the lecturer of the subject, with the permission of the dean, the abstract of the lecture, a short survey on the topic of the lecture is possible.
**The procedure for admission to the discipline final control** is given in the Regulations of the Academic process in National Pirogov Memorial Medical University, Vinnytsya (link https://www.vnmu.edu.ua/en/general-regulations ). To the final control allowed students who do not have missed practical classes and lectures and received an average traditional grade of at least "3".
**Additional points.** Individual points in the discipline (from 1 to 12) that student can receive for individual work, the amount of which is published on the website of the department in the educational methodical materials of the discipline, the number of points is determined by the results of IRS according to Regulation of the Academic process in National Pirogov Memorial Medical University, Vinnytsya (link https://www.vnmu.edu.ua/en/general-regulations ).
**Conflict resolution.** In case of misunderstandings and complaints to the teacher because of the quality of educational services, knowledge assessment and other conflict situations, student should submit his / her claims to the teacher. If the issue is not resolved, the student has the right to apply to the head of the department according to Complaints Consideration Procedure in VNMU named after M.I. Pirogov (link https://www.vnmu.edu.ua/en/general-regulations )
**Politics in terms of remote learning.** Distance learning regulated by the Regulations of the elements of remote learning in National Pirogov Memorial Medical University, Vinnytsya (https://www.vnmu.edu.ua/ General information). The main training platforms for studying are Microsoft Team and Google Meets. Practical classes and lectures, exercises and consultations during distance learning is published on the website of the department (https://www.vnmu.edu.ua/ en/ Department of Pharmaceutical Chemistry / to Students or https://www.vnmu.edu.ua/en/Department of Pharmaceutical Chemistry / News).
Feedback from teachers is via messengers (Viber, Telegram, WhatsApp) or e-mail (at the teacher's choice) during working hours.

1. **Educational resources.**

Educational and methodological support of the discipline is published on the website of the department (https://www.vnmu.edu.ua/ en/ department of Pharmaceutical Chemistry / for students). Consultations are held twice a week according to the schedule.

2. **The timetable and distribution of groups** with assigned teachers are published on the web page of the department ((https://www.vnmu.edu.ua /en/ department of Pharmaceutical Chemistry / for students).

3. Questions to the intermediate and final semester control (credit) of the discipline are published on the web page of the department (https://www.vnmu.edu.ua / en/ department of Pharmaceutical Chemistry / for students).

The syllabus of the discipline " Pharmacognosy " was discussed and approved at the meeting of the department of Pharmaceutical Chemistry (record №1, dated "01" September 2022)

Responsible for the academic discipline

(signature) Assoc. Prof. of HEI Marina DUCHENKO

(signature) Assoc. Prof. of HEI Anna OCHERETNIUK

Head of the department (signature) Assoc. Prof. of HEI Tetiana YUSHCHENKO