

NATIONAL PIROGOV MEMORIAL MEDICAL UNIVERSITY, VINNYTSIA



COURSE SYLLABUS

For the training of master's students

PHARMACEUTICAL MYCOLOGY: FUNGI IN PHARMACY AND BIOTECHNOLOGY

Specialty	I8 Pharmacy; Specialisation I8.01 Pharmacy
Educational Programme	Educational and Professional Programme (EPP) "Pharmacy, Industrial Pharmacy", 2025
Higher Education Level	Second (Master's) level
Academic Year	2026–2027
Status of the Discipline	Elective
Language of Instruction	Ukrainian, English
Total Workload	3.0 ECTS credits / 90 hours
Year of Study / Semester	Year II / Semester IV
Developer(s)	S. D. Kryklyva, Candidate of Biological Sciences, Associate Professor
Instructor(s), Guest Lecturers	V. V. Rodinkova, Doctor of Biological Sciences, Professor S. D. Kryklyva, Candidate of Biological Sciences, Associate Professor
Venue and Contact Details	Department of Pharmacy, 56 Pyrohova Street, Vinnytsia Telephone: 55–39–52; Email: pharmacy@vnmu.edu.ua

1. DESCRIPTION OF THE ACADEMIC DISCIPLINE

ABSTRACT

The programme of Pharmaceutical Mycology: Fungi in Pharmacy and Biotechnology has been developed in accordance with the requirements for training students at the second (Master's) level in higher medical education institutions in Ukraine, the European Credit Transfer and Accumulation System (ECTS), and the curriculum for Specialty I8 Pharmacy within Field of Study I Healthcare and Social Security.

The discipline is an elective component of the Educational and Professional Programme in Pharmacy, within the general training cycle for the Master of Pharmacy degree. It comprises 3 ECTS credits and is taught in Semester IV of the second year of study.

The course examines the structural and functional characteristics of members of the kingdom Fungi in relation to their practical use in medicine and pharmacy as sources of medicinal substances and in biotechnology. It also considers fungi as agents of diseases in humans, animals, and plants, and methods of prevention.

Prerequisites for the Educational Component. The course builds on Pharmaceutical Botany, Inorganic and Organic Chemistry, Information Technology in Pharmacy, Ukrainian, and Latin.

PURPOSE AND OBJECTIVES

The aim is to study the morphological and biological characteristics of fungi, their modes of dispersal, their beneficial and harmful roles in human life and economic activities, their symbiotic and parasitic relationships with other organisms, and the diseases they can cause in humans, animals, and plants.

Integral Competence

The ability to solve typical and complex specialised tasks and practical problems in professional pharmaceutical activities using the principles, theories, and methods of fundamental, chemical, technological, biomedical, and socioeconomic sciences; integrate knowledge and resolve complex issues; formulate judgements based on incomplete or limited information; and communicate knowledge, conclusions, and their rationale clearly and unambiguously to specialist and non-specialist audiences.

General Competencies

GC 01. Commitment to environmental conservation.

GC 02. The ability to think abstractly and analyse and synthesise information.

GC 03. Knowledge and understanding of the subject area and professional practice.

GC 04. The ability to adapt and act in new situations and demonstrate initiative.

GC 09. The ability to conduct research at an appropriate level.

Specific Competencies

SC 01. The ability to collect, interpret, and apply data required for professional practice, research, and the implementation of innovative projects in pharmacy.

SC 02. The ability to integrate knowledge and solve complex pharmaceutical problems in broad or multidisciplinary contexts.

SC 06. The ability to communicate knowledge, conclusions, and reasoning in pharmacy clearly and unambiguously to specialists and non-specialists, including students.

SC 07. The ability to provide health education to the public to prevent common diseases and dangerous infectious, viral, and parasitic diseases, promote timely detection, and support treatment adherence in accordance with the diseases' medical, biological, and microbiological characteristics.

SC 20. The ability to organise and carry out the harvesting of medicinal plant raw materials in accordance with Good Agricultural and Collection Practices (GACP), ensuring the quality of medicinal plant raw materials and medicines derived from them. The ability to anticipate and evaluate approaches to the conservation and protection of wild medicinal plant populations in accordance with applicable legislation.

Post-requisites for the Educational Component. In accordance with the sectoral standard for higher education, the course supplements biological training and provides a foundation for Pharmacognosy, Educational Practice in Pharmacognosy, Pharmacology, Homeopathy, Medicinal

Toxicology, Toxicological and Forensic Chemistry, Drug Technology, Medicinal Cosmetic Product Technology, Forensic Medicine, and Allergology.

2. LEARNING OUTCOMES

Upon successful completion of the academic discipline, the student will be able to:

PLO 01. Apply specialised knowledge, abilities, and skills from general and professional disciplines in professional practice.

PLO 02. Critically analyse scientific and applied problems in pharmacy.

PLO 06. Communicate professionally in the state language, use oral communication skills in a foreign language, analyse professional texts, and translate foreign-language information sources.

PLO 12. Promote health preservation, including disease prevention and the rational prescribing and use of medicines. Perform professional duties conscientiously and comply with legislation governing the promotion and advertising of medicines. Use psychological communication skills to build trust and mutual understanding with colleagues, physicians, patients, and consumers.

PLO 13. Predict and determine the effects of environmental factors on the quality and consumer characteristics of medicines of natural and synthetic origin and other pharmacy products; organise their storage in accordance with their physicochemical properties and Good Storage Practices (GSP).

3. FORMS OF ORGANISATION OF THE EDUCATIONAL PROCESS AND THEIR SCOPE

Full-time Study

Type of Learning Activity	Hours
Lectures	14
Practical Classes	16
Independent Study (IS)	60
Total	90

Part-time Study

Type of Learning Activity	Hours
Lectures	4
Practical Classes	8
Independent Study (IS)	78
Total	90

4. THEMATIC PLAN

No.	Module and Topic Titles
Module 1	Pharmaceutical Mycology: Fungi in Pharmacy and Biotechnology
1	Fungi as a Separate Kingdom of Living Organisms.
2	History of the Development of Mycology.
3	Edible Fungi and Their Cultivation.
4	Fungi in Biotechnology.
5	Fungi as Producers of Toxic and Hallucinogenic Substances.
6	Diagnostic and Biological Significance of Fungal Spores as Components of Atmospheric Air.
7	Fungi as Agents of Human Diseases: Diagnosis and Prevention.
8	Mycoses of Animals, Fish, and Insects: Diagnosis.
9	Fungal Diseases of Plants and Their Classification.
10	Ecological Groups of Fungi.

No.	Module and Topic Titles
11	The Importance of Fungi in Nature and Human Life.
12	Applications of Fungi in Pharmacy.
13	Applications of Fungi in Medicine.

5. FORMS AND METHODS OF ASSESSMENT OF LEARNING OUTCOMES

Ongoing Assessment during Practical Classes	Methods: oral and/or written questioning and testing, computer-based questioning and testing, and solving situational tasks.
Final Assessment of the Academic Discipline – Pass/Fail Assessment	Conducted during the final practical class and determined on the basis of ongoing academic performance in accordance with the University Regulations on the Organisation of the Educational Process: https://www.vnmua.edu.ua/downloads/other/polog_organiz_ocv_proc(2026).pdf
Assessment Tools for Learning Achievement	Theoretical questions, tests, situational tasks, practical assignments, and demonstration of practical skills.

6. ASSESSMENT CRITERIA

Assessment of students' knowledge is carried out in accordance with the current Regulations on the Organisation of the Educational Process at National Pirogov Memorial Medical University, Vinnytsia.

[https://www.vnmua.edu.ua/downloads/other/polog_organiz_ocv_proc\(2026\).pdf](https://www.vnmua.edu.ua/downloads/other/polog_organiz_ocv_proc(2026).pdf)

Type of Assessment	Assessment Criteria / Scale
Ongoing Assessment	According to the traditional grading scale: 5 – “Excellent”, 4 – “Good”, 3 – “Satisfactory”, 2 – “Unsatisfactory”
Interim Assessments	According to the traditional grading scale
Assessment of Practical Skills	According to the traditional grading scale
Pass/Fail Assessment	According to the 200-point scale (the arithmetic mean of the grades obtained during the semester is converted into points). Passed: 122–200 points. Failed: fewer than 122 points.

GRADING SCALE: NATIONAL AND ECTS

Total Score for All Learning Activities	ECTS Grade	National Grade: Examination, Course Project (Paper), Practical Training	National Grade: Pass
180–200	A	Excellent	Passed
170–179.99	B	Good	Passed
160–169.99	C	Good	Passed
141–159.99	D	Satisfactory	Passed
122–140.99	E	Satisfactory	Passed
0–121.99	FX	Unsatisfactory, with the possibility of retaking	Failed, with the possibility of retaking
0–121.99	F	Unsatisfactory, with mandatory repetition of the discipline	Failed, with mandatory repetition of the discipline

Criteria for Assessing Students' Knowledge

Assessment of Oral/Written Responses during Ongoing Assessment

The grade “Excellent” is awarded when a student demonstrates comprehensive knowledge of the topic, illustrating responses with a variety of relevant examples; provides complete, accurate, and clear answers without prompting or leading questions; presents the material without errors or

inaccuracies; confidently solves problems and completes practical tasks of varying levels of complexity; and independently generates innovative ideas.

The grade “Good” is awarded when a student demonstrates good knowledge and understanding of the topic and provides correct, coherent, and well-structured answers, although they may not be fully comprehensive. The student answers additional questions correctly and without significant errors; successfully solves problems and completes practical tasks, experiencing difficulties only with the most complex assignments.

The grade “Satisfactory” is awarded when a student demonstrates knowledge of the overall content of the topic and a satisfactory level of understanding. With the help of guiding questions, the student is able to solve modified (simplified) problems; solves problems and completes practical tasks, although experiencing difficulties even with relatively simple assignments; is unable to formulate a coherent and systematic response independently but provides correct answers to direct questions.

The grade “Unsatisfactory” is awarded when a student’s knowledge and skills do not meet the requirements for the grade “Satisfactory”.

The assessment criteria for all other types of students’ academic work are based on the requirements of the Regulations on the Organisation of the Educational Process at National Pirogov Memorial Medical University, Vinnytsia ([https://www.vnmu.edu.ua/downloads/other/polog_organiz_ocv_proc\(2026\).pdf](https://www.vnmu.edu.ua/downloads/other/polog_organiz_ocv_proc(2026).pdf)) and are specified in the programme of the academic discipline.

Assessment of Students’ Independent Study

Students’ independent study undertaken as part of a topic alongside contact hours is assessed as part of the ongoing assessment of that topic during the relevant practical class.

The maximum number of points a student may receive upon completion of the discipline is 200 points. The minimum passing score is 122 points.

7. METHODOLOGICAL SUPPORT

Teaching and learning materials (lecture notes or extended lecture outlines), thematic plans for lectures, practical classes and independent study, assignments for ongoing assessment, methodological guidelines, and teaching manuals.

8. ACADEMIC DISCIPLINE POLICIES

The completion of learning activities and all academic work within the discipline must comply with the requirements of the Regulations on the Organisation of the Educational Process at National Pirogov Memorial Medical University, Vinnytsia; ([https://www.vnmu.edu.ua/downloads/other/polog_organiz_ocv_proc\(2026\).pdf](https://www.vnmu.edu.ua/downloads/other/polog_organiz_ocv_proc(2026).pdf)), the Regulations on the Organisation of the Educational Process for Higher Education Students Pursuing the Degree of Doctor of Philosophy at National Pirogov Memorial Medical University, Vinnytsia (https://www.vnmu.edu.ua/downloads/other/pologPhD_org.pdf); the Law of Ukraine “On Education” (Article 42); the Law of Ukraine “On Academic Integrity”; and the Code of Academic Integrity of National Pirogov Memorial Medical University, Vinnytsia (https://www.vnmu.edu.ua/downloads/other/kodex_akad_dobr_edit%202026.pdf)

Students are entitled to high-quality educational services and a safe learning environment under martial law, emergency situations and states of emergency; access to up-to-date scientific and educational information; and qualified academic guidance and support in studying the discipline and acquiring practical skills.

The Department’s policy on the provision of educational services is student-centred and is based on the regulatory documents of the Ministry of Education and Science of Ukraine and the Ministry of Health of Ukraine, the University Statute, the procedures governing the provision of educational services, including in emergency situations, as stipulated by the principal regulations and administrative directives governing the organisation of the educational process at National Pirogov Memorial Medical University, Vinnytsia, as well as on the principles of academic integrity.

Academic Integrity. When studying the discipline and completing all types of learning assignments and/or research activities, students must comply with the Law of Ukraine “On

Education” (Article 42), the Law of Ukraine “On Academic Integrity”, and the Code of Academic Integrity of National Pirogov Memorial Medical University, Vinnytsia (University website → General Information → Key Documents → Code of Academic Integrity). In the event of a violation of academic integrity principles, appropriate measures shall be taken in accordance with the applicable regulatory documents.

Compliance with VNMU Internal Regulations and Safety Requirements during Practical Classes. At the first practical class, the instructor provides a safety briefing on appropriate conduct on the Department premises, informs students of the location of the shelter and the evacuation route to the shelter in accordance with the approved evacuation plan, explains the rules of conduct while proceeding to and remaining in the shelter, and provides instructions on all actions stipulated by the Emergency Response Plan (pursuant to Order No. 505 dated 30 August 2023). In the event of an air raid alert or any other emergency warning signal, the instructor suspends the class. The instructor and students proceed together to the shelter and remain there until the warning signal is cancelled. Once the alert has been lifted, the instructor and students either resume the class in the Department’s classrooms or students independently complete the remaining learning material, which is subsequently assessed at the next class.

Requirements for Preparation for Practical Classes

Students are required to participate actively in the educational process: attend classes and come adequately prepared; complete the test tasks related to the current topic in their workbooks and fill in the required diagrams and tables; actively participate in discussions of the class topic; complete all assignments specified in the programme; search for additional information relevant to the topic and present it to their peers.

Students are expected to arrive at classes on time. Late arrival is not permitted in accordance with the Internal Regulations for Students of VNMU. A student who arrives more than 10 minutes late is not admitted to the class and is required to make up the missed class in accordance with the established procedure.

For specialties within Field of Study I “Healthcare and Social Security”, students are required to wear a medical coat during practical classes. Students who fail to comply with this requirement are not admitted to the class.

Students are expected to be polite, courteous, and respectful in their interactions with teaching staff, other University employees, fellow students, and other persons studying at VNMU. Students must maintain a quiet and orderly environment and demonstrate appropriate conduct on the Department premises.

In its activities, the Department adheres to the principles of mutual respect and tolerance. Students are expected to uphold the same principles.

Students must comply with safety regulations while on the Department premises.

When working in teaching and research laboratories, students must comply with the applicable safety regulations (published on the website of the Department of Pharmacy). When completing practical assignments, students must keep their workstations clean and orderly and leave them tidy upon completion of the practical work.

Use of Mobile Phones and Other Electronic Devices. The use of mobile phones and other electronic devices during classes is not permitted, except for emergency calls or when such devices are used to present supplementary materials relevant to the topic of the class.

Absence from Classes. Missed classes must be made up in accordance with the procedure established by the current Regulations on the Organization of the Educational Process at National Pirogov Memorial Medical University, Vinnytsia ([https://www.vnmdu.edu.ua/downloads/other/polog_organiz_ocv_proc\(2026\).pdf](https://www.vnmdu.edu.ua/downloads/other/polog_organiz_ocv_proc(2026).pdf)), at the times specified in the make-up schedule published on the website of the Department of Pharmacy (VNMU website), either with the instructor on duty or with the student’s regular instructor. Making up a missed class involves completing the assignments related to the topic of the missed class in accordance with the specific requirements of the discipline.

Mastery of lecture topics is assessed during practical classes, seminars (including the assessment of practical skills), and final assessment, in accordance with the Regulations on the Organisation of the Educational Process at National Pirogov Memorial Medical University, Vinnytsia ([https://www.vnmu.edu.ua/downloads/other/polog_organiz_ocv_proc\(2026\).pdf](https://www.vnmu.edu.ua/downloads/other/polog_organiz_ocv_proc(2026).pdf))

Admission to Final Assessment. The procedure for admission to final assessment in the discipline is set out in the current Regulations on the Organisation of the Educational Process at National Pirogov Memorial Medical University, Vinnytsia ([https://www.vnmu.edu.ua/downloads/other/polog_organiz_ocv_proc\(2026\).pdf](https://www.vnmu.edu.ua/downloads/other/polog_organiz_ocv_proc(2026).pdf)).

Students are admitted to final assessment provided that they have no outstanding academic requirements: the average grade for ongoing assessment must be at least 3.0 (72 points on the 120-point scale); all final sessions for the content modules must have been completed with a passing grade ("3" or higher); and all missed practical classes must have been made up with a passing grade ("3" or higher). Otherwise, the student must improve their average grade by making up unsatisfactory grades and must make up all missed classes.

Additional Points for Individual Assignments. Students may receive additional points in the discipline for the successful completion of individual assignments, the content of which is published on the Department's website as part of the teaching and learning materials for the discipline. The number of points awarded is determined based on the results of the individual assignment in accordance with the current Regulations on the Organisation of the Educational Process at National Pirogov Memorial Medical University, Vinnytsia ([https://www.vnmu.edu.ua/downloads/other/polog_organiz_ocv_proc\(2026\).pdf](https://www.vnmu.edu.ua/downloads/other/polog_organiz_ocv_proc(2026).pdf)).

Resolution of Conflict Situations

In the event of misunderstandings or concerns regarding the quality of educational services, assessment of academic performance, or other conflict situations involving an instructor, students should first raise their concerns directly with the instructor. If the issue remains unresolved, the student has the right to submit an appeal to the Head of the Department in accordance with the Regulations on the Consideration of Appeals from Higher Education Students at National Pirogov Memorial Medical University, Vinnytsia (VNMU website → General Information → Key Documents).

Students also have the right to contact the student self-government bodies, the administration of the Faculty (Institute), or the University administration, either directly or through the designated feedback channels ("trust boxes"), links and addresses for which are available on the official VNMU website.

The Department recognises that a student-centred approach entails students' responsibility for the conscious and active acquisition of knowledge and for proper compliance with the rules and requirements established by applicable legislation and VNMU regulatory documents. The Department reserves the right to inform the relevant University bodies of any violations committed by students.

Policy on Blended Learning

The organisation of blended learning is governed by the Regulations on the Introduction of Elements of Distance Learning at National Pirogov Memorial Medical University, Vinnytsia (VNMU website → General Information → Key Documents). The main online learning platforms used for classes are Microsoft Teams and Google Meet.

The procedures for conducting practical classes, lectures, make-up classes, and consultations in the distance learning format are published on the Department's webpage (VNMU website → Department of Pharmacy → For Students/Postgraduate Students → Mode of Study → Year of Study → Teaching and Learning Materials).

Communication with the Instructor. Students may contact the instructor via Microsoft Teams chat, messaging applications (Viber, Telegram, WhatsApp), or email, as determined by the instructor, during working hours.

9. LEARNING RESOURCES

Teaching and learning materials for the discipline are available on the Department's website. The materials can be accessed via: VNMU website → Department of Pharmacy → For Students/Postgraduate Students.

LITERATURE

Core Literature for Pharmaceutical Mycology: Fungi in Pharmacy and Biotechnology

1. Singh, R. S., & Bhari, R. (Eds.). (2024). *Fungal Biotechnology: Industrial Applications and Market Potential*. Elsevier.

Covers fungal production systems, enzymes, bioactive products, and industrial applications. Particularly relevant to the biotechnology component of the course.

Official publisher link. [Elsevier Shop](#)

2. Satyanarayana, T., & Deshmukh, S. K. (Eds.). (2023). *Fungi and Fungal Products in Human Welfare and Biotechnology*. Springer.

Addresses pharmaceutical and nutraceutical applications, fungal secondary metabolites, antibiotic-producing fungi, and bioactive polysaccharides.

Official publisher link. [Springer Nature Link](#)

3. Shukla, A. C. (Ed.). (2022). *Applied Mycology: Entrepreneurship with Fungi*. Springer.

Connects fungal biology with practical applications in pharmacy, fermentation, enzyme production, and industrial biotechnology.

Official publisher link. [Springer Nature Link](#)

4. Satyanarayana, T., Deshmukh, S. K., & Deshpande, M. V. (Eds.). (2021). *Progress in Mycology: Biology and Biotechnological Applications*. Springer.

Provides broader coverage of fungal biology, diversity, enzymes, mycotoxins, and biotechnological applications. The publisher specifies ©2021; the print and electronic editions were released in February 2022.

Official publisher link. [SpringerLink](#)

Supplementary Literature for Pharmaceutical Mycology: Fungi in Pharmacy and Biotechnology

1. Berovic, M., & Zhong, J.-J. (Eds.). (2023). *Biochemical Engineering and Biotechnology of Medicinal Mushrooms*. Springer.

Recommended for medicinal mushroom cultivation, solid-state and submerged fermentation, bioreactors, downstream processing, and bioactive compounds.

Official publisher link. [Springer Nature Link](#)

2. Agrawal, D. C., & Dhanasekaran, M. (Eds.). (2023). *Mushrooms with Therapeutic Potentials: Recent Advances in Research and Development*. Springer.

Supports discussion of medicinal mushrooms, pharmacological research, and the investigation of fungal products as potential therapeutic agents.

Official publisher link. [Springer Nature Link](#)

3. Valiante, V. (2023). Advances in synthetic biology of fungi and contributions to the discovery of new molecules. *ChemBioChem*, 24(11), e202300008.

A focused review of fungal genetic engineering, biosynthetic gene clusters, and approaches to discovering new bioactive molecules.

DOI and publisher link. [Wiley Online Library](#)

4. World Health Organization. (2022). *WHO Fungal Priority Pathogens List to Guide Research, Development and Public Health Action*. WHO.

A freely available reference for medically important fungi, antifungal resistance, and priorities for antifungal research and development.

Official WHO publication and free download. [who.int](#)

ELECTRONIC RESOURCES

University website: <https://vnmue.edu.ua>

University Library: <https://library.vnmue.edu.ua>

World Health Organization: <https://www.who.int/en/>

Centre for Education Quality Assessment of the Ministry of Health of Ukraine: <https://www.testcentr.org.ua/uk/>

Ministry of Health of Ukraine: <https://moz.gov.ua/>

Public Health Center of the Ministry of Health of Ukraine: <https://phc.org.ua/kontrol-zakhvoryuvan>

Plant Cell: https://en.wikipedia.org/wiki/Plant_cell

Plant Cell Anatomy: <http://www.enchantedlearning.com/subjects/plants/cell/>

Plant Cell Structure and Parts: <http://www.buzzle.com/articles/plant-cell-structure-and-parts.html>

Centraalbureau voor Schimmelcultures: <http://www.cbs.knaw.nl/>

American Phytopathological Society: <http://www.apsnet.org/>

Mycobank interactive database: <http://www.mycobank.org>

Krok 1 Pharmacy: Pharmaceutical Botany, Test 1: <https://testkrok.org.ua/?test=31340>

The course syllabus for “Pharmaceutical Mycology: Fungi in Pharmacy and Biotechnology” was discussed and approved at the meeting of the Department of Pharmacy (Minutes No. 1 dated 26 August 2026).

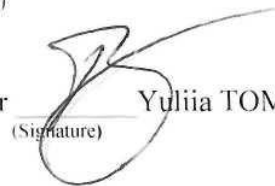
Course Coordinator:
Doctor of Biological Sciences, Professor



(Signature)

Viktoriia RODINKOVA

Acting Head of the Department of Pharmacy:
Candidate of Pharmaceutical Sciences, Associate Professor



(Signature)

Yuliia TOMASHEVSKA