



**MINISTRY OF HEALTH OF UKRAINE  
NATIONAL UNIVERSITY OF PHARMACY  
Faculty of Pharmaceutical Technologies and Management  
Department of Educational and Information Technologies**

**INFORMATION TECHNOLOGY IN PHARMACY**

(Course Name)

**WORK PROGRAM  
of the course**

**training for** Master of Pharmacy  
(Higher Educational Level Name)

**field of knowledge** 22 Public Health  
(Code and Knowledge Field Name)

**in specialty** 226 Pharmacy, Industrial Pharmacy  
(Code and Specialty Name)

**of educational program** Pharmacy for foreign students  
(Educational Program Name)

**specialization** \_\_\_\_\_  
(Specialization Name)

**2021**  
year of creation

Work program of a course “**Information Technology in Pharmacy**” in specialty **226 Pharmacy, Industrial Pharmacy** of educational program **Pharmacy for foreign students** for applicants of higher education of 1st year of study.

Educational course team:

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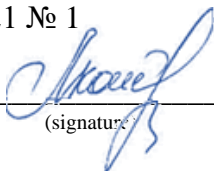
Maryna NESSONOVA, Candidate of Technical Sciences, Assoc. Prof. of the Educational and Information Technologies Department

(indicate the authors' full names, their positions, scientific and academic degrees)

Work program of the course have been considered and approved at the Educational and Information Technologies Department Meeting

Record from «01» September 2021 № 1

Head of the Department

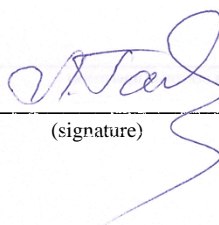
  
(signature)

Prof. Lidiia KAIDALOVA  
(Name and SURNAME)

Work program of the course have been approved at the Meeting of Methodical Profile Commission on Distance and Postgraduate Pharmaceutical Education

Record from «20» September 2021 № 1

Head of Specialized Committee

  
(signature)

Prof. Larisa GALIY  
(Name and SURNAME)

## 1. The Description of the Course

**Language of study:** English

**Course Status:** Elective

**Entrance qualification for studying the course:** basic knowledge in informatics, IT and computer technology, in mathematics and statistics, as well as disciplines “Biophysics, physical methods of analysis” and “General and inorganic chemistry”.

**The purpose statement of studying the course “Information Technology in Pharmacy”** is information processes in the field of pharmacy (retrieval, storage, processing, and transmission of pharmaceutical information) using actual software and hardware and the latest information technologies.

**Information volume of academic course.** To study the course is given 90 hours, 3 ECTS credits.

## 2. Objectives and Tasks of the Course

**The objective of teaching the course “Information Technology in Pharmacy”** is to form theoretical knowledge and practical skills in using actual information technologies and modern software in the field of pharmacy, training in the processing of pharmaceutical, medical and biological information using information and communication technologies, ensuring the development of information competence in future pharmacists.

The **main tasks** of the course “**Information Technology in Pharmacy**” are:

- to form students’ skills in using computers and information technology in the daily activities of a specialist;
- to form students’ skills in algorithmic and system thinking when using software applications for various purposes in their future professional activity;
- to ensure mastering basic principles of electronic documentation by students;
- to provide the fundamentals for calculation, evaluation and processing of pharmaceutical, economical and statistical information in pharmacy;
- to form practical skills in data analysis and developing search queries to a relational database with subject content.

## 3. Competence and Planned Educational Outcomes

The course “**Information Technology in Pharmacy**” provides acquisition of competencies by applicants for higher education:

- **integrated:**
  - the ability to solve typical and complex specialized problems and practical tasks in professional activities of a pharmacist as well as in research and innovative activity, which imply the use of information technology, personal computer, and skills in using general and specialized software to conduct researches and/or provide innovations.
- **general:**
  - GC 1. Skills in using information and communication technologies (GC9\*).
  - GC 2. Ability to abstract thinking, analysis and synthesis, the ability to learn and be modernly trained (GC4\*).
  - GC 3. Ability to apply knowledge in practical situations (GC2\*).
  - GC 4. Ability to system thinking when solving professional tasks, which ensures the appropriate quality of researches and work performed (GC11\*, GC12\*).
- **special (professional)**
  - PC 1. Ability to use Internet technology for the organization and support of educational and scientific activities, for preparing reports, and for electronic document management (PC8\*, PC15\*).
  - PC 2. Ability to apply general and special software in practice to calculate economical and financial indices for evaluation of pharmaceutical establishments performance, to calculate basic taxes and fees, to form prices for medicines and medical devices etc. (PC8\*, PC9\*).
  - PC 3. Ability to predict and evaluate the ways to solve problems in the pharmaceutical industry; to perform statistical analysis of pharmaceutical, medical and financial data (PC9\*, PC11\*, PC16\*).

PC 4. Ability to use modern information (including cloud) and communication technologies for information exchange, collection, analysis, processing and presentation of results (PC8\*, PC14\*, PC17\*).

PC 5. Ability to design, develop and use information databases (PC8\*, PC14\*).

Note. \* – competencies from the Standard.

As a result of studying the course, the applicant for higher education will be able to *know*:

- fundamentals of the newest information and communication technologies implementation;
- functionality of general and special software applications for solving professional tasks;
- basic principles of electronic documentation;
- fundamentals and basic methods of calculations and processing of pharmaceutical, economic and statistical information in pharmacy;
- basics of using DBMS in design, use and maintenance of pharmaceutical databases;

*do*:

- carry out professional activities using information technology, information databases, navigation systems, Internet resources, software and other information and communication technologies (PLO9\*);
- use information resources for independent search, analysis and synthesis of information from various sources needed to solve typical and complex specialized professional tasks (PLO4\*);
- create, edit, design and formalize professional texts, reports on work performed, technical documentation for the production of medicines and medical devices (PLO9\*, PLO26\*);
- use office software tools to perform calculations, to order, group and systemize professional information, to predict the main economic indicators of pharmacies (PLO12\*, PLO19\*, PLO21\*);

*have*:

- professional and general competencies.

Note. \* – PLO (program learning outcomes) from the Standard.

#### 4. Course Structure

Names of content modules and topics	The amount of hours											
	the whole amount	full time study					part time study					
		including					including					
		lec.	sem.	p.l.	lab	self-study	lec.	sem.	p.l.	lab	self-study	
<i>1</i>	2	3	4	5	6	7	8	9	10	11	12	13
<b>Module 1 : Content module 1. Fundamentals of information technology in pharmacy. Retrieval, processing and analysis of pharmaceutical data</b>												
<b>Topic 1.</b> Introduction to information technology in pharmacy. Spreadsheets tools for pharmaceutical data management	30	6		16		8						
<b>Topic 2.</b> Automation of creating and maintaining professional documentation using word processing software	28	2		8		18						
<b>Topic 3.</b> Internet resources for pharmacy, medicine and healthcare	30	2		4		24						
<b>The whole amount of hours for the content module 1</b>	<b>88</b>	<b>10</b>		<b>28</b>		<b>50</b>						
<b>The final test</b>	2			2								
<i>The whole amount of hours of the course</i>	<b>90</b>	<b>10</b>		<b>30</b>		<b>50</b>						

## 5. Content of the Course

### Module 1 : Content module 1. Fundamentals of information technology in pharmacy.

#### Retrieval, processing and analysis of pharmaceutical data

#### Topic 1. Introduction to information technology in pharmacy. Spreadsheets tools for pharmaceutical data management.

The objectives and the structure of the course. Main tasks and components of pharmaceutical informatics. Fundamentals of pharmaceutical tasks formalization and algorithmization. Functionality of spreadsheets software tools for solving pharmaceutical tasks. Information processing with electronic spreadsheets: data entry, data types, formats of data representation. Logical operators and expressions. Using logical built-in functions for price formation of medical products. Spreadsheets tools for information arrangement and retrieval. Sorting and filtering data. Built-in functions for conditional totals calculations. Pivot tables for pharmaceutical data analysis.

#### Topic 2. Automation of creating and maintaining professional documentation using word processing software.

Basics of word processing and formatting (text and page formatting, spellchecking etc.). Technologies for creating text documents with embedded objects (OLE): diagrams, flowcharts, mathematical and chemical formulas, equations of chemical reactions. Creating and formatting tables in text documents. Using automated lists to represent pharmaceutical information. Documents structuring using styles and references.

#### Topic 3. Internet resources for pharmacy, medicine and healthcare.

Network technology. Internet services. Classification of healthcare and pharmaceutical www-resources. Principles of pharmaceutical information retrieval using electronic compendia, online databases of medical products, chemical compounds, normative documents and scientific publications. Comparative analysis of pharmaceutical information online databases functionality and services.

## 6. Names of Lectures

№	Name of topic	The amount of hours	
		Full time study	Part time study
1	Introduction to the course. Advanced calculations and formatting in spreadsheets. Using logical functions for professional tasks	2	
2	Spreadsheets tools for sorting and filtering data	2	
3	Spreadsheets' built-in functions for conditional totals calculations. Using Pivot Tables to process pharmaceutical data	2	
4	Fundamentals of word processing (text formatting, spellchecking). OLE technology. Lists and tables in text documents. References (footnotes & endnotes, automated contents)	2	
5	Internet resources for pharmacy, healthcare and medicine	2	
<b>The whole amount of hours</b>		<b>10</b>	

## 7. Topics of Seminars

*(Seminars workshop is not provided by the working curriculum)*

## 8. Topics of Practical Lessons

№	Name of topic	The amount of hours	
		Full time study	Part time study
1	Introduction to the course. Entrance control of knowledge and skills. Fundamentals of spreadsheets (simple calculations, formatting, charts)	4	
2	Advanced calculations and formatting in spreadsheets. Logical functions for professional tasks	4	

3	Spreadsheets tools for sorting and filtering data. Conditional formatting	4	
4	Spreadsheets' built-in functions for conditional totals calculations. Using Pivot Tables to process pharmaceutical data	4	
5	Fundamentals of word processing (text formatting, spellchecking, embedding pictures)	4	
6	Lists and tables in text documents. References (footnotes&endnotes, automated contents)	4	
7	Internet resources for pharmacy, healthcare and medicine	4	
8	Final test	2	
<b>The whole amount of hours</b>		<b>30</b>	

### 9. Topics of Laboratorial Lessons

*(Laboratory workshop is not provided by the working curriculum)*

### 10. Self-Study Work

№	Name of topic	The amount of hours	
		Full time study	Part time study
1	Main tasks and components of pharmaceutical informatics. Fundamentals of pharmaceutical tasks formalization and algorithmization	4	
2	Spreadsheets tools for pharmaceutical data management	4	
3	Automation of creating and maintaining professional documentation using word processing software	8	
4	OLE technology	5	
5	Automated forms of pharmaceutical documentation	5	
6	Internet resources for pharmacy, healthcare and medicine	8	
7	Internet resources for chemistry	8	
8	Comparative analysis of pharmaceutical information online databases functionality and services	8	
<b>The whole amount of hours</b>		<b>50</b>	

### Tasks for Self-Study Work

Students' independent self-study work includes preparation for in-class lessons, doing practical assignments for independent work, as well as in-depth study of course topics in the following areas:

1. Principles of information security in pharmaceutical databases.
2. Information protection – security, privacy and confidentiality in pharmaceutical databases.
3. Database management systems (DBMS) for retail and pharmaceutical industry.
4. Electronic forms of pharmaceutical documentation.
5. Fundamentals of paperless technology for pharmaceutical document management.
6. Basics of e-commerce for pharmaceutical business.
7. Mobile applications for pharmacists. Applications for patients and for healthcare professionals.
8. Google cloud technology, Google services.
9. Expert systems and decision-making support systems in pharmacy.
10. Network operating systems and cloud services MS Office 365.
11. The structure of the information space of the pharmaceutical industry.
12. Software for statistical analysis of pharmaceutical data.
13. The structure of E-Health.
14. Software and hardware for remote and mobile use of information network resources.
15. Information-reference and information-search systems in pharmacy.
16. Automation of financial calculations in spreadsheets.

17. Software for correlation analysis of experimental data in pharmaceutical researches.
18. Software for regression analysis of experimental data in pharmaceutical researches.
19. Special freeware and online graphical editors for chemistry.
20. Using software for modelling pharmaceutical kinetics processes.

### 11. Individual Tasks

*(Individual tasks is not provided by the working curriculum)*

### 12. Criteria and Evaluation Order of Educational Outcomes

Scheme of calculating and distribution of points:

Current testing (max pts)			Final module test	Total
Topic 1	Topic 2	Topic 3	40	100
35	15	10		

Total rating in “Information technology in Pharmacy” is calculated as the sum of points scored by a student during the current testing, and her points for the final module test. The maximum possible rating in the course is 100 pts; the minimum grade required to pass is 60 pts.

The current rating in the course is gained by a student as a result of her work at practical lessons (performing of training practical tasks), and assessment of her independent self-study work, that means completing homework assignments. There are 7 in-class lessons and 5 homework assignments in the “Information technology in Pharmacy” course, and each of these activities is scored at a maximum of 5 pts. The minimum possible current rating required to be admitted to final module test is 36 pts; the maximum possible current rating in the course is 60 pts.

In-class work and independent work assignments are graded according to the following criteria:

[4.5 ; 5] pts – in a case if a higher education student

- solves not less than 90% of tasks of the assignment without mistakes or with minor errors or inaccuracies,
- easily implements theoretical knowledge on the topic to solve practical problems,
- submits the assignment for grading on time (for in-class assignments – not later than 15 minutes after the end of the lesson, for self-study assignments – in accordance with the deadline);

[3.7 ; 4.5) pts – in the cases when a higher education applicant

- either solves at least 74%, but less than 90% of tasks of the assignment without mistakes or with minor errors or inaccuracies,
- or solves over 90% of tasks of the assignment, but some of them with gross mistakes;
- mostly implements theoretical knowledge on the topic to solve practical problems, however encounter some difficulties in particular tasks,
- submits the assignment for grading on schedule;

[3 ; 3.7) pts – in the cases when a higher education applicant

- either solves at least 60%, but less than 74% of tasks of the assignment without mistakes or with minor errors or inaccuracies,
- or solves over 74% of tasks of the assignment but with gross mistakes;
- is not always able to implement theoretical knowledge on the topic to solve practical problems,
- either submits the weak assignment for grading on time, or submits properly done assignment more than a week later;

[0 ; 3) pts – in the cases when a higher education applicant

- either solves less than 60% of tasks of the assignment, or more tasks but with gross mistakes;
- meets significant difficulties when trying to apply theoretical knowledge on the topic to solve practical problems,
- either submits the weak assignment for grading on schedule, or submits assignment with gross mistakes more than a week later.

**The final module test** is carried out at the last lesson of the module. It is graded at 40 pts maximum, and consists of theoretical part (maximum 20 pts) and practical part (maximum 20 pts).

Minimum score required to pass the final module test is 24 pts.

Theoretical part of the final module test consists of 10 test questions. Each correct answer scores 2 pts.

Practical part of the final module test is graded according to the results of solving practical tasks of examination paper wherein the student's ability to apply theoretical knowledge to solve practical tasks is taken to account:

- correct implementation of proper methods, functions and tools for pharmaceutical data processing with electronic spreadsheets – 80%;
- ability to use information resources for search, analysis and synthesis of information from various sources – 10%,
- skills in word processing for professional documentation creation and design – 10%.

On practical part of the final module test a higher education student gains [18 ; 20] pts if all the tasks are solved and all the answers are given in the correct form; the solutions are presented in a logical sequence, contain necessary explanations and justifications of the applied methods. In a case if some minor inaccuracies or errors occur, the applicant for higher education easily answers clarifying questions, supplementing (correcting) her answer. A student of higher education demonstrates perfect skills in using computer programs and pharmaceutical information resources, the ability to navigate the program output and easily decipher it. A student of higher education may receive additional points if uses several different software tools to solve a problem.

On practical part of the final module test a higher education student gains [14.8 ; 18] pts if tasks are solved and the answers are given with minor errors; some necessary explanations and justifications of the applied methods are omitted; the solutions are not always presented in a logical sequence. In a case of clarifying questions, the applicant for higher education is not always able to supplement or correct her answer. A student of higher education demonstrates sufficient skills in using software tools and pharmaceutical information resources, the ability to navigate and easily decipher the program output. A student of higher education may receive additional points if uses several different software tools to solve a problem.

On practical part of the final module test a higher education student gains [12 ; 14.8] pts if solutions are derived with a number of errors; some applied methods do not fit the task; necessary explanations and justifications of the applied methods are absent; some answers are not full or wrong. A student of higher education demonstrates mediocre skills in using computer programs and pharmaceutical information resources, a weak ability to navigate and decipher the program output.

On practical part of the final module test a higher education student gains [0 ; 12] pts if solutions and answers for practical tasks are not given at all or they contain many gross errors; necessary explanations and justifications of the applied methods are absent. A student of higher education demonstrates the lack of skills in using software tools and pharmaceutical information resources, the absence or extremely weak ability to navigate and decipher the program output.

### 13. Forms of Progress and Final Test of Academic Achievements

**The current control** of academic achievements is carried out at each practical lesson by observational method and oral examination (frontal, individual, combined); the control of self-study work is based on the assessment the success of completed assignments for independent work.

**The final test control** consists of theoretical test (test multichoice questions) and practical tasks that cover all the topics of the course.

**Form of the final control** – Credit.

### 14. Teaching Course Materials

While studying “Information technology in pharmacy” the applicants of higher education will have access to the following teaching materials:

1. Presentations of lectures, video recordings of lectures;
2. Manuals for practical lessons;
3. Tasks and manuals for solving practical tasks for self-study work;
4. Tests;
5. Guidelines for self-study and training for final test.



## 15. Reading Suggestions

### The Main Reading Suggestions

1. *Information Technology in Pharmacy : manual for students of higher schools* / Yu.M. Penkin, N.M. Iatsenko, S.V. Velma, M.M. Nessonova. - Kharkiv : NUPh : Golden Pages, 2013. – 352 p.

### Supplementary Reading Suggestions

1. *Pharmacy Informatics* / Ph.O. Anderson, S.M. McGuinness, Ph. E. Bourne (eds). – CRC Press, 2010. – 310 p.
2. Goundrey-Smith S. *Information Technology in Pharmacy : An Integrated Approach*. – Springer, 2013. – 240 p.
3. *Health Informatics: Practical Guide* (7<sup>th</sup> edition) / W.R. Hersh, R.E. Hoyt. – Informatics Education, 2018. – 475 p.
4. *The Pharmacy Informatics Primer* / D. Dumitru (ed). – American Society of Health-System Pharmacists, Inc., 2009. – 251 p.
5. *Essentials of Clinical Informatics* / M.E. Frisse, K.E. Misulis (eds). – Oxford University Press, 2019. – 366 p.

## 16. Electronic Resources

1. NUPh scientific library: <http://lib.nuph.edu.ua/>
2. Educational and Information Technologies Department website: <https://physics.nuph.edu.ua/en/>
3. Course learning materials on the NUPh's distance learning technology website: <https://pharmel.kharkiv.edu/moodle/course/view.php?id=110>
4. Electronic Archive (eaNUPh): <https://dspace.nuph.edu.ua/home.jsp?locale=en>
5. Excel Tutorial: <https://www.youtube.com/watch?v=Jl0Qk63z2ZY>
6. Basics of Pharmacy Data Management in Excel: <https://www.youtube.com/watch?v=9N8u4cL0oCo>
7. Computer Application in Pharmacy: using word processor: [https://www.youtube.com/watch?v=R3z3NY7v\\_0M](https://www.youtube.com/watch?v=R3z3NY7v_0M)
8. European Medicines Agency official website: <https://www.ema.europa.eu/en>
9. International Union of Basic and Clinical Pharmacology (IUPHAR): <http://www.iuphar.org>
10. Drug Bank Database: <https://go.drugbank.com>
11. Educational projects of AMIA (American Medical Informatics Association): <https://www.amia.org/amia10x10>
12. Electronic Medicines Compendium: <http://www.medicines.org.uk/EMC>
13. Drugs.com online database: <http://www.drugs.com>
14. PubMed database of biomedical journal citations and abstracts: <http://www.ncbi.nlm.nih.gov/pubmed>