MINISTRY OF HEALTH OF UKRAINE
ODESSA NATIONAL MEDICAL UNIVERSITY
Department of General and Clinical Pharmacology and Pharmacognosy

APPROVE

Vice-Rector for Scientific and Pedagogical Affairs
works

_____ Eduard BURYACHKIVSKY

" 1 " September 2025_ year

METHODOLOGICAL RECOMMENDATIONS
TO PRACTICAL CLASSES
FROM THE ACADEMIC DISCIPLINE

Academic discipline

Information technology in pharmacy

2025

Approved:

Meeting of the Department of General and Clinical Pharmacology and Pharmacognosy
Odessa National Medical University

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TOPIC

« Safety Engineering. Introduction and Structure of Medical Informatics »

Objective: To master skills related to the structure of medical informatics. To contribute to the development of professional competence of a pharmacist through the formation of a holistic understanding of the role of information technologies in the modern pharmaceutical environment and the activities of a pharmacist.

Basic concepts:

Informatics is a science that studies the structure and general properties of information, the patterns and methods of its creation, storage, retrieval, transformation, transmission and use in all spheres of human activity.

Information is a set of data about objects, processes, and phenomena that can be received, transmitted, processed, stored, accumulated, and used.

Medical informatics **is** a new science that studies the patterns of information processes in medical and biological systems, methods of implementing information technologies in medical practice.

Medical information **is** a variety of data about the human body, medical institutions, treatment methods, types of preventive measures, and reference literature.

Plan:

1. Control of the reference level of knowledge .

Question :

1. How do you understand the concept of "information"?
2. Explain the appropriate definition of the concept of "information".
3. Name and describe the types of information.
4. Describe the properties of information.
5. Explain the characteristic features of biomedical information.
6. What is information entropy?
7. How does the information transfer process work?
8. What is called encoding (decoding) of a message?
9. Define the concept of "communication channel".
10. What is the difference between one-way and two-way communication?
11. Describe the following types of communications: "sender is receiver", "no receiver", and "no sender".
12. Give a classification of message carriers.
13. Give examples of long-lived and short-lived message carriers.
14. Describe the information encoding system in computing.
15. Highlight the main differences between positional and non-positional number systems.
16. Are the binary and decimal number systems positional? Justify your answer.
17. Explain the general rule for converting numbers from one system to another.
18. Explain the principle of encoding non-numeric information.
19. Medical informatics is an academic discipline, medical informatics is a branch of science, what is the difference between these categories?

2. Discussion of theoretical questions to test basic knowledge on the topic

Essay topics :

1 The concept of "information": Philosophical approaches to the definition and key properties. (Covers questions 1, 2, 4)

2 Classification of information: Main types (by form, purpose, scope) and their detailed characteristics. (Covers question 3)

3 Information entropy: Theoretical foundations, quantification methods and role in uncertainty reduction. (Covering question 6)

4 Biomedical information: Characteristics, reliability requirements and role in clinical decision-making. (Covering question 5)

5 Information transfer process: Model, stages, communication channels and principles of effective communication. (Covers questions 7, 9)

6 Message encoding and decoding: Principles, mechanisms, and their role in ensuring data confidentiality and integrity. (Covering question 8)

7 Communication Models: Differences between one-way and two-way communication, their advantages and disadvantages. (Covering question 10)

8 Anomalous types of communications: Analysis of the "sender is receiver", "no receiver" and "no sender" models in modern networks. (Covering question 11)

9 Message Carriers: Classification by Material and Functionality. Examples of Long-Lasting and Short-Lasting Formats. (Covers Questions 12, 13)

10 Number Systems: Comparative analysis of positional and non-positional systems and their historical significance. (Covering question 15)

11 Positional number systems: Justification of the belonging of binary and decimal systems to the positional type. (Covers question 16)

12 Converting numbers between number systems: General rule and algorithms for conversion. (Covering question 17)

13 Information Coding System in Computing: Basics of Binary Representation and Use. (Covering Question 14)

14 Coding of non-numeric information: Principles of representing characters, text and graphic data (ASCII, Unicode standards). (Covering question 18)

15 Medical Informatics: The essence of the field of science and the features of the academic discipline. The distinction between these categories. (Covers question 19)

3. Formation of professional skills .

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Practical task

Overview of popular medical sites

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 Goal:

  Students should research several popular medical websites that provide information for monitoring health or helping to manage medication. They should analyze the main features of these sites, the options for patients and healthcare professionals, and evaluate their ease of use.

  Task description:

 1. **Introduction to the task** :

 ➢ Students should find and analyze 3-5 medical websites that help with health monitoring or medication management.

 ➢ The main emphasis is on the functions of the sites, the ease of finding information, and their usefulness for patients and healthcare professionals.

2. **Stages of implementation** :

Search for medical sites :

✓ Students can use search engines or recommendations to find sites using queries such as "health monitoring websites" or "medication management websites."

✓ Examples of sites to research: <u>WebMD</u> , <u>Drugs.com</u> , <u>Mayo Clinic</u> , <u>Medscape</u> , <u>Healthline</u> (Fig. 1.) .
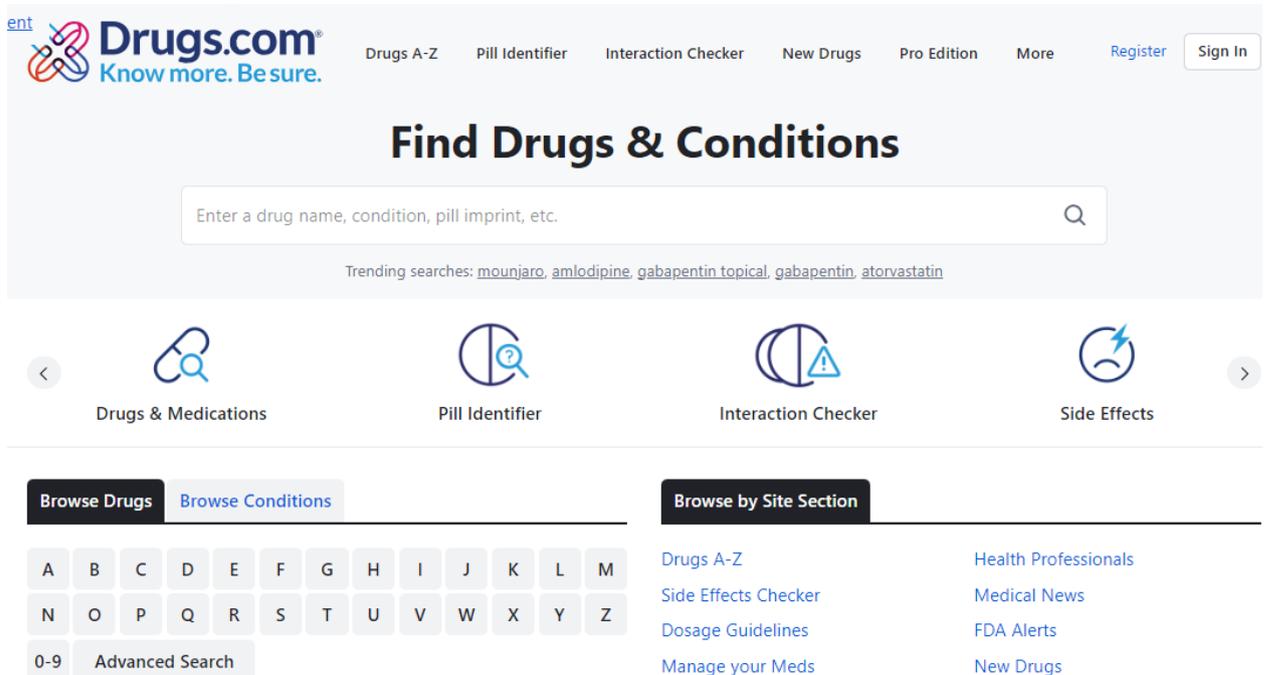

Fig. 1. Drugs.com home page

Analysis of the main functions :

For health monitoring sites :

✓ Ability to search for information about diseases, symptoms, treatment methods, and prevention.

✓ Ability to track users' health status (articles about lifestyle, diet, exercise).

For medication management sites :

✓ Information about drugs (instructions, side effects, interactions with other medications).

✓ Availability of tools for managing medication intake (reminders, interactions).

✓ Dosage information, recommendations for patients and healthcare professionals.

Assessment of the ease of searching for information :

✓ How easy is it for a user to find the information they need about medications or symptoms? Is there easy search or navigation?

✓ Are there other useful tools available, such as dosage calculators or interactive tests to diagnose symptoms?

✓ Mobile-friendly websites (are they user-friendly on smartphones and tablets?).

Analysis of additional capabilities:

✓ Availability of additional features, such as the ability to create personal profiles to track your own health or manage medications.

✓ Is there an option to share data with doctors, upload information about your health, or receive personalized recommendations?

✓ Integration with other medical or fitness apps for comprehensive health monitoring.

3. **Report on work performed** :

➢ Students must prepare a short report (1-2 pages) where:

✓ Describe each site, its main functions and capabilities.

✓ Evaluate the ease of use and information search.

✓ Compare sites and indicate which site is most convenient or useful for patients or healthcare professionals.

4. **Conclusions** :

➢ At the end of the report, students should draw conclusions about which sites are most effective for monitoring health or managing medication.

➢ Indicate which site they would recommend for patients, pharmacists, or healthcare professionals to use regularly.

4. Summing up :

Students will gain practical skills in analyzing medical websites, learning to find information that may be useful to patients in the context of taking medications or monitoring their health. They will be able to evaluate the usefulness of medical resources and their user-friendliness.

List of recommended readings
Main:

1 Medical Informatics : textbook / I.Ye. Bulakh, Yu.Ye. Liakh, VP Martseniuk, I.Yo. Khaimzon. — 4 [th] edition. — Kyiv : AUS Medicine Publishing, 2018. — 368 p.

2. G.G. Shvachych, V.V. Tolstoy, L.M. Petrechuk, Y.S. Ivashchenko, O.A. Gulyaeva, O.V. Sobolenko Modern information and communication technologies: Textbook. - Dnipro: NMetAU, 2017. -230 p.

3. Medical informatics in modules. Practical course: practical course for medical (pharmacological) universities of the IV level of accreditation / I. Ye. Bulakh [and others]. ; edited by I. Ye. Bulakh ; NMU named after O. O. Bogomolets. – K.: Medicine, 2012. – 208 p.

4. Computer modeling in pharmacy: a manual for pharmaceutical faculties of universities of the Ministry of Health of Ukraine / I. E. Bulakh, L. P. Voitenko, I. P. Kryvenko. – Kyiv: Medicine, 2017. – 208 p.

Additional

1. Forkun Y. V. Informatics: a textbook. / Y. V. Forkun, N. A. Dlugunovich. - – Lviv: Publishing house "Novyi svit – 2000", 2018. – 464 p.

2. Computers and computer technologies: teaching aids / Yu. B. Brodsky, K. V. Molodetska, O. B. Borysyuk, I. Yu. Grinchuk. – Zhytomyr: Publishing house "Zhytomyr National Agroecological University", 2016. – 186 p.

3. Pharmaceutical Encyclopedia. – Kh.: National University of Pharmacy: LLC "MORION", 2016.

4. Workshop on information technologies in pharmacy [Electronic resource]: teaching aids for university students / S. V. Velma, N. M. Yatsenko, Yu. M. Penkin; National University of Pharmacy. – Kh.: National University of Pharmacy, 2016. F A 1.1-26-295

5. Information technologies in pharmacy: a manual for pharmaceutical universities and pharmaceutical faculties of medical universities of the IV level of accreditation / I. E. Bulakh, L. P. Voitenko, L. O. Kukhar; ed. I. E. Bulakh. – Kyiv: Medicine, 2008. – 224 p.

Electronic information resources

1.   **https://info.odmu.edu.ua/chair/pharmacognosy/files** – website of methodological recommendations of the Department of Pharmacognosy of Odessa National Medical University.

2. www.uacm.kharkov.ua – Ukrainian Association "Computer Medicine"

3. http://www.drlz.com.ua/ – State Register of Medicinal Products of Ukraine

4. http://www.compendium.com.ua – Compendium, medicines

5. http://www.openoffice.org/ – official OpenOffice.org website

6. https://www.libreoffice.org/ – official LibreOffice.org website

7. www.medinfo.com.ua – medical search engine of Ukraine

8. https://tabletki.ua/uk/ – pharmaceutical search engine of Ukraine

9.   https://allchemistry.info/services/onlayn-redaktor-himicheskih-formul – online editor of chemical formulas

10 http://www.apteka.ua – online newspaper "Apteka"

TOPIC
« Information transmission. Network technologies. Fundamentals of telemedicine »

Objective: . To master the skills of information transfer and network technologies. To promote the formation of professional competence of a pharmacist through the formation of a holistic understanding of the role of information technologies in the modern pharmaceutical environment and the activities of a pharmacist. To know the main services of the global Internet; the purpose of the most important Internet services; the most important Ukrainian and international pharmaceutical resources; ways of effectively searching for information on the Internet.

Basic concepts:

Internet services - these are systems that provide services to network users.

E-mail is a system that allows you to create, send, store, and read text documents, spreadsheets in a certain format, graphic files, programs, etc.

Teleconference (forum) - an Internet service through which a subscriber can leave his open message on the network. Later, interested users can view it and give the same open response. In fact, teleconferences are collective thematic e-mail.

WWW (World Wide Web) is a direct access service that requires a full Internet connection and allows interactive interaction with information presented on Web servers. It is based on the principle of hypertext and can present information using all possible multimedia tools: audio, video, text, graphics, etc.

IRC - a system of "chat rooms", so-called chat rooms. This is an interactive service that allows users to communicate in real time using text messages typed on the keyboard.

Plan:
1. Control of the reference level of knowledge .

Question :

1. History of the Internet.
2. The concept of Internet service. List of modern Internet services.
3. Email is the very first service of the Internet. Basic principles of operation and possibilities of use in the pharmaceutical business.
4. Teleconferences: classification, main purpose, possibilities of use in the pharmaceutical business.
5. Internet communication services: IRC, IP telephony - possibilities of use in the pharmaceutical business.
6. WWW as an Internet service.
7. Web analogues of basic services (forums, blogs, etc.).
8. Information retrieval services: search engines and meta-search tools.
9. Basic techniques for effective information search on the Internet.
10. History of the Ukrainian segment of the Internet.
11. The world's most popular medical and pharmaceutical resources: Medline, RxList - functionality and methods of application in practical pharmacy.
12. Main Ukrainian pharmaceutical resources: State Register of Medicinal Products, websites of the weekly Apteka and state institutions in the field of healthcare - possibilities of application in practical pharmacy.

2 Discussion of theoretical questions to test basic knowledge on the topic

Essay topics:

1 History of the Internet: Evolution from ARPANET to the global information network.

2 Internet Services: Definition, classification and detailed list of modern communication, information and search services.

3 WWW as a fundamental service of the Internet: Principles of functioning, architecture and its role in creating the Global Network.

4 Ukrainian segment of the Internet: History of formation, key stages of development and current state.

5 Email in the pharmaceutical business: Principles of operation, possibilities of use for internal communications, marketing and cooperation with suppliers.

6 Teleconferences and forums in the pharmaceutical industry: Classification, purpose and application for distance learning (webinars) and professional exchange of experience.

7 Internet communication tools for pharmacists: Using IRC, IP telephony and instant messengers for operational interaction, consultation and telemedicine solutions.

8 Blogs and social media in pharmaceutical marketing: Using web-based services to promote information, educate consumers, and build reputation.

9 Information retrieval services: Principles of search engines and meta-search tools. Comparative analysis of their effectiveness.

10 Effective Internet Information Search: Basic Techniques, Logical Operators, and Strategies for Working with Large Volumes of Scientific Data.

11 World medical and pharmaceutical resources: Functional capabilities of Medline, RxList and their application in pharmacist practice.

12 International pharmaceutical databases: Analysis of structure, search methods and data use for pharmacovigilance and clinical trials.

13 State Register of Medicinal Products of Ukraine: Structure, procedure for maintenance and practical application in the activities of pharmacy establishments.

14 Ukrainian pharmaceutical and government resources: Opportunities to use the websites of the weekly "Apteka" and healthcare institutions for professional development.

15 Electronic resources in pharmaceutical education: The role of Internet services and databases in the professional development and continuing professional development of pharmacists.

3. **Formation of professional skills and practical abilities**
Practical task
Scientific journal database

1. Search and collect information on the provided connections in the relevant databases:
   - ➢ *Nature* Official website: **https://www.nature.com/**
   - ➢ *Oxford University Press (OUP)* Official website: **https://academic.oup.com/journals**
   - ➢ *PubMed* Official website: https://www.ncbi.nlm.nih.gov/pubmed
   - ➢ *"Annual Reviews"* Official website: **https://www.annualreviews.org/**
   - ➢ *Wiley Online Library* Official website: https://onlinelibrary.wiley.com/
   - ➢ *The Royal Society of Chemistry* Official website: https://pubs.rsc.org/
   - ➢ *Google Scholar* Official website: https://scholar.google.com/
   - ➢ **Sci-Hub** Official website: **https://sci-hub.se/**

No.	Connection name	No.	Connection name
1	Loprazolam, Allobarbital	16	Dexibuprofen, Ibuprofen
2	1-4 benzodiazepines, Barbital	17	Naproxen, Oxaprozin
3	Lorazepam, Bromazepam	18	Meclofenamic acid, Firocoxib
4	Nitrazepam, Aspirin	19	Aspirin; Diclofenac
5	Salsalate, Clonazepam	20	Fenoprofen, Sulindac
6	Piperidine, Aceclofenac	21	Dexketoprofen, Indomethacin
7	Mesocarb, Diazepam	22	Piroxicam, Ketoprofen
8	Phenobarbital, Loxoprofen	23	Diflunisal, Oxazepam
9	Chlordiazepoxide, Naproxen	24	Celecoxib, I soxicam
10	Aspirin; Allobarbital	25	Tolmetin, Rofecoxib
11	Tolmetin, Bromazepam	26	Aceclofenac, Nabumetone
12	Meloxicam, Clonazepam	27	Mefenamic acid, Loxoprofen
13	Dexibuprofen, Aspirin	28	Meloxicam, Droxicam
14	Firocoxib, Naproxen	29	Lornoxicam, Tenoxicam
15	Tenoxicam, Bromazepam	30	Clophelin, Ethinamate

2. Save brief information about connections in the Microsoft Word text editor, having previously formatted it according to the rules:
   - Font - Times New Roman
   - Font size - 14
   - Outline: bold or italic (optional)
   - Text alignment - width (connection and section names - center)
   - Line spacing - 1.5
3. Write a brief description of the sites you searched.

4. Summing up :

This practical lesson is dedicated to mastering the skills of information transfer and network technologies necessary for the professional competence of a pharmacist. The basics of the functioning of the Internet, its history, key communication services (WWW, E-mail, Teleconferences, IRC) and communication models are studied. Special attention is paid to mastering the techniques of effective information search on the Internet, including the Ukrainian segment. The emphasis is on the practical use of the most important global (Medline, RxList) and national (State Register of Drugs) pharmaceutical resources. The final goal is to provide the pharmacist with the knowledge for the effective use of IT in his activities and understanding the basics of telemedicine.

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List of recommended readings

Main:

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Auxiliary

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6. https://www.libreoffice.org/ – official LibreOffice.org website

7. www.medinfo.com.ua – medical search engine of Ukraine

8. https://tabletki.ua/uk/ – pharmaceutical search engine of Ukraine

9. https://allchemistry.info/services/onlayn-redaktor-himicheskih-formul – online editor of chemical formulas

10 http://www.apteka.ua – online newspaper "Apteka"

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TOPIC

« Basics of working with the Windows operating system »

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Objective: . To master the skills of working with the Windows operating system . To know the types of built-in applications and utilities; the main properties of programs in the Windows OS **;** **the** structure of a typical window . To be able to use the Windows OS interface; to be oriented in computer software.

Basic concepts:

An object **is** anything that Windows operates on : a program, disk, folder, file, document, icon, shortcut, etc. The concept of a "file" has remained unchanged. Its permissible length is 255 characters.

A folder **is** a directory, i.e. a list of programs, files. Inside one folder there can be others.

A shortcut **is** a reference to a separate existing object that is hidden in the file system. It has the same name as the object it represents, although the name can be changed. It exists to provide quick access to the object.

A pictogram **is** a kind of icon, a drawing. They are found everywhere, and by its appearance you can determine the type of object it represents.

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Plan:

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1. **Control of the reference level of knowledge .**

   Question :

1. What is the "Start" button for?
2. How do I open the main menu ?
3. What commands does the main menu have ?
4. What is   the "Programs" command used for?
5. Explain the meaning of using the "Documents" command ?
6. How can   I restore accidentally deleted objects?
7. History of the development of computing technology. First generation.
8. History of the development of computing technology. Second generation.
9. History of the development of computing technology. The third generation.
10. History of the development of computing technology. The fourth generation.
11. History of the development of computing technology. The fifth generation.
12. The essence of the operating system and types of OS at the present time.
13. History of the Windows operating system .
14. MS-DOS history.
15. Linux operating system
16. MAC OS operating system .
17. Windows desktop .
18. The main menu in Windows OS . (presentation required)
19. Copying and renaming objects. Working with folders in Explorer (presentation required)

   2   Discussion of theoretical questions to test basic knowledge on the topic

Essay topics:

1 The Start button and the Main menu in Windows: Purpose, how to open it, and a detailed overview of basic commands. (Covering questions 1, 2, 3, 18)

2 Managing files and programs through the Main Menu: Functions of the "Programs" and "Documents" commands. (Covers questions 4, 5)

3 The Windows desktop and built-in utilities: Organizing space and using additional tools. (Covering question 17)

4 File Operations in Explorer: Copying, Renaming Objects, and Working Efficiently with Folders. (Covering Question 19)

5 Recovering deleted objects and data security in a Windows environment. (Covering question 6)

6 The First Generation of Computing: Key Technologies, Machines, and Scientific Breakthroughs. (Covering Question 7)

7 Second Generation of Computing: Introduction of transistors, its impact on size and speed. (Covered by question 8)

8 The Third Generation of Computing: The Era of Integrated Circuits and the Birth of Minicomputers. (Covering Question 9)

9 Fourth Generation of Computing: Microprocessors, personal computers, and the beginning of networking technologies. (Covering question 10)

10 The Fifth Generation of Computing: Artificial Intelligence, Parallel Computing, and Current Development Directions. (Covering Question 11)

11 Operating System (OS): Essence, functions and classification of modern types of OS. (Covers question 12)

12 History of development and evolution of the Windows operating system from the first versions to the present. (Covering question 13)

13 MS-DOS: History, architecture, and its role as the foundation for early versions of Windows. (Covering question 14)

14 Linux Operating System: Open source philosophy, key distributions, and scope. (Covering question 15)

15 MAC OS Operating System: History, Architectural Features, and Professional Benefits. (Covering Question 16)

3. Formation of professional skills .

Practical task
Skills in working with the Windows interface and file system

Objective: To consolidate knowledge about basic objects (file, folder, shortcut, icon), Main Menu functions, and basic file system management operations (copy, rename, restore) in the Windows operating system environment.

Equipment:
- ➢ Personal computer (PC) with Windows OS.
- ➢ Notepad text editor (built-in utility).
- ➢ File manager Explorer.
- ➢ Recycle Bin.

Task execution procedure
Block 1: Creating a working environment and file hierarchy

1 Create a main folder: On the Desktop, create a new folder named "Pharmacist_[Your Last Name]".

2 Creating subfolders: Inside the main folder "Pharmacist_[Your Last Name]", create two new folders:

- "Systems"
- "OS_Documents"

3 Creating files:

- Open the built-in Notepad utility (via the Main Menu or search).
- Enter a short text in it: "Ibuprofen is an NSAID."
- Save this file in the "Documents_OS" folder under the name "Pharmacology".

4 Working with the shortcut:

- Right-click on the file "Pharmacology".
- Create a Shortcut to this file.
- Move the created shortcut to the "System" folder.

Block 2: Object Operations and Main Menu
1 Copy and rename:

- Make a copy of the "Systems" folder (right-click on the folder, select "Copy", then "Paste" in the main folder).
- Rename the created copy to "Backup".

2 Using the Main Menu ("Start"):

- Click the "Start" button.
- Find and launch the built-in Calculator application in the Main Menu or through search.
- Perform a simple calculation (e.g., $145 + 23 = ?$).
- Close Calculator.

3 Using the "Documents" command (or its modern analogue in the "Start" menu/"File Explorer"):

- Launch Explorer (via the Main Menu or the icon on the taskbar).
- Make sure you can quickly navigate to your Documents (or My Documents) folder through the Explorer navigation bar.

Block 3: Deleting and restoring objects
1 Deleting an object:

- Go to the "Backup" folder.
- Delete this folder (use the Delete key or the context menu).
- Object recovery:
- Open the Recycle Bin on the Desktop.
- Find the deleted "Backup" folder.
- Right-click on it and select the "Restore" command.
- Make sure the "Backup" folder has returned to the main "Pharmacist_[Your Last Name]" folder.

Checklist for the report

✓ What does the folder icon "Pharmacist_[Your Last Name]" look like and how does it differ from the file icon "Pharmacology"?
✓ What function did the shortcut you created in the "System" folder perform?
✓ What Main Menu command did you use to launch Calculator (or what other method did you use)?
✓ Where was the "Backup" object restored from and why is this mechanism needed in Windows?

4. Summing up :

The given practical lesson is devoted to mastering the basics of working with the Windows operating system, which is a fundamental skill for any PC user, especially for the formation of professional competence of a specialist. In general, the lesson provided a holistic understanding of the role of the OS as a basis for further work with specialized programs and information resources.

List of recommended readings
Main:

1 Medical Informatics : textbook / I.Ye. Bulakh, Yu.Ye. Liakh, VP Martseniuk, I.Yo. Khaimzon. — 4 th edition. — Kyiv : AUS Medicine Publishing, 2018. — 368 p.
2. G.G. Shvachych, V.V. Tolstoy, L.M. Petrechuk, Y.S. Ivashchenko, O.A. Gulyaeva, O.V. Sobolenko Modern information and communication technologies: Textbook. - Dnipro: NMetAU, 2017. -230 p.
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Electronic information resources

1. **https://info.odmu.edu.ua/chair/pharmacognosy/files** – website of methodological recommendations of the Department of Pharmacognosy of Odessa National Medical University.
2. www.uacm.kharkov.ua – Ukrainian Association "Computer Medicine"
3. http://www.drlz.com.ua/ – State Register of Medicinal Products of Ukraine

4. http://www.compendium.com.ua – Compendium, medicines

5. http://www.openoffice.org/ – official OpenOffice.org website

6. https://www.libreoffice.org/ – official LibreOffice.org website

7. www.medinfo.com.ua – medical search engine of Ukraine

8. https://tabletki.ua/uk/ – pharmaceutical search engine of Ukraine

9. https://allchemistry.info/services/onlayn-redaktor-himicheskih-formul – online editor of chemical formulas

10 http://www.apteka.ua – online newspaper "Apteka"

<div align="center">**TOPIC**</div>

<div align="center">" Creating complex text documents "</div>

Objective: . To master the skills of creating text documents. To know the basic services and properties of Microsoft Word; classification of electronic document management systems; basic principles of protecting electronic documents. To be able to: use the capabilities of standard office software packages that provide collaborative work on a specific document; create documents linked to others and update these links.

Basic concepts:

The Word text editor **is** one of the most common text editors. This is due primarily to its numerous advantages, which primarily include wide functionality. It is difficult to find a task in working with texts that could not be solved using Word.

A toolbar is a row of buttons that perform a specific action when clicked. To click a button, you click the mouse on the button.

Word is a multi-window editor. There can be multiple document windows inside an editor window. The user can set the size and position of each window. Each window can edit separate text.

Formatting is the operations related to the design of text and changing its appearance. Formatting operations are valid only for inserted fragments. There are three main formatting operations: character formatting; paragraph formatting; page formatting.

Page - is the main element of the document. Therefore, the appearance of the document depends on the choice of its size, location and design methods in each specific case.

<div align="center">**Plan:**</div>

1. Control of the reference level of knowledge .

Question :

1. What page modes do you know?
2. How do I switch to a scale that is not listed?
3. What is preview used for?
4. How do I print the current page?
5. How to set the orientation of a letter?
6. What are headers and footers and what are they used for?
7. What text input modes do you know? How do they differ?
8. How do I install new fonts?
9. What command should I call to work with the font? What can I do with it?
10. Definition and benefits of electronic document management.
11. Main tasks and functional requirements of electronic document management systems.
12. Main criteria for selecting an EDS.
13. The most common electronic document management systems.
14. ERP and ECM systems - comparison of functional capabilities (using the example of 1C:Document Management and Directum).
15. Examples of implementing electronic document management systems in the medical and pharmaceutical industries.
16. Problems that arise when implementing EDS and ways to solve them.
17. Main ways to ensure authorization of electronic documents.

18. Electronic signature: purpose, principles of operation, legal caveats.

19. Basics of collaborative work on documents in standard office software packages: document structure, corrections, and versioning in Microsoft Word.

20. The basics of collaborative work on documents in standard office software packages: creating linked documents in Microsoft Word.

21. Basics of collaborative work on documents in standard office software packages: creating mailings in Microsoft Word.

2. Discussion of theoretical questions to test basic knowledge on the topic

Essay topics:

1. Page modes and document scaling: Types, toggles, and their significance for print preview. (Covering questions 1, 2, 3)

2. Preparing a document for printing: Setting orientation, working with headers and footers, and printing features of the current page. (Covering questions 4, 5, 6)

3. Basics of document collaboration in Microsoft Word: Versioning, revisions, and document structure. (Covering questions 19)

4. Creating Linked Documents and Mailings in Microsoft Word: Automation and Mass Communication Techniques. (Covers Questions 20, 21)

5. Text input modes and their differences: Features of using insert and replace modes. (Covering question 7)

6. Managing fonts in the operating system and text editor: Installing new fonts and a detailed overview of the formatting command. (Covering questions 8, 9)

7. Electronic Document Management (EDM): Definition, advantages and main tasks of modern systems. (Covers questions 10, 11)

8. Electronic Document Management Systems (EDMS): Basic Functional Requirements and Key Selection Criteria. (Covers Questions 11, 12)

9. EDS Market Analysis: Overview of the most common electronic document management systems and their main characteristics. (Covering question 13)

10. ERP vs. ECM systems: Comparative analysis of functionality using the example of 1C:Document Management and Directum. (Covers question 14)

11. Implementation of electronic document management systems: Examples of successful implementation in the medical and pharmaceutical industries. (Covering question 15)

12. Problems of implementing an EDS: Typical difficulties and ways to effectively solve them. (Covering question 16)

13. Authorization of electronic documents: Basic ways to ensure legal validity and authenticity. (Covering question 17)

14. Electronic signature (ES): Purpose, principles of operation and legal basis for use in document management. (Covers question 18)

15. Managing document format and authenticity: Working with headers and footers, letter orientation, and electronic signatures. (Covering questions 5, 6, 17, 18)

3. Formation of professional skills .

Practical lesson
Microsoft Word functions

The goal is to learn how to configure the MS Word word processor, learn the basic functions of the word processor, and gain typing and editing skills.

Task 1 Setting up the MS Word screen and tools

1   Launch Microsoft Word.

2   Change the appearance of the screen, add a ruler, scroll bars, configure quick opening of recently used documents: **File tab → Settings → Advanced → Show document contents:** ˅ **Show pictures and captions,** ˅ **Show text animation.** ˅ **Show text borders → Screen: Number of documents in the recent files list: 10, Unit of measurement: Centimeters,** ˅ **Show all windows on the taskbar,** ˅ **Enable keys,** ˅ **Show horizontal scroll bar,** ˅ **Show vertical bar scrolling,** ˅ **Show vertical ruler in markup mode → OK**

3   Add a horizontal ruler: **View** tab → group **Show →** ˅ **Ruler**

4   Setting autosave every 5 minutes: **File tab → Settings → Save →** ˅ **Autosave every 5 minutes → OK .**

Task 2 Creating a document, entering and editing text

1   Create a new document: **File tab → New → New Document → Create.**

2   Save the document as om \ diabetes. docx : File tab → **Save → in the** *Save Document* dialog box, select the drive (C) → create a new folder *Documents* → open it → in the **File type field** , select the format in which the document will be saved (Word **Document (*) .docx)**) → in the **File name field** , specify the file name (**diabetes mellitus**) → click the **Save button** .

3   Set the following page options: tab **Page Layout → Page Settings** group ⬒ → Margins tab → **Margins (top - 2; bottom - 2; left - 3; right - 2) → Orientation (portrait)** → Paper Size tab → **Paper Size (A4) → OK**

4   Set text display scale 150 %: **View tab → Scale** group → **Scale** command → **Free - 150 → OK**

5   Set the document display mode: **View tab → Document View Modes** group → Page **Layout** .

6   Set the display of non-printing characters: **Home tab → Paragraph** group → click the button ¶ .

7   Type Text *1* from Appendix A.

8   To quickly save the document: click the button 💾 .

9   Set automatic text checking mode 1[)] :

•   select text → **Review tab → Language** group → **Language** command → **Proofing language → Mark selected text as : Ukrainian → OK**

•   tab **File → Settings → Spelling → Before spelling correction in Word →** ˅ **Automatically check spelling,** ˅ **Use contextual spell checking,** ˅ **Automatically check grammar,** ˅ **Also check spelling → OK** .

10 Configure automatic hyphenation: **Page Layout tab → Page Settings** group → **Hyphenation** command → ˅ **Auto** .

11 Save file as: tab **File → Save as → \ sugar diabetes 1 .docx → Save.**

12 Copy the first paragraph to the end of the text: select the paragraph → **Home tab → Clipboard group → Copy** command → move the cursor to the end of the text → **Clipboard group → Paste** command .

13 Move the second and third paragraphs to the end of the text: select the paragraphs → **Home tab → Clipboard group → Cut** command → move the cursor to the end of the text → **Clipboard group exchange → Insert** command .

14 Delete the first paragraph: select the paragraph → **Home tab → Clipboard group → Cut** .

15 Setting text preview: **File tab → Print** .

16 Exit Preview: **Home Tab** .

17 Close created documents without closing the word processor: **File tab → Close.**

---

1 Move the cursor to the word underlined with a wavy red line, call up the context menu on it and select the correct word from the list .

18 Open documents **diabetes l .docx** and **diabetes .docx** , using the quick open file list: **File tab → Recent →**

19 Place two windows side by side: **View tab → Window group → Side by side** command .

20 Setting and canceling synchronous document viewing: **View tab → Window group → Synchronous Scrolling** command .

21 Close open side-by-side documents: **View tab → Window group → Side-by-side command** .

22 Break the window of the document **diabetes .docx** in half: **View** tab → **Window** group → **Split** command → set the divider in the desired part of the screen workspace.

23 Unsplit: **View tab → Window group → Unsplit** command .

24 Save documents.

25 Quit Microsoft Word.

<div align="center">

Task 3 Typing and formatting text
</div>

1 Launch Microsoft Word.

2 Open file: **File** tab → **Open → Documents and diabetes .docx → Open.**

3 Configure text autocorrect: **File tab → Preferences → Spelling → AutoCorrect Options** button → bookmark **AutoReplace** → in the Replace with: field, enter *di* → in the **To** : field, enter **diabetes** → click the **Add button → OK→OK**

4 Type *Text 2* from Appendix B at the end of the document, using the auto-replace capabilities.

5 Save changes: **File tab → Save As → Documents \diabetes mellitus 2 .docx → Save** .

6 Set page parameters: tab **Markup pages → Page Settings** ⌐ group → **Fields tab → Margins** (**top - 1.5 cm; left - 2 cm; bottom - 1.5 cm; right - 1.5 cm) → Orientation – portrait → Paper Size** tab → **Paper Size – A4 → OK.**

7 Set the character size: select all text (**Ctrl + A) → Home** tab → **Font** group → **Font size – 10 Fri.**

8 Format paragraphs:

• **First paragraph**

I Select the first paragraph → **Home tab** → group **Paragraph** → ⌐ **Indents** tab **and spacing → Alignment - Width; First line indent - no;** Paragraph spacing - **24 points** , after the paragraph - **12 points** ; **Line spacing - double → OK.**

II **Home tab → Paragraph** group → click the arrow next to **the Border button** and select **Border and fill → Border** tab → Border type - **frame** ; Line **type - wavy** ; **Color - red** ; **Width - 1.5 pt → Options button → Margins top - 6 pt** , bottom - 6 pt, left - 6 pt, right - 6 **pt → OK → OK** .

• **Second paragraph**

1 Select the second paragraph → **Home tab → Paragraph** group → ⌐ **Indents and Spacing** tab → **Alignment – By left margin ; Indent left - 2 cm, right – 2 cm, First line indent – 1 cm; Line spacing – Exactly – 12 pt → OK.**

II **Home → Paragraph** group → click the arrow next to the Borders button and select **Borders and Shading → Borders** tab → **Border type** - **shadow** ; **Line type** – **double** ; **Color blue; Width – 1.5 pt → Options button → Margins top – 12 pt, bottom – 12 pt, left – 12 pt, right – 12 pt → OK→OK**

• **Third paragraph**

I Select the third paragraph → **Home tab → Paragraph** group ⌐ → tab **Indents and Spacing → Alignment** - **Width; Indent left - 2 cm, right - 2 cm. Interval before** paragraph - **12 pt, after paragraph - 12 pt** ; **Interval line spacing – 1.5 lines → OK.**

Home tab → **Paragraph** group → click the arrow next to **the Borders button** and select **Borders & Fill → Fill** tab → **Fill - blue → OK.**

• **Fourth paragraph**

I Highlight the fourth paragraph → **Home** tab → **Paragraph** group ⬜ → **Indents and Spacing tab** → **Alignment** - **Center** → **OK** .

• **Fifth paragraph**

I   Select the fifth paragraph → **Home tab** → **Paragraph** group → ⬜ **Indents and Spacing** tab → **Alignment** – **width; Line spacing** – **Multiplier** – **value 1.7; Left indent – 1 cm, right indent – 1 cm, Spacing before paragraph – 6 pt, after paragraph – 6 pt** → **OK.**
II **Home** tab → **Paragraph** group → click the arrow next to **the Borders button** and select **Borders & Shading** → **Border** tab → **Border type** - **frame; Line type** – **triple; Color – green; Width – 3 pt** → **OK.**
•   Format the document page as a frame with a picture.
I **Home tab** → **Paragraph** group — click the arrow next to **the Borders button** and select **Borders and Fill** — **Page tab** → **Border type - frame** ; **Picture – select any** → **OK.**
9 Save the file with a new name; **File tab** → **Save as** → **diabetes mellitus 3.docx** → **Save** .
10 Close the file.
11 Open file / **diabetes mellitus 2.docx.**
12 Set font options:
• Title

I Select the heading → **Home tab** → **Font** group → ⬜ **Font** tab → **Font** - **Times New Roman** , **Style - Bold, Size - 16 pt, Text color - red** → **Advanced** tab → **Character spacing** : **Spacing** - **Spacing 1 pt** → **OK** .
II   **Home** tab → **Font** group → **Register** button → **UPPERCASE AND CAPITAL LETTERS**
III   **Home** tab → **Paragraph** group → **Align Center** button .

• **First paragraph**

I   Select the first paragraph → **Home tab** → **Font** ⬜ group → Font tab → **Font - Arial, Text - Italic, Size - 14 pt** → **OK** .
Home tab → **Paragraph** group → **Align text right** button .

• **Second paragraph**

I   Select the second paragraph → **Home tab** → **Font** ⬜ group → tab **Font** → **Font - Book Antiqua** → **Image - Normal, Size -12 pt. Underline - dotted line** → **Underline color - blue** → **OK.**
II   **Home** tab → **Paragraph group** → **Align text to left button** .

• **Third paragraph**

I   Highlight the third paragraph → **Home** tab → **Font** group ⬜ → Font tab → **Font - Times New Roman, Text - Bold Italic, Size -   10pt, Modification**
ᵛ **crossed out** → **OK .**
II Home   tab → **Paragraph** → **Align to Width** button .

• **Fourth paragraph**

I   Select the fourth paragraph → **Home tab** → **Font** ⬜ group → **Font tab** → **Font - Times New Roman, Image - Normal, Size - 12 pt** → **OK** .

II   **Home** tab → **Paragraph** group → **Indents and Spacing** tab → **Alignment – Width; Spacing before paragraph - 0 pt, after paragraph - 0 pt; Spacing between lines - Multiplier - 1.15 → OK.**

Task 4 Search, replace, and sort text

1 Sort the text in ascending order in the following fragment of the document: endocrine genesis (Itsenko-Cushing syndrome, acromegaly, diffuse toxic goiter, pheochromocytoma);

pancreatic diseases (tumor, inflammation, resection, hemochromatosis, etc.); gestational diabetes; other rare forms of diabetes (after taking various medications, congenital genetic defects, etc.).

• Select a fragment of text → **Home tab → Paragraph** group → **Sort button** → from the type list, select **Text** → set the radio button next to growth - **OK**

2 Find the phrase "diabetes mellitus" in the text and replace it with diabetes.

Home tab → **Editing group** → **Replace** command → in the **Find field** : enter   *diabetes*   → **Replace** field **to** : enter *the CD* → click **the More button** → select **Direction** – **Everywhere** → click the **Replace All button** → in the window that appears, information about the number of replacements will be displayed → **OK** → close the window.

3 Search the document for the following format: **alignment - width, font - Times New Roman, image - normal, size - 12 pt, spacing before paragraph - 0 pt, after paragraph - 0 pt; line spacing: multiplier - 1.15. Replace all fragments of text with this format with the format: left alignment, font - Century, size - 10 pt, style - italic.**

• To do this, place the cursor at the beginning of the document → **Home tab → Editing group** → click the arrow next to the **Find button** and select the command **Advanced Search** → clear the **Find field → Format** button → **Font** → from the **Font list** , select **Times New Roman** → from the **Font list** , select **Normal** → from the **Size list** , select **12 → OK → Format** button → **Paragraph → Indents and Spacing** tab → from **the Alignment list** , select **By width** ; **Spacing** before paragraph – **0 point** , after paragraph – **0 point** ; **Spacing** interline - **Multiplier - 1.15 → OK → Find button further** .

4   Go to the **Replace tab** → clear the **Replace with field → Format** button → **Font** → from **the Font list** , select **Century** → from the **Select Italics list** → from the **Size list, select 10 → OK → Format button → Paragraph → from the Alignment list, select Left → OK → Direction - Everywhere → click the Replace All button → the window that appears will display information about the number of replacements → OK → close the window.**

5   Calculate the volume of the document: **number of pages, words, characters, paragraphs, lines.**

Review tab → **Spelling** group → **Statistics** button → **Close** .

6   Save file as: tab **File → Save as →** / **diabetes mellitus 4.docx → Save**

7   Close the file. 8   Quit Microsoft Word.

4. Summing up :

This class focused on two key areas: deep proficiency in Microsoft Word for creating and formatting documents, and theoretical and practical aspects of Electronic Document Management (EDM).

You have mastered the basic principles of formatting (page layouts, headers, footers, printing) and learned the skills of collaborating on documents (linking, reviewing versions).

In addition, you gained a comprehensive understanding of the EDS – from its definition, functional requirements and selection criteria, to the analysis of popular systems and legal principles for ensuring the authenticity of documents using an electronic signature.

This knowledge is critically important for effective documentation work in the modern, especially pharmaceutical and medical, industry.

List of recommended readings
Main:

1 Medical Informatics : textbook / I.Ye. Bulakh, Yu.Ye. Liakh, VP Martseniuk, I.Yo. Khaimzon. — 4 th edition. — Kyiv : AUS Medicine Publishing, 2018. — 368 p.

2. G.G. Shvachych, V.V. Tolstoy, L.M. Petrechuk, Y.S. Ivashchenko, O.A. Gulyaeva, O.V. Sobolenko Modern information and communication technologies: Textbook. - Dnipro: NMetAU, 2017. -230 p.

3. Medical informatics in modules. Practical course: practical course for medical (pharmacological) universities of the IV level of accreditation / I. Ye. Bulakh [and others]. ; edited by I. Ye. Bulakh ; NMU named after O. O. Bogomolets. – K.: Medicine, 2012. – 208 p.

4. Computer modeling in pharmacy: a manual for pharmaceutical faculties of universities of the Ministry of Health of Ukraine / I. E. Bulakh, L. P. Voitenko, I. P. Kryvenko. – Kyiv: Medicine, 2017. – 208 p.

Auxiliary

1. Forkun Y. V. Informatics: a textbook. / Y. V. Forkun, N. A. Dlugunovich. - – Lviv: Publishing house "Novyi svit – 2000", 2018. – 464 p.

2. Computers and computer technologies: teaching aids / Yu. B. Brodsky, K. V. Molodetska, O. B. Borysyuk, I. Yu. Grinchuk. – Zhytomyr: Publishing house "Zhytomyr National Agroecological University", 2016. – 186 p.

3. Pharmaceutical Encyclopedia. – Kh.: National University of Pharmacy: LLC "MOR I ON", 2016.

4. Workshop on information technologies in pharmacy [Electronic resource]: teaching aids for university students / S. V. Velma, N. M. Yatsenko, Yu. M. Penkin; National University of Pharmacy. – Kh.: National University of Pharmacy, 2016. F A 1.1-26-295

5. Information technologies in pharmacy: a manual for pharmaceutical universities and pharmaceutical faculties of medical universities of the IV level of accreditation / I. E. Bulakh, L. P. Voitenko, L. O. Kukhar; ed. I. E. Bulakh. – Kyiv: Medicine, 2008. – 224 p.

Electronic information resources

1. **https://info.odmu.edu.ua/chair/pharmacognosy/files** – website of methodological recommendations of the Department of Pharmacognosy of Odessa National Medical University.

2. www.uacm.kharkov.ua – Ukrainian Association "Computer Medicine"

3. http://www.drlz.com.ua/ – State Register of Medicinal Products of Ukraine

4. http://www.compendium.com.ua – Compendium, medicines

5. http://www.openoffice.org/ – official OpenOffice.org website

6. https://www.libreoffice.org/ – official LibreOffice.org website

7. www.medinfo.com.ua – medical search engine of Ukraine

8. https://tabletki.ua/uk/ – pharmaceutical search engine of Ukraine

9. https://allchemistry.info/services/onlayn-redaktor-himicheskih-formul – online editor of chemical formulas

10 http://www.apteka.ua – online newspaper "Apteka"

TOPIC
" Computer data: data types, processing, and management. "

Objective: . To master skills related to the structure of medical informatics. To know the definition of a database (DB) and a DBMS; the main types of modern databases and DBMS; the principles of building modern databases; the main chemical databases with the possibility of online search. To be able to enter data into the database, form queries and view reports; to use the main chemical databases to search for pharmacologically active compounds

Basic concepts:

    A database **is** a set of interconnected information about a certain object, which is organized according to certain rules and provides a search for the necessary information, which allows you to draw conclusions and make decisions on this basis. Any set of information that serves this purpose can be considered a database, even if the information is not stored in a computer. An example of a database can be a set of laboratory indicators of a group of patients who were treated in a clinic over a certain time.

    A node **is** a collection of data attributes that describe an object. In a hierarchical tree diagram, nodes are represented as vertices of a graph. Each node at a lower level is connected to only one node at a higher level. A hierarchical tree has only one vertex (the root of the tree), which is not subordinate to any other vertex and is at the highest (first) level.

    A database management system is a system based on software and hardware that provides the definition, creation, manipulation, control, management, and use of databases.

    Forms are special objects designed for entering and viewing data, as well as creating on-screen documents. These are special electronic forms created by users to display individual records from one or more database tables on the screen.

    Reports are database objects designed to display and print data. A report prints information from base tables obtained from a query.

Plan:
1. Control of the reference level of knowledge .
Question :
1. Basic concepts of databases and the history of their development.
2. Database classification.
3. Data models: hierarchical, network, and relational.
4. Basic principles of building a relational database.
5. Database design stages.
6. Interaction with the database: forms, queries, reports.
7. Classification of modern database management systems.
8. Language tools of database management systems.
9. The future and prospects of DBMS
10. Main commercial DBMSs: MySQL , Oracle , SQLite and their functionalities.
11. Text chemical databases (The PubChem Project , TOXNET): functionalities.
12. Open databases of chemical compound structures (ChemSpider , Chemical Structure Lookup Service , eMolecules): functionalities and query types.
13. Commercial chemical databases (Reaxys and SciFinder): functionalities and benefits

2. Discussion of theoretical questions to test basic knowledge on the topic

Essay topics:

1. Basic concepts of databases (DB): History of development, definition and role in modern computer science.
2. Data Classification and Models: Comparative analysis of hierarchical, network, and relational database models.
3. Principles of building and designing a relational database: Stages, normalization, and ensuring integrity.
4. User interaction with the database: Forms, queries, and reports as key elements of database functionality.
5. Classification of modern database management systems and their place in the corporate environment.
6. Database language tools: The role and functionality of the SQL language in data management and manipulation.
7. Commercial DBMSs: Analysis of the functionality of MySQL, Oracle, and SQLite and their applications.
8. DBMS Development Prospects: Cloud Technologies, NoSQL Solutions, and the Future of Data Management.
9. Textual chemical databases for toxicological research: Functionalities of PubChem Project and TOXNET.
10. Open databases of chemical compound structures: ChemSpider, Chemical Structure Lookup Service, and eMolecules — types of queries and their role in searching.
11. Commercial chemical databases: Reaxys and SciFinder — a comparison of functionality and advantages for pharmaceutical chemistry.
12. Relational data model as a basis for creating pharmaceutical information systems.
13. Database design for pharmacovigilance: Structural requirements and development stages.
14. The role of SQL language tools in queries to chemical and biological databases.
15. Information resources for the pharmacist: Comparative analysis of open and commercial chemical databases for practical application.

3. Formation of professional skills .

<div align="center">

Practical task

Chemical compound databases

</div>

Objective: To study the interface and rules for searching for information in the provided databases.

Implementation:

1. Find basic information about a chemical substance using all the databases provided:

> ➤ **ChemSpider** Website : http://www.chemspider.com/
> ➤ **PubChem** Website : **https://pubchem.ncbi.nlm.nih.gov/**
> ➤ **DrugBank** Website : **https://www.drugbank.ca/**
> ➤ Merck Index Website : **https://www.rsc.org/Merck-Index/**

(The number with the corresponding chemical compounds corresponds to the group list).

No.	Molecule name	No.	Molecule name
1	Aspirin; Diclofenac;	16	Isoxicam; Dexibuprofen
2	Aceclofenac; Loxoprofen	17	Oxaprozin, Ketoprofen
3	Nabumetone; Oxaprozin	18	Lornoxicam, Diflunisal (Dolobid)
4	Piroxicam; Flurbiprofen	19	Meclofenamic acid; Loxoprofen
5	Meloxicam; Dexketoprofen	20	Aceclofenac; Aspirin;
6	Tenoxicam; Ketoprofen	21	Ketorolac; Tenoxicam;
7	Droxicam; Fenoprofen	22	Sulindac; Dexketoprofen
8	Lornoxicam; Naproxen	23	Ibuprofen; Droxicam
9	Meclofenamic acid; Celecoxib	24	Etodolac; Naproxen
10	Mefenamic acid; Rofecoxib	25	Aspirin; Rofecoxib
11	Ketorolac; Diflunisal (Dolobid)	26	Meloxicam; Loxoprofen
12	Etodolac; Salicylic acid	27	Tolmetin; Dexibuprofen
13	Sulindac; Salsalate (Disalcid)	28	Droxicam; Ketoprofen
14	Tolmetin; Firocoxib	29	Piroxicam; Dexketoprofen
15	Indomethacin; Ibuprofen	30	Oxaprozin, Fenoprofen

2. Save brief information about the connections in the Microsoft Word text editor, having previously formatted it according to the rules:

- The font is Times New Roman
- Font size – 14
- Outline: bold or italic (optional where appropriate)
- Text alignment – width (connection and section names – center)
- Line spacing – 1.5

(The report must contain information from 4 databases for each chemical compound)

3. Save the document to your folder called "Chemical Compounds Database" and send it to your teacher.

4. Summing up :

This course provided a fundamental understanding of databases (DBs) and DBMSs, their history, classification, and key relational principles of construction. Practical skills of interaction with DBs (entry, query generation, and report viewing) were acquired, and the main commercial DBMSs (MySQL, Oracle) were studied. The key achievement was the study of chemical databases (PubChem, ChemSpider, SciFinder), their functionality, and query types. This allows the pharmacist to effectively use online resources for searching and analyzing pharmacologically active compounds.

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5. Information technologies in pharmacy: a manual for pharmaceutical universities and pharmaceutical faculties of medical universities of the IV level of accreditation / I. E. Bulakh, L. P. Voitenko, L. O. Kukhar; ed. I. E. Bulakh. – Kyiv: Medicine, 2008. – 224 p.

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8. https://tabletki.ua/uk/ – pharmaceutical search engine of Ukraine

9. https://allchemistry.info/services/onlayn-redaktor-himicheskih-formul – online editor of chemical formulas

10 http://www.apteka.ua – online newspaper "Apteka"

TOPIC
" Coding and classification. "

Objective: . To master the skills regarding the structure of coding and archiving of pharmaceutical information. To know the main classifiers on the Internet; the purpose of coding on the World Wide Web; the most important medical and pharmaceutical Ukrainian classifiers . To be able to use online medical and pharmaceutical classifiers; to conduct an analysis of the classification system in Ukraine.

Basic concepts:

Classification **-** firstly, it is the process of designing a classification system, and secondly, it is the process of coding itself (describing an object using codes or conditions that are indicators of concepts) within a certain classification system.

A thesaurus is a list of terms used for a specific application area or field.

Examples are a list of diagnostic conditions or a list of conditions for laboratory tests.

Coding is the process of assigning an individual object to a particular class, or to a set of classes in the case of multi-axis classification. In most classifications, classes are designated by codes. Coding is, in effect, an interpretation of the various properties of an object. Codes can be designated by numbers, letters, or both.

Taxonomy is the theoretical study of classification, including its basic principles, procedures, and rules. Taxonomy is a term known from Linnaeus' work on the classification of biological organisms.

Plan:
1. Control of the reference level of knowledge .

Question :

1. What is classification?
2. Highlight the main requirements for classification.
3. Name the requirements for computer coding systems.
4. Give examples of single- and multi-axis classification.
5. The history of coding;
6. Types of codes (numeric, mnemonic, hierarchical, mapping codes);
7. Noise-resistant coding;
8. History of use and principle of operation of the Enigma encryption machine
9. Classification: purpose, requirements;
10. History of the classification;
11. International classification systems: ICD (International Classification of Diseases), ICRD.
12. Coding system DSM , SNOMED ICD (Systematized Nomenclature of Human and Veterinary Medicine) ;
13. Universal Decimal Classifier (UDC);
14. Anatomical-therapeutic-chemical classification of drugs (ATC);
15. TNM classification of malignant tumors: history, principles, practical application;
16. Classification systems in Ukraine;
17. The use of "classification" in the pharmaceutical industry;

18. Medical information systems in Ukraine (Helsi, EMSiMED, MEDSTAR, MedCard Plus);

2. Discussion of theoretical questions to test basic knowledge on the topic
Essay topics:

1. Classification theory: Definition of the concept, history of its origin and basic requirements for the construction of classification systems. (Covers questions 1, 2, 9, 10)

2. Classification Methods: Comparative analysis of single and multi-axis classification with industry examples. (Covering question 4)

3. Fundamentals of coding: History of origin, requirements for computer coding systems and classification of the main types of codes (numeric, mnemonic, mapping). (Covers questions 5, 3, 6)

4. Specialized coding and security: Principles of jamming-resistant coding and the historical experience of the Enigma encryption machine. (Covers questions 7, 8)

5. Hierarchical codes: Features of construction, advantages and application of the hierarchical principle in modern classifiers. (Covers question 6)

6. International Classification of Diseases (ICD and ICPC): Principles of construction, structure and their importance for global health statistics and primary health care. (Covering question 11)

7. DSM and SNOMED ICD: Coding systems for psychiatry (DSM) and detailed medical terminology (SNOMED ICD) - a comparison of functionality. (Covering question 12)

8. Anatomical Therapeutic Chemical Classification (ATC): Code structure, principles of use, and the critical role of ATC in the pharmaceutical industry. (Covering questions 14, 17)

9. TNM classification of malignant tumors: History, principles and practical application in oncology for determining the stage of the disease. (Covering questions 15)

10. Universal Decimal Classification (UDC): Structure, principles and its use for systematizing scientific and medical literature. (Covering question 13)

11. Use of classification in the pharmaceutical industry: Implementation of international standards (ATS) for the accounting, analysis and regulation of medicinal products. (Covering question 17)

12. National Classification Systems in Ukraine: Overview, Integration with International Standards and Development Prospects. (Covering Question 16)

13. Medical Information Systems (MIS) in Ukraine: Analysis of the Functional Capabilities of Helsi, EMSiMED, MEDSTAR, MedCard Plus and Their Interaction with Classifiers. (Covering Question 18)

14. Codification in clinical practice: A comparative analysis of the use of SNOMED ICD and ICD in medical documentation and electronic patient records. (Covering questions 11, 12)

15. Requirements Synergy: Ensuring compliance with classification and coding requirements for the effective operation of modern computerized medical systems. (Covers questions 2, 3)

3　Formation of professional skills and abilities .
Practical task
Analysis of the Anatomical Therapeutic Chemical Classification

Conduct an analysis using the codes provided (see Table 1) and provide the search results in the form of a table based on the sample (see Table 2). The task is completed in the Compendium and in the international database.

ATX Matrix

No.	CODE						
	1	2	3	4	5	6	7
1	A01AA01	G01AA02	C04AX19	J01AA01	P02BX01	C04AC07	H02AB04
2	C04AX11	H02AA01	A01AB08	M02AA01	R01AA02	A01AA04	G01AA07
3	G01AA01	A01AB07	C04AX20	J01AA02	P02BX02	C04AC03	H02AB05
4	C04AX10	H02AA02	A01AB09	M02AA02	R01AA03	G01AA08	A01AB04
5	A01AA02	G01AA03	C04AX21	J01AA03	P02BX03	C04AC02	H02AB06
6	C04AX07	H02AA03	A01AB10	M02AA03	R01AA04	A01AA51	G01AA09
7	G01AA04	A01AB06	C04AX23	J01AA04	P02BX04	C04AC01	H02AB07
8	C04AX02	H02AB02	A01AB11	M02AA04	R01AA05	G01AA10	A01AB03
9	A01AA03	G01AA05	C04AX24	J01AA05	P02CA01	C04AB02	H02AB08
10	C04AX01	H02AB03	A01AB12	M02AA05	R01AA07	A01AB02	G01AA11
11	G01AA06	A01AB05	C04AX26	J01AA06	P02CA02	C04AF01	H02AB10
12	C04AC07	H02AB04	A01AB13	M02AA06	R01AA11	A01AB19	G01AA07
13	A01AA04	G01AA07	C04AX27	J01AA07	P02CA03	C04AX11	H02AA01
14	C04AC03	H02AB05	A01AB14	M02AA07	R01AA12	G01AA01	A01AB07
15	G01AA08	A01AB04	C04AX28	J01AA08	P02CA04	C04AX10	H02AA02
16	C04AC02	H02AB06	A01AB15	M02AA08	R01AA13	A01AA02	G01AA03
17	A01AA51	G01AA09	C04AX30	J01AA09	P02CA05	C04AX07	H02AA03
18	C04AC01	H02AB07	A01AB16	M02AA09	R01AA14	G01AA04	A01AB06
19	G01AA10	A01AB03	C04AX32	J01AA10	P02CA06	C04AX02	H02AB02
20	C04AB02	H02AB08	A01AB17	M02AA10	R01AA15	A01AA03	G01AA05
21	A01AB02	G01AA11	C04AE01	J01AA11	P02CA51	C04AX01	H02AB03
22	C04AB01	H02AB09	A01AB18	M02AA11	R06AA01	G01AA06	A01AB05
23	G01AA51	A01AB21	C04AE04	J01AA12	P02CF01	C04AC07	H02AB04
24	C04AF01	H02AB10	A01AB22	M02AA12	R06AA04	A01AA01	G01AA02
25	A01AB19	G01AA07	C04AE51	J01AA20	P02CX02	C04AX11	H02AA01

ATX classification of medicines

No.	Code	Content	Second level	Drug code	Drug name (Chemical substance)
1	C	Preparations for the treatment of diseases of the cardiovascular system	C03	C03CA01	Furosemide
2	<u>C</u>	Drugs for the treatment of cardiovascular diseases	<u>C03</u>	C03CA01	Furosemide
..7					

4. Summing up :

The lesson focused on mastering the theoretical foundations of classification and coding of information in the field of medicine and pharmacy. Types of codes and requirements for building classification systems were studied, as well as their history (including "Enigma"). International classifiers (ATX , ATC, SNOMED) necessary for the work of a pharmacist were considered in detail, and national systems in Ukraine were analyzed. The practical part consolidated the skills of online search and analysis of the structure of diagnostic codes according to the ATX system . The main goal is to form the ability to use these tools for structuring and archiving professional information.

List of recommended readings
Main:

1 Medical Informatics : textbook / I.Ye. Bulakh, Yu.Ye. Liakh, VP Martseniuk, I.Yo. Khaimzon. — 4 th edition. — Kyiv : AUS Medicine Publishing, 2018. — 368 p.

2. G.G. Shvachych, V.V. Tolstoy, L.M. Petrechuk, Y.S. Ivashchenko, O.A. Gulyaeva, O.V. Sobolenko Modern information and communication technologies: Textbook. - Dnipro: NMetAU, 2017. -230 p.

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4. Computer modeling in pharmacy: a manual for pharmaceutical faculties of universities of the Ministry of Health of Ukraine / I. E. Bulakh, L. P. Voitenko, I. P. Kryvenko. – Kyiv: Medicine, 2017. – 208 p.

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8. https://tabletki.ua/uk/ – pharmaceutical search engine of Ukraine

9. https://allchemistry.info/services/onlayn-redaktor-himicheskih-formul – online editor of chemical formulas

10 http://www.apteka.ua – online newspaper "Apteka"

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TOPIC

« Biosignal analysis. Biosignal processing methods »

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Objective: . To master skills in methods of recording and processing biosignals. To know the main types of biosignals; examples of the application of biosignal analysis; signal transformation and classification . To be able to distinguish biosignals from non-stationary signals ; to conduct biosignal analysis according to the sequence of stages .

Basic concepts:

Deterministic waveforms **-** Repetitive biological processes, such as the heart or breathing, generate signals that are also repetitive. Such signals often exhibit approximately deterministic waveforms.

Stochastic waveform - generated, for example, by groups of cells that depolarize in an approximately random fashion, such as muscle cells or nerve cells in the cortex (electroencephalogram (EEG) generation).

Evoked signals are evoked responses on EEG tests or mechanical or electrical stimulation of cells, nerves, and muscles.

<div align="center">

Plan:

</div>

1. Control of the reference level of knowledge .
Question :

1. What signals do cells and organisms send?
2. What is the main goal of biosignal processing?
3. What is the purpose of studying biosignals?
4. The structure of cells in the human body
5. Stages of biosignal analysis
6. Signal registration, conversion and classification
7. Biosignals and non-stationary signals
8. Signal types (Deterministic biosignals)
9. Stochastic waveform
10. Analog-to-digital conversion
11. Examples of biosignal applications
12. The purpose of studying biosignals
13. Criteria for testing hypotheses. Parameter estimation.

2. Discussion of theoretical questions to test basic knowledge on the topic
Essay topics:

1. The cell as a source of biosignals: Structure, generation mechanisms and types of signals transmitted by the organism. (Covers questions 1, 4)
2. Biological signals: Definition, main purpose of processing and importance of their study in diagnostics. (Covers questions 2, 3, 12)
3. Biosignals in medical diagnostics: Purpose of the study and examples of their application to assess human health. (Covers questions 3, 11, 12)
4. Types of biosignals: Characteristics of deterministic (defined) biosignals and their importance in modeling physiological processes. (Covering question 8)

5. Stochastic (Random) Biosignal Shapes: Definition, examples, and methods for analyzing stochastic waveforms in biological systems. (Covering question 9)

6. Stationarity of biosignals: Analysis of biosignals as non-stationary signals and the impact of this feature on the choice of methods for their processing. (Covering question 7)

7. Stages of biosignal analysis: From recording to interpretation. (Covering question 5)

8. Biosignal recording and conversion: Acquisition methods, preparation and analog-to-digital conversion (ADC). (Covers questions 6, 10)

9. Analog-to-Digital Conversion (ADC) of Biosignals: Principles, Errors, and Sampling Requirements to Ensure Data Reliability. (Covering Question 10)

10. Classification and identification of biosignals: Algorithms and automated processing methods for pattern recognition. (Covering question 6)

11. Biosignal Parameter Estimation: Measurement Methods and Quantification of Signals for Medical Research. (Covering Question 13)

12. Hypothesis testing in biosignal analysis: Criteria, statistical methods and their use for the reliability of results. (Covering question 13)

13. Integrated applications of biosignals: Examples of signal usage and processing for monitoring vital functions and medical diagnostics. (Covering question 11)

14. Systematization of biological information: Classification of signals and their role in creating databases for medical informatics. (Covers questions 6, 11)

15. A cybernetic view of the organism: Biosignals as information channels: from generation at the cellular level to mathematical modeling. (Covering questions 1, 4, 5)

3. Formation of professional skills .

Practical task
Biosignal Analysis and Digitization

Objective: To consolidate knowledge about the types of biosignals and model the initial stages of their processing: identification, registration, and analog-to-digital conversion (ADC).

Stage 1. Identification and qualitative analysis of the signal

1. Consider and visualize the signal (Conventional signal: Typical ECG cardiac cycle where the "R wave" reaches a maximum). For further analysis, assume that the signal has a clearly repeating shape.

2. Determine the type of signal: Based on visual analysis, determine whether this signal has the characteristics of a deterministic (clearly repeating patterns, like an ECG) or a stochastic (random, chaotic appearance, like an EEG) signal.

3. Classification: Suggest which biological process most likely generates a similar signal (e.g., ECG, EEG, EMG, etc.) and give two examples of applications of this signal in medicine.

4. Definition of Stationarity: Is this signal completely stationary (its characteristics do not change over time)? Justify your answer.

Stage 2. Analog-to-Digital Conversion (ADC) Simulation

The purpose of this stage is to simulate the process of discretization (taking a sample) and quantization (measuring the amplitude) performed by an ADC converter.

1. Create a new table in Excel/Sheets with the following columns:
   o Sample No. (n)

- Time (t, ms) – Assume that 50 ms elapses between adjacent samples.
- Amplitude (V, conventional units)
2. Complete the table for 10 consecutive samples:
- Column Sample No. (n): from 1 to 10.
- Column Time (t, ms): 0, 50, 100, 150, 200, 250, 300, 350, 400, 450.
- Column Amplitude (V, conventional units): Use the following conventional amplitude values to simulate signal digitization (ECG cycle where maximum "R wave" = +5):

Sample No.	Time (t, ms)	Amplitude (V)
1	0	0.5
2	50	1.0
3	100	0.3
4	150	0.0
5	200	-1.0
6	250	5.0
7	300	-2.5
8	350	0.0
9	400	1.5
10	450	0.8

Stage 3. Visualization and analysis of discrete data
1. Plot a graph: Using the table you created, plot a dot plot or line plot of Amplitude (V) versus Time (t). This will visually represent your "digitized" signal.
2. Parameter evaluation:
   - Determine the maximum and minimum amplitude values in your sample.
   - Calculate the arithmetic mean of the amplitude for all 10 points.

Stage 4. Report preparation
Create a short report in a text editor or directly in a spreadsheet that contains:
1. The name of the task.
2. Answers to questions from Stage 1 (Signal Type, Classification, Stationarity).
3. Screenshot of your data table (Step 2).
4. Screenshot of the constructed graph (Stage 3).
5. Parameters are defined (maximum, minimum, average).

4. Summing up :
      This course provided you with a comprehensive understanding of biosignals generated by cells and the body and methods for their processing. You successfully mastered the basic theoretical concepts, including the differences between deterministic and stochastic signal forms, as well as the nature of non-stationary signals, which is critical for their correct analysis. Special attention was paid to key processing stages, in particular analog-to-digital conversion (ADC) and signal classification. The practical task allowed you to simulate the full cycle of working with a biosignal: from identifying a conditional ECG cycle and manual data discretization, to visualizing the digitized signal and estimating parameters (maximum, minimum, average). Thus, you formed the necessary understanding of how biological information is converted into digital data suitable for mathematical analysis, diagnostics and monitoring in modern medical cybernetics .

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10 http://www.apteka.ua – online newspaper "Apteka"

TOPIC
« Visualization of biomedical data. Processing and analysis of medical images. »

Objective: . To master skills related to the visualization of medical and biological data. To know the principle of operation of CT, MRI, NMR; formation of medical images ; methods of obtaining medical images . To be able to process medical images .

Basic concepts:

Medical image - we will understand a picture of the spatial distribution of any type of radiation, transformed into the visible part of the optical range, accessible to visual perception.

Analog signals are continuous signals, they contain a large amount of redundant information.

Radiology (conventional radiology) is the most common method in radiology departments. The image is recorded on films sensitive to X-rays, and can later be converted into digital form from these films.

Computed tomography (CT) uses X-rays, but instead of a single flat image, a CT image is produced by computer processing multiple images taken in different directions.

Nuclear magnetic resonance (NMR) computer reconstructs images from the received radio signals, the intensity and duration of which depend on the biological characteristics of the tissue. Without using ionizing radiation, NMR provides images whose appearance depends on the metabolism and characteristics of the tissues.

Ultrasound examination (US) is a high-frequency sound (elastic) vibration. The probe sends ultrasonic pulses and receives the reflected ones, which, with the help of piezoelectric crystals, are converted into electrical signals.

Plan:
1. Control of the reference level of knowledge .
Question:
1. The concept of medical imaging
2. Medical imaging: issues of physiology and information processing
3. Medical image as an object of medical informatics
4. Medical imaging methods
5. Computed tomography, history of origin and principle of operation.
6. Ultrasound examination, history of origin and principle of operation.
7. Radiology, history of origin and principle of operation.
8. Magnetic resonance, history of origin and principle of operation.
9. Radionuclide research: history of origin and principle of operation.
10. Methods of processing and analyzing medical images
11. Three-dimensional visualization method and its application.
12. Modern trends in image processing.

2. Discussion of theoretical questions to test basic knowledge on the topic
**Essay topics:**
1. Medical image as an object of medical informatics: Definition, classification and role of images in modern electronic document management. (Covers questions 1, 3)

2. Medical imaging: The relationship between physical principles, physiological processes, and initial information processing. (Covering question 2)

3. General classification of medical imaging methods: Principles of invasiveness, energy sources, and areas of diagnostic application (Covering question 4).

4. Radiology: History of origin, physical principle of operation (attenuation of X-ray radiation) and evolution to digital radiography. (Covering question 7)

5. Computed Tomography (CT): History, principle of layer-by-layer scanning and methods of three-dimensional image reconstruction. (Covering question 5)

6. Ultrasound (US): History, principle of operation (Doppler effect and echolocation) and applications in dynamic and functional monitoring. (Covering question 6)

7. Magnetic resonance imaging (MRI): History, principle of operation (nuclear magnetic resonance), and role in high-contrast imaging of soft tissues. (Covering question 8)

8. Radionuclide research (SPECT and PET): History of origin, principle of action (use of radiopharmaceuticals) and possibilities of functional diagnostics. (Covers question 9)

9. Comparative Analysis: Key differences in physical principles, safety, and diagnostic capabilities of CT, MRI, and ultrasound. (Covering questions 4, 5, 6, 8)

10. Basic methods of medical image processing and analysis: Filtering, contrast enhancement, segmentation and region of interest (ROI) extraction. (Covered by 10 questions)

11. Three-dimensional imaging (3D): Reconstruction, rendering methods (MIP, VRT) and their application in surgical planning and navigation. (Covering question 11)

12. Current trends in image processing: Implementation of artificial intelligence (AI) and machine learning algorithms for automatic diagnosis. (Covering question 12)

13. Fusion Imaging: Principles of combining functional data (PET/radionuclide) with anatomical data (CT/MRI). (Covers questions 4, 10)

14. Medical imaging standards DICOM and PACS systems: Ensuring interoperability, archiving and data transfer in healthcare institutions. (Covering issue 3)

15. Quantitative Image Analysis (Radiomics): Moving from Visual Assessment to Numerical Feature Extraction for the Development of Personalized Medicine and Pharmacy. (Covering Questions 10, 12)
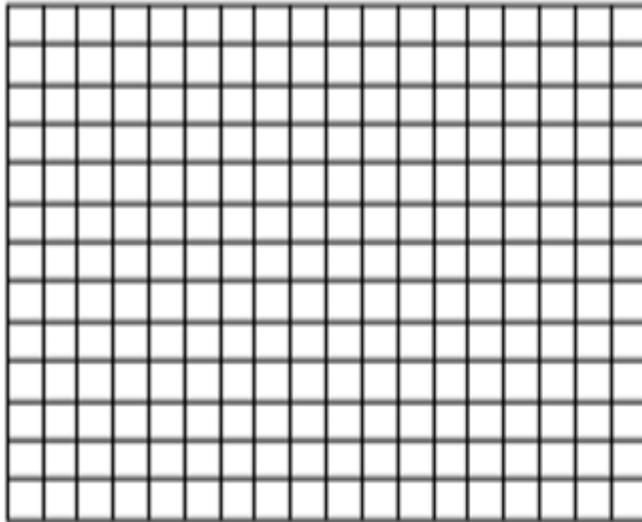
3. Formation of professional skills .

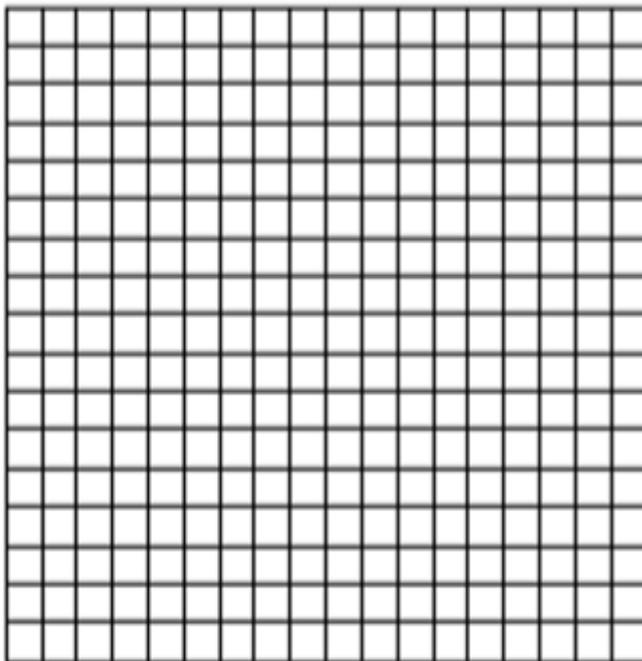### Practical task
Coding a visualization image

The first drawing is the simplest, and the last one is more complicated. It is easy to make mistakes, so it is better to use a colored pencil and an eraser, for convenience*
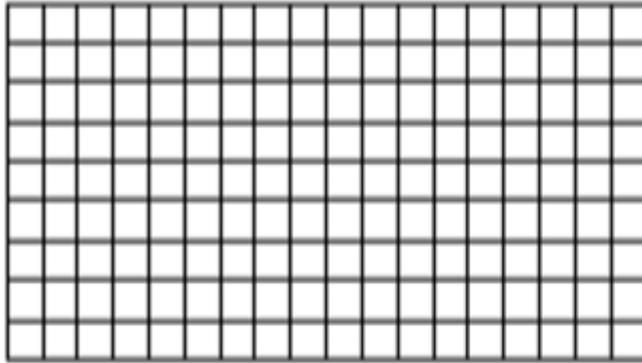
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0, 1, 6, 1, 2, 1, 6, 1
0, 1, 7, 2, 7, 1
1, 1, 14, 1
2, 1, 12, 1
2, 1, 5, 2, 5, 1
3, 1, 10, 1
4, 2, 6, 2
6, 6

Task 2

Now that you know how numbers represent pictures, why not make your own coded picture for a friend? Draw your picture on the top grid, and when you're done, write the code with the numbers on the bottom grid. Cut (send a photo) along the dotted line and give the bottom grid to

your friend to color. (Note: you don't have to use the entire grid if you don't want to, just leave a few blank lines at the bottom of the grid if your picture doesn't fill the entire grid.)

4. Summing up :

This course provided you with a deep understanding of medical imaging (CT, MRI) and their role in informatics. You mastered the key skill of image processing by simulating the windowing process (changing brightness and contrast), which allowed you to effectively highlight structures of different densities (bone, soft tissue) from the same image. In addition, you consolidated the skills of segmentation and region of interest (ROI), emphasizing the importance of quantitative analysis for clinical and pharmacological decision-making. Thus, you understood how image processing methods maximize the diagnostic value of data and are an integral part of

modern medicine, directly affecting the effectiveness of diagnostics and pharmacotherapy planning .

List of recommended readings
Main:

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2. G.G. Shvachych, V.V. Tolstoy, L.M. Petrechuk, Y.S. Ivashchenko, O.A. Gulyaeva, O.V. Sobolenko Modern information and communication technologies: Textbook. - Dnipro: NMetAU, 2017. -230 p.

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9. https://allchemistry.info/services/onlayn-redaktor-himicheskih-formul – online editor of chemical formulas

10 http://www.apteka.ua – online newspaper "Apteka"

TOPIC
" Decision support methods. Strategies for obtaining medical knowledge "

Objective: . To master skills in decision support methods . To learn the classification of diagnostic and prognostic technologies; types of medical logic; disadvantages of deterministic logic . Be able to develop logical-probabilistic diagnostic systems according to the stages.

Basic concepts:

     Deterministic logic **is** the oldest medical method, although it can hardly be called the most effective in all clinical cases. When implementing deterministic logic, the doctor's brain executes an algorithm, that is, a clear sequence of predetermined actions and rules. As a result of the correct execution of such an algorithm, the doctor should have a ready (and ideally - a single) diagnostic solution, as well as an initial scheme of the treatment process.

     Phase interval logic **is** a technique for analyzing the values of patient condition parameters in a multidimensional parametric disease space. This type of logic is currently used in advanced biochemical analysis systems.

     The logical-probabilistic approach is a diagnostic method that calculates the probability of a particular diagnosis for a given set of symptoms. This probability is obtained by statistically processing a large number of verified medical histories with clearly established diagnoses.

Plan:
1. Control of the reference level of knowledge .
Question :

     1. Types of diagnostic and prognostic technologies

     2. Types of medical logic

     3. Deterministic logic

     4. Phase interval logic

     5. Probabilistic logic

     6. Wald's statistical analysis sequence method

     7. Application of probabilistic logic in diagnostics

     8. Definition and architecture of knowledge systems

     9. Expert systems in medicine

     10. Formal models of knowledge representation

     11. Characteristics of expert systems

     12. Examples of application of expert systems

     13. Trends in the development of knowledge systems

2. Discussion of theoretical questions to test basic knowledge on the topic
Essay topics:
1. Types of diagnostic and prognostic technologies: Classification and comparative analysis of approaches to forming a medical prognosis and diagnosis. (Covers questions 1, 2)
2. Deterministic logic in medicine: Principle of operation, advantages and limitations of application in clinical diagnostics and pharmacotherapy. (Covering question 3)
3. Fuzzy Logic: Concept, features of modeling fuzziness and uncertainty in medical data. (Covering question 4)

4. Probabilistic Logic: Fundamentals, Mathematical Models, and Critical Role in Situations of High Diagnostic Uncertainty. (Covering Question 5)

5. Applying probabilistic logic in diagnostics: Real-world examples of use for risk assessment and decision-making under limited information. (Covering questions 5, 7)

6. Wald's sequential statistical analysis method: Working principle, algorithm and its effectiveness in minimizing the number of diagnostic tests. (Covering question 6)

7. Hybrid Medical Logic Models: Integrating Deterministic, Phase, and Probabilistic Approaches to Create Complex Diagnostic Algorithms. (Covering Questions 2, 4, 5)

8. Knowledge Systems: Definition, architecture and principles of building an information base for expert systems. (Covering question 8)

9. Expert systems in medicine: History, main characteristics and strategic place in supporting clinical decision-making. (Covers questions 9, 11)

10. Formal models of knowledge representation: A detailed analysis of the use of production rules, frames and semantic networks in medical ES. (Covering question 10)

11. Practical application of expert systems: Examples of the use of ES in various fields of medicine (diagnostics, pharmacovigilance, intensive care). (Covers question 12)

12. Expert systems in pharmacy: Applications for drug interaction monitoring, dosage optimization, and personalized drug selection. (Covering questions 9, 12)

13. Trends in Knowledge Systems Development: Implementing Machine Learning and Deep Learning (AI) Technologies into Traditional Expert Systems. (Covering Question 13)

14. Expert System Design: Creation methodology, knowledge engineering stages and ES validation issues in a clinical environment. (Covers questions 8, 11)

15. The Role of AI in Diagnostics: Comparison of Traditional Expert Systems (Rule-based) with Modern Diagnostic Technologies Based on Deep Learning. (Covering Questions 1, 13)

3. Formation of professional skills .

Practical task
Development of a Logical-Probabilistic Diagnostics System

Objective: To master the skills of developing and applying a logical-probabilistic diagnostic system, using Bayes' Theorem and the principle of conditional independence of symptoms, for decision-making in pharmacy.

Stage 1. Scenario and Input Data

Imagine that you are a clinical pharmacist assessing a patient after starting a new course of medication. The patient is exhibiting some adverse events. You need to determine whether this is an adverse reaction to the medication (Diagnosis X_1) or simply an exacerbation of another, unrelated condition (Diagnosis X_2) .

Given:
1. **Diagnoses (X_j) :**
   o X_1 : Acute hypersensitivity reaction (Adverse reaction).
   o X_2 : Common viral infection (Not drug-related).
2. **Prior probabilities P (X_j)** (probability of symptoms occurring):
   o P (X_1) (Hypersensitivity reaction) = **0.15** (low probability).
   o P (X_2) (Viral infection) = **0.85** (high probability in the general population).
3. **Conditional probabilities of symptoms P (C_i | X_j)** (Probability of symptom C_i given diagnosis X_j) :

| Symptom (C_i) | P (C_i | X_1) (Hypersensitivity) | P (C_i | X_2) (Viral infection) |

| :------------- | :---------------------------- | :----------------------------- |
C1 : Skin rash	0.90	0.05
C2 : Dry cough	0.20	0.75
C3 : Headache	0.65	0.90

Observation (Symptom Complex C): The patient has **a Rash** (C1) , has **a Dry Cough** (C2) , but **does NOT** have **a Headache** (¬C3) .

Stage 2. Development in spreadsheets (4 steps)
Step 1. Calculate the conditional probability of a negative symptom (Required for correctness)
Since the patient **does NOT** have a headache, first calculate P (¬C3 | Xj) :
P (¬C3| Xj) = 1 − P (C3| Xj)
Diagnosis	P (¬C3 | X1) (Hypersensitivity)	P (¬C3 | X2) (Viral infection)
Value	= 1 - 0.65 = **0.35**	= 1 - 0.90 = **0.10**
Step 2. Calculating the Conditional Probability of the Symptom Complex (Likelihood, P (C |Xj))
The calculation is carried out according to the principle **of conditional independence** of symptoms:
P (C | Xj) = P (C1| Xj) · P (C2| Xj) · P (¬C3| Xj)
   1. **Calculate P (C | X1) (Likelihood for Hypersensitivity):**
        o   P (C | X1) = P (C1| X1) · P (C2| X1) · P (¬C3| X1)
        o   P (C | X1) = 0.90 · 0.20 · 0.35 = **[Result A]**
   2. **Calculate P (C | X2) (Likelihood for Viral Infection):**
        o   P (C | X2) = P (C1| X2) · P (C2| X2) · P (¬C3| X2)
        o   P (C | X2) = 0.05 · 0.75 · 0.10 = **[Result B]**
Step 3. Calculate the Total Probability of Symptoms (P (C))
This is necessary as a normalizing factor for Bayes' Theorem.
P (C) = P (C | X1) · P (X1) + P (C | X2) · P (X2)
   •   P (C) = ([Result A] · 0.15) + ([Result B] · 0.85) = **[Result B]**
Step 4. Calculate the Posterior Probability (Posterior Prob., P (Xj | C))
Use Bayes' Theorem to find the probability of each diagnosis after taking into account the observed symptoms:
P (Xj| C) = P (C) P (C | Xj) · P (Xj)
   1. **Calculate P (X1 | C) (Probability of Hypersensitivity):**
        P (X1 | C) = [Result B][Result A] · 0.15
   2. **Calculate P (X2 | C) (Probability of Viral Infection):**
        P (X2 | C) = [Result B][Result B] · 0.85
Stage 3. Conclusions and Decisions
Complete the report by answering the following questions:
   1. **Diagnostic decision:** Which diagnosis has the highest posterior probability (P (Xj | C))?
   2. **Logical analysis:** How did changing the prior probability (P (Xj)) affect the final decision? Were symptoms that are rare for one diagnosis but common for another (e.g., Rash) more influential?
   3. **Pharmaceutical decision:** From the pharmacist's perspective, what critical decision should be made when the most likely diagnosis is identified? (For example: immediate withdrawal of drug X1 , or only symptomatic treatment of X2 ?)
4. Summing up :
       This lesson successfully summarized the mastery of logical-probabilistic diagnostics and its key tool, Bayes' Theorem. Through spreadsheet simulations, you learned to transform a priori

(initial) knowledge about the probability of diseases into posterior (final, diagnostic) probabilities, given a specific set of symptoms.

You clearly understood the sequence of steps: from calculating the conditional probabilities of the symptom complex P (C | Xj) based on the principle of conditional independence, to determining the overall probability P (C) and finally applying Bayes' formula. This practical approach demonstrated how rare but highly specific symptoms (e.g., rash in hypersensitivity) can radically change the diagnostic conclusion, even if the a priori probability of the alternative diagnosis (viral infection) was much higher.

For a pharmacist, this is a critically important skill, as it allows for quantitative justification of a clinical decision — for example, whether a drug should be immediately discontinued due to a suspected adverse reaction, or whether symptomatic treatment can be limited, confirming the high probability of an independent disease.

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9. https://allchemistry.info/services/onlayn-redaktor-himicheskih-formul – online editor of chemical formulas

10 http://www.apteka.ua – online newspaper "Apteka"

" Formal logic in solving problems of diagnosis, treatment and prevention of diseases "

Objective: . To master skills related to logic in solving problems of diagnostics, treatment and prevention of diseases . To know the concepts and types of logic statements ; binary and unary operations, negation operations, conjunction operations, disjunction operations; basic logical functions and logical IF functions . To be able to build any complex expressions using logical operations, using the symbols "+", "x", "-".

Basic concepts:

A problematic statement is a statement that asserts or denies something with a certain degree of assumption. For example, "The cause of the headache is probably high blood pressure."

Reliable - a statement containing knowledge that is substantiated and tested by practice . For example, "life without water is impossible."

Conditional - a statement that reflects the dependence of a phenomenon on certain circumstances and in which the basis and the consequence are connected by means of the logical conjunction "if..., then... For example, "if the diagnosis is myocardial infarction, then a cardiac arrhythmia is observed." Therefore, in a conditional statement, it is necessary to distinguish between the basis and the consequence.

The value if true is the value returned if the logical expression is True. The value_if_true can be a formula.

The value if error is the value returned if the logical expression is False. The value_if_error can be a formula.

Plan:

1. Control of the reference level of knowledge .

Question :

     1. Fundamentals of propositional logic (concept, types of propositions)

     2. Logical operations and truth tables (Binary and unary operations,)

     3. Logical operations and truth tables (Conjunction operation)

     4. Logical operations and truth tables (Implication operation)

     5. Logical operations and truth tables (Venn Diagram)

     6. Logical operations and truth tables (Equivalence operation)

     7. Logical operations and truth tables (Disjunction operation)

     8. Logical operations and truth tables (Negation operation)

     9. Properties of logical operations (Basic logical functions, logical function IF in Excel)

     10. Basic logical functions AND, OR and NOT in Excel

     11. Ways to represent logical functions

2. Discussion of theoretical questions to test basic knowledge on the topic

Essay topics:

     1. Fundamentals of propositional logic: Definition, historical context and concept of logical proposition (atomic, complex). Types of propositions in natural and formal languages. (Covering question 1)

2. Ways to represent logical functions: Analytical, tabular, graphical and programmatic ways to represent logical dependencies. (Covered by question 11)

3. Binary and unary logical operations: A complete overview, definitions, and their role as a basis for building complex logical constructs. (Covering question 2)

4. Conjunction operation (Logical I): Definition, truth table and its application in formulating necessary conditions (e.g. diagnostic criteria). (Covering question 3)

5. Disjunction Operation (Logical OR): Definition, truth table, and its use to describe sufficient conditions or multiple choice. (Covered in Question 7)

6. Negation Operation (Logical NOT): Definition, truth table, and role in negating statements and forming opposite conditions. (Covered by Question 8)

7. Implication Operation (Logical IF-THEN): Definition, truth table and its importance in modeling cause-effect relationships and "If-Then" rules (the basis of expert systems). (Covering question 4)

8. Equivalence Operation (Logical THEN AND ONLY THEN): Definition, truth table, and its application to establish necessary and sufficient conditions. (Covering question 6)

9. Venn diagram as a tool for visualizing logical operations: Construction of diagrams for conjunction, disjunction and negation. Connection between propositional logic and set theory. (Covering question 5)

10. Basic properties of logical operations: Commutativity, associativity, distributivity, De Morgan's law and their importance for simplifying logical expressions. (Covered by question 9)

11. The IF logical function in Excel: Syntax, usage rules, and examples for creating simple decision-making algorithms based on conditions. (Covering question 9)

12. Basic logical functions AND, OR, and NOT in Excel: Practical examples of using these functions for data filtering and conditional formatting. (Covering question 10)

13. Combined use of logical functions in Excel: Creating complex logical expressions (e.g., AND, OR, and IF) to model clinical criteria. (Cover questions 9, 10)

14. Concepts of Tautology and Contradiction: Definition, methods of verification using truth tables and their role in ensuring the consistency of logical systems. (Covering question 2)

15. Minimal basis of logical operations: Proof that all other logical operations can be expressed in terms of a minimal set (e.g., only in terms of Schaefer's Stroke or Pierce's Arrow). (Cover questions 2, 11)

3. Formation of professional skills .

Practical task
Logical Functions in Excel for Decision Making

Objective: To master the skills of constructing **truth tables** for binary operations and to practically apply **the IF, AND, and OR functions** in spreadsheets to model diagnostic criteria.

Task 1: Constructing Truth Tables (Basics of Propositional Logic)

Objective: To visually confirm the definitions of basic binary logical operations.

1. **Create a new table** with the following columns:
   o A: Statement P
   o B: Statement Q
   o C: Conjunction P AND Q
   o D: Disjunction P OR Q

- o E: Implication P → Q
- o F: Equivalence P ↔ Q

2. **Fill in the inputs (P and Q):** Use all four possible combinations of true/false (TRUE/FALSE or 1/0):
   - o Line 1: TRUE, TRUE
   - o Line 2: TRUE, FALSE
   - o Line 3: FALSE, TRUE
   - o Line 4: FALSE, FALSE

3. **Apply Excel formulas:**
   - o Column C (P AND Q): Use the function =Y(A1; B1).
   - o Column D (P OR Q): Use the function =OR(A1; B1).
   - o *There are no direct functions for Implication (E) and Equivalence (F), so use their algebraic equivalent:*
   - o **Implication (P→Q):** It is false only if P is true and Q is false. Formula: =IF(A1; B1; TRUE()).
   - o **Equivalence (P↔Q):** It is true when P and Q have the same value. Formula: =A1=B1.

Task 2: Modeling Pharmaceutical Decision Making Criteria

Objective: Use a combination of logical functions to automate a complex clinical rule.

Scenario: A pharmacist should dispense the over-the-counter drug **"Obezbolin" to a patient** only under the following conditions:

1. **Condition A (Required):** Patient is over **18 years old** (age requirement).
2. **Condition B (Clinical Requirements):** Patient has **Headache** OR **Myalgia (muscle pain)**.
3. **Condition C (Contraindications):** The patient **does NOT** have a fever (temperature less than 37.5 ∘ C).

Solution: The drug is released if (Condition A) **AND** (Condition B) **AND** (NOT Condition C).

1. **Create an Excel table** with 5 patients and the following columns (input data):
   - o Patient (1-5)
   - o Age (years)
   - o Headache (TRUE/FALSE)
   - o Myalgia (TRUE/FALSE)
   - o Temperature (∘ C)
   - o Solution (Output column)

Patient	Age (B)	Headache (C)	Myalgia (D)	Temperature (E)	Solution (F)
1	25	TRUE	FALSE	36.6	**FORMULA**
2	16	TRUE	TRUE	37.0	**FORMULA**
3	40	FALSE	FALSE	36.8	**FORMULA**
4	55	FALSE	TRUE	38.0	**FORMULA**
5	19	FALSE	TRUE	37.4	**FORMULA**

2. **Formulate and enter a complex logical formula** in cell F2 (and copy it for other patients) using **the IF, AND, OR, NOT functions** to determine whether the medication can be dispensed.
   - **Condition A:** B2>=18 **Error! No file name specified.**
   - **Condition B:** OR(C2;D2) **Error! No file name specified.**
   - **Condition C (no contraindication):** E2<37.5 **Error! File name not specified.**
   - **Complex formula:** =IF(AND(B2>=18; OR(C2; D2); E2<37.5); "Release"; "Reject")

Stage 3. Analysis of results and report

1. **Analyze the result:** Explain why patient 2 and patient 4 were denied the medication. Name the specific logical condition (A, B, or C) that was violated in each case.
2. **Form a conclusion:** Write a short conclusion about how **combining logical functions** allows you to create an automated and consistent **decision-making system** in pharmacological practice.

4. Summing up :

This session successfully demonstrated how propositional logic is a fundamental tool for automating decision-making in clinical and pharmaceutical practice.

You have consolidated theoretical knowledge by learning to build truth tables for basic logical operations (AND, OR, Implication, Equivalence), which provides a clear understanding of their mathematical basis.

The main practical result is the ability to transform complex, multifactorial clinical criteria (for example, patient compliance with an over-the-counter drug) into a single, consistent logical formula in Excel. Using the IF, AND, and OR functions, you can create a powerful model that instantly evaluates a set of conditions and provides a clear-cut decision ("Release" or "Reject").

Thus, you have mastered a key mechanism used in modern decision support systems (DSS), which is indispensable for minimizing human error and ensuring patient safety in the pharmaceutical industry.

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10 http://www.apteka.ua – online newspaper "Apteka"

" Formalization and algorithmization of medical problems "

Objective: . To master skills regarding formalization and algorithmization of medical problems . To know the basic properties of the algorithm ; the main stages of preparing the problem for recording in the form of an algorithm; forms of writing algorithms; rules for organizing cyclic algorithms. In the myth, build a structural diagram of an algorithm for calculation.

Basic concepts:

An algorithm is a method (way) of solving a problem, written according to certain rules that ensure its unambiguous understanding and mechanical execution for all values of the initial data.

Discreteness - since the process of solving a problem is divided into separate stages (steps), an algorithm is a sequence of actions, commands that determine the execution of the stages of the process;

Definiteness - each algorithm command must be clearly understood by the user and make execution uncertainty impossible;

Efficiency - the algorithm must lead to a result in a finite number of steps;

Mass - each algorithm developed to solve a certain problem must be applicable to solving problems of this type for all permissible values of the initial data;

Finiteness - the execution of actions specified by the algorithm consists of a finite number of steps.

A linear algorithm is an algorithm in which actions (blocks) are performed sequentially one after another (linearly).

A branching algorithm is an algorithm in which the solution process changes depending on the verification and fulfillment of certain conditions.

A cyclic algorithm is an algorithm that uses the same mathematical and logical operations (loops) on data many times.

Plan:
1. Control of the reference level of knowledge .
Question :
1. Types of algorithms by the nature of the connections (linear algorithm, branching algorithm, cyclic algorithm)
2. Ways to represent algorithms (verbal, symbolic, and graphical)
3. Concept and general characteristics of intelligent systems. (Quasialgorithms)
4. Organizational foundations of expert systems. (Classification of expert systems, tools for creating ES)
5. Intelligent analysis and reporting systems in enterprises. Examples of using intelligent BI platforms. (Cognos & BI structure)
6. Intelligent analysis and reporting systems at enterprises. Examples of using intelligent BI platforms. (BI Server and BI Publisher)
7. Intelligent analysis and reporting systems in enterprises. Examples of using intelligent BI platforms. (BI Delivers and Oracle BPEL Process Manager)
8. Intelligent analysis and reporting systems in enterprises. Examples of using intelligent BI platforms. (BI Office Plug-In, BI Disconnected Analytics)

9. Intelligent Data Mining and Text Mining Technologies
10. Agent-oriented systems in enterprises. Formation of dynamic business processes in the global Internet.
11. Virtual organizations. Types of virtual enterprises.
12. Ontological approach to knowledge use in enterprises. Organizational ontologies
13. Algorithm and their properties (discreteness, definiteness, efficiency, massiveness, finiteness)

2. Discussion of theoretical questions to test basic knowledge on the topic
Essay topics:

1. Algorithm: Properties, types and representations — Analysis of discreteness, determinism, efficiency, massiveness and finiteness of algorithms. Classification by the nature of connections (linear, branched, cyclic) and methods of representation (verbal, symbolic, graphical). (Covers questions 1, 2, 13)

2. Quasi-algorithms and intelligent systems — Concept, general characteristics of intelligent systems and the fundamental difference between quasi-algorithms and traditional ones. (Covering question 3)

3. Organizational foundations of expert systems (ES) — Classification of expert systems, their architecture, and overview of the tools used to create them. (Covering question 4)

4. Intelligent Data Mining and Text Mining Technologies — Principles of operation and methods of intelligent knowledge extraction from large arrays of structured and unstructured data. (Covers question 9)

5. Ontological approach to knowledge use — Definition of ontologies, their application in enterprises and the role of organizational ontologies in knowledge systematization. (Covering question 12)

6. Agent-oriented systems in enterprises - The principle of operation, architecture and formation of dynamic business processes in the global Internet using software agents. (Covers question 10)

7. Virtual organizations — Concept, features of functioning and detailed analysis of different types of virtual enterprises. (Covering question 11)

8. Cognos Framework and Business Intelligence (BI) — Examples of using intelligent BI platforms. Analysis of Cognos framework and components. (Covering question 5)

9. BI Server and BI Publisher — The role of these components in the overall architecture of intelligent analysis and reporting systems in enterprises. (Covering question 6)

10. BI Delivers and Oracle BPEL Process Manager — Integrating BI analytics with business process management tools. (Covering question 7)

11. Mobile and Disconnected BI Solutions — Analyze the functionality of the BI Office Plug-In and the BI Disconnected Analytics to enable offline analysis and reporting. (Covering Question 8)

12. Modeling business processes using algorithms — Using different types of algorithms (linear, branched, cyclic) to formalize and optimize business operations. (Covering questions 1, 13)

13. BI Technology Benchmarking — Review and compare the functionality of various BI components for analysis and reporting. (Covering questions 5, 6, 7, 8)

14. Evolution of Knowledge Systems — Transition from classical expert systems (ES) to modern intelligent systems using Text Mining and Data Mining. (Covers questions 4, 9)

15. Synergy of Intelligent Systems — Integrated use of ontological approach, agent-oriented systems and BI platforms to create flexible virtual organizations. (Covers questions 10, 11, 12)

3. Formation of professional skills and abilities .

Practical task
Business Logic Modeling Using Algorithms

Goal: To master the skills **of classifying algorithms** , their **graphical representation** (verbal and flowchart) and to practically apply **branched and cyclic algorithms** to model the data analysis process at an enterprise.

Task 1. Classification and Representation of Algorithms

Scenario: The process of placing an order for goods in the warehouse.

Describe (verbally and graphically) the three stages of order processing that demonstrate three different types of algorithms.

1. **Linear algorithm (Documentation):**
   o **Action:** Preparation of a set of documents (Invoice → Invoice → Certificate).
   o **Task:** Write **a verbal description** of the steps and draw **a flowchart** .
2. **Branched algorithm (Existence check):**
   o **Action:** Check the product: **IF** the product is in stock **AND** the expiration date is > 30 days, **THEN** send it for picking, **OTHERWISE** report the absence.
   o **Task:** Write **a verbal description** and draw **a flowchart** using a logic block (diamond).
3. **Cyclic algorithm (Party check):**
   o **Action:** Order picking: **UNTIL** the quantity of the ordered item is reached, **REPEAT** the next unit from the nearest batch.
   o **Task:** Write **a verbal description** and draw **a flowchart** using a loop (checking a condition at the beginning or end).

Test question:

Explain which of **the algorithm properties** (discreteness, determinism, efficiency, massiveness, finiteness) are most important for the correct operation of the Branching and Cyclic algorithms.

Task 2. Modeling of Business Intelligence (BI)

Scenario: It is necessary to conduct data mining of sales data to classify customers (ontological approach) and identify the need for manual intervention (quasi-algorithm).

1. **Create an Excel table** with the following columns (data for 5 hypothetical customers):

Client	Annual volume of purchases (UAH)	Percentage of overdue debt (%)	Contract Existence (TRUE/FALSE)	Classification (Ontology)	Conclusion (Quasi-algorithm)
1	150000	2	TRUE	**FORMULA A**	**FORMULA B**
2	5000	15	FALSE	**FORMULA A**	**FORMULA B**
3	450000	0	TRUE	**FORMULA A**	**FORMULA B**

4	200000	12	FALSE	**FORMULA A**	**FORMULA B**
5	80000	5	TRUE	**FORMULA A**	**FORMULA B**

2. **Form a classification (Ontology)** — Branched Algorithm (FORMULA A):

   IF function to classify customers:
   - o **"VIP"** : If the purchase volume is > 200,000 UAH.
   - o **"Standard"** : If the volume of purchases is from 50,000 to 200,000 UAH.
   - o **"Novice/Small"** : Otherwise.

3. **Form a Conclusion (Quasi-algorithm/BI-analysis)** — Combined branched algorithm (FORMULA B):

   IF, AND, OR functions to determine the need for manual intervention (analysis that an expert system would perform):
   - o **"Manual Analysis"** : **IF** (Client — "VIP" **AND** Overdue Debt > 5%) **OR** (Client — "Newbie/Small" **AND** No Contract)
   - o **"Automatic control"** : Otherwise.

Stage 3. Report and Justification

Create a report that contains:

1. **Answers to Task 1:** Verbal description and flowcharts for Linear, Branching, and Cyclic algorithms.
2. **Answer to the control question** (properties of algorithms).
3. **Excel table (Screenshot)** with filled in "Classification" and "Conclusion" columns.
4. **Analysis of Findings:** Explain what exactly caused the need for **"Manual Analysis"** for client 4.
5. **Conclusions:** Justify how modeling such processes in Excel reflects the work **of intelligent analysis systems (BI platforms)** that use **extensive algorithms** for automatic data classification (ontology) and initiation of further actions.

4. Summing up :

   This class provided you with a deep understanding of algorithmic structures and their role in modeling business processes in an enterprise.

   You learned to classify algorithms into linear, branching, and cyclic, and to represent them using flowcharts, which is key to formalizing any workflow. Practical spreadsheet modeling allowed you to apply these principles to create branching algorithms that simulate the operation of intelligent analysis systems (BI platforms).

List of recommended readings
Main:

1 Medical Informatics : textbook / I.Ye. Bulakh, Yu.Ye. Liakh, VP Martseniuk, I.Yo. Khaimzon. — 4 [th] edition. — Kyiv : AUS Medicine Publishing, 2018. — 368 p.

2. G.G. Shvachych, V.V. Tolstoy, L.M. Petrechuk, Y.S. Ivashchenko, O.A. Gulyaeva, O.V. Sobolenko Modern information and communication technologies: Textbook. - Dnipro: NMetAU, 2017. -230 p.

3. Medical informatics in modules. Practical course: practical course for medical (pharmacological) universities of the IV level of accreditation / I. Ye. Bulakh [and others]. ; edited by I. Ye. Bulakh ; NMU named after O. O. Bogomolets. – K.: Medicine, 2012. – 208 p.

4. Computer modeling in pharmacy: a manual for pharmaceutical faculties of universities of the Ministry of Health of Ukraine / I. E. Bulakh, L. P. Voitenko, I. P. Kryvenko. – Kyiv: Medicine, 2017. – 208 p.

Auxiliary

1. Forkun Y. V. Informatics: a textbook. / Y. V. Forkun, N. A. Dlugunovich. - – Lviv: Publishing house "Novyi svit – 2000", 2018. – 464 p.

2. Computers and computer technologies: teaching aids / Yu. B. Brodsky, K. V. Molodetska, O. B. Borysyuk, I. Yu. Grinchuk. – Zhytomyr: Publishing house "Zhytomyr National Agroecological University", 2016. – 186 p.

3. Pharmaceutical Encyclopedia. – Kh.: National University of Pharmacy: LLC "MOR I ON", 2016.

4. Workshop on information technologies in pharmacy [Electronic resource]: teaching aids for university students / S. V. Velma, N. M. Yatsenko, Yu. M. Penkin; National University of Pharmacy. – Kh.: National University of Pharmacy, 2016. F A 1.1-26-295

5. Information technologies in pharmacy: a manual for pharmaceutical universities and pharmaceutical faculties of medical universities of the IV level of accreditation / I. E. Bulakh, L. P. Voitenko, L. O. Kukhar; ed. I. E. Bulakh. – Kyiv: Medicine, 2008. – 224 p.

Electronic information resources

1.   **https://info.odmu.edu.ua/chair/pharmacognosy/files** – website of methodological recommendations of the Department of Pharmacognosy of Odessa National Medical University.

2. www.uacm.kharkov.ua – Ukrainian Association "Computer Medicine"

3. http://www.drlz.com.ua/ – State Register of Medicinal Products of Ukraine

4. http://www.compendium.com.ua – Compendium, medicines

5. http://www.openoffice.org/ – official OpenOffice.org website

6. https://www.libreoffice.org/ – official LibreOffice.org website

7. www.medinfo.com.ua – medical search engine of Ukraine

8. https://tabletki.ua/uk/ – pharmaceutical search engine of Ukraine

9.   https://allchemistry.info/services/onlayn-redaktor-himicheskih-formul – online editor of chemical formulas

10 http://www.apteka.ua – online newspaper "Apteka"

TOPIC
" Biostatistics Methods "

Objective: . To master skills related to biostatistics methods. To know statistical data analysis; the law of distribution of discrete random variables; the law of distribution of continuous random variables; the empirical law of distribution of random variables. **To** be able to plan research and prepare data for analysis; to estimate distribution parameters and test hypotheses .

Basic concepts:

Statistics - the daily use of data, numerical observations and their quantitative information (for example, body weight of newborns, age of patients, number of leukocytes in the blood, etc.); Statistics - a discipline that studies statistical methods, scientific methods of collecting, processing, presenting, analyzing and interpreting data, formulating statistical conclusions based on quantitative data.

A *statistical population* is a group consisting of a large number of relatively homogeneous elements (objects) taken together within known limits of time or space.

A *sample* is a part of a population, the properties of which are used to judge the population. Based on the analysis of a sample, one can obtain a fairly complete picture of the patterns inherent in the entire population.

The average value is a generalizing numerical characteristic of qualitatively homogeneous quantities, which characterizes the entire statistical population by one characteristic with a single number. The average value expresses what is common to a characteristic in a given set of observations.

Median - the value that divides a distribution into two equal parts, the central or middle value of a series of observations arranged in increasing or decreasing order.

The mode is the value that occurs most often in a series of observations. In our example, the mode is $M_0 = 120$.

Correlation is a type of statistical or probabilistic pattern that describes the relationship between two quantities X and Y, of which one (X) depends not only on the other (Y) but also on a set of other factors. As a result, each value of X corresponds to not one value of Y, but a number of these values.

Plan:
1. Control of the reference level of knowledge .
Question :
1. Modern data analysis technology
2. Research planning and data preparation for analysis
3. Statistical data analysis (Laws of distribution of random variables)
4. Law of distribution of discrete random variables (Bernoulli binomial distribution) (example)
5. Distribution law of continuous random variables (Normal Gaussian distribution law) (example)
6. Student (Gosset) distribution (example)
7. Empirical law of distribution of random variables
8. Estimation of distribution parameters and hypothesis testing (stages, hypothesis testing criteria, stability of criteria)

9. Requirements for samples when conducting research.
10. Pearson's test and Student's t -test (example)
11. Regression analysis
12. Variational series and its parameters (mean, mode, median)
13. Calculating statistical parameters using a computer

2. Discussion of theoretical questions to test basic knowledge on the topic
Essay topics:

1. Modern data analysis technologies: Overview and comparison of the main methods (BI, Data Mining, ML) and their role in decision-making. (Covering question 1)

2. Study planning and data preparation for analysis: Protocol requirements, data collection, cleaning, transformation, and validation. (Covering questions 2, 9)

3. Variational series and its parameters: Calculation, meaning and application of basic central tendencies (mean, mode, median) to describe a sample. (Covered by question 12)

4. Empirical law of distribution of random variables: Concept, graphical representation (histograms) and its role in initial data analysis. (Covering question 7)

5. Statistical data analysis: General characteristics, classification and the role of distribution laws of random variables as a basis for conclusions. (Covering question 3)

6. Binomial Bernoulli distribution: Application conditions, mathematical formula and examples of use for analyzing discrete events (e.g., treatment success/failure). (Covering question 4)

7. Gaussian Normal Distribution: Conditions, Parameters (μ, σ), Properties and Its Central Role in Statistics (with Examples). (Covering Question 5)

8. Student's (Gosset's) distribution: Differences from the normal distribution, applications for small samples, and examples of use. (Covering question 6)

9. Estimation of distribution parameters and hypothesis testing: Steps, sampling requirements, concepts of null and alternative hypotheses. (Covering questions 8, 9)

10. Hypothesis Testing Criteria: Overview of the main criteria, the concept of significance level (α), and the robustness of criteria. (Covering question 8)

11. Pearson's test Purpose, application conditions and example of use to check the correspondence of empirical data to the theoretical distribution. (Covering question 10)

12. Student's t-test: Purpose, application conditions (one-sample, two-sample) and example of use for comparing means. (Covering question 10)

13. Regression Analysis: Definition, types (linear, multiple) and its applications for modeling relationships and predicting dependent variables. (Covering question 11)

14. Computing statistical parameters using a computer: Overview of the functionality of specialized software (SPSS, R, Python) and spreadsheets. (Covering question 13)

15. Comprehensive analysis in clinical trials: Full cycle: from sample requirements and its description (variation series) to hypothesis testing (t-test) and regression modeling. (Covering all key issues)

3. Formation of professional skills .

Practical task
Statistical Data Analysis and Hypothesis Testing

Objective: To master the skills **of descriptive statistics** and the application **of Student's t-test** to test the statistical significance of differences between two groups of data.

Required tools

1. Spreadsheets (Microsoft Excel or Google Sheets).
2. Knowledge of basic statistical functions (AVERAGE, MEDIAN, MODE, T.TEST / TTEST).

Scenario: Evaluating the Effectiveness of a New Analgesic

A pharmaceutical company is testing the effectiveness of a new analgesic (Group A) compared to a standard drug (Group B). The main measure is **the time to onset of pain relief** (in minutes).

Output data:

No.	Group A (New drug)	Group B (Standard drug)
1	21	30
2	25	35
3	19	28
4	22	32
5	24	26
6	28	34
7	20	31
8	23	29
9	26	33
10	22	30

Task 1. Descriptive Statistics (Variation Series)

Objective: To describe the central tendency and variability of the data within each group.

1. **Create a table** in spreadsheets, enter the data.
2. **Calculate basic statistical parameters for EACH group** using built-in functions:

Parameter	Group A (New drug)	Group B (Standard drug)
Average ($\bar{X}$)	=AVERAGE(...)	=AVERAGE(...)
Median	=MEDIAN(...)	=MEDIAN(...)
Fashion	=FASHION(...)	=FASHION(...)
Standard deviation (SD)	=STANDARD.V(...)	=STANDARD.V(...)
Sample size (n)	10	10

3. **Make an initial conclusion:** Based on the average values, which drug is likely to be faster?

Task 2. Hypothesis Testing (Student's t-test)

Objective: To determine whether the detected difference in mean values is **statistically significant** or is due to chance.

1. **Formulate hypotheses:**
   - **Null hypothesis ($H0$):** There is no statistically significant difference between the mean time to onset of the effect of Group A and Group B.

- **Alternative hypothesis (H1):** There is a statistically significant difference between the mean time to onset of effect (the new drug acts faster).
2. **Perform a t-test:** Use the T.TEST (Excel) or TTEST (Google Sheets) function.
   - **Parameters of the function T.TEST(Array1; Array2; Tails; Type):**
     - **Array1:** Group A data.
     - **Array2:** Group B data.
     - **Tails: 2** (Two-tailed test, as we are testing whether there is a difference in either direction).
     - **Type: 2** (Two samples with equal variances is a standard assumption for small samples).
   - **Formula:** =T.TEST(Group A data; Group B data; 2; 2)
3. **Determine the p-value:** The result of the function will be **the p-value** (Probability that the difference is random).
4. **Make a decision:**
   - Assume a standard significance level of $\alpha=0.05$.
   - **IF p-value < 0.05, THEN reject** H0 (The difference is significant).
   - **IF p-value $\geq$ 0.05, THEN accept** H0 (Difference not significant).

Stage 3. Report and Conclusion
1. **Create a report** that contains a table with all the calculated parameters (Task 1).
2. **Record the p-value** obtained in Task 2.
3. **Formulate the conclusion of the study:**
   - Is the new drug **statistically significantly** faster than the standard drug?
   - What decision should a pharmaceutical company make about a new drug based on this analysis?
   - Explain why **the Student's t-test** is a key tool for testing hypotheses in clinical trials.

4. Summing up :

This class has provided you with a comprehensive understanding of statistical data analysis and its critical importance in the field of clinical research.

You have successfully mastered descriptive statistics by learning to calculate key parameters of a variation series (mean, median, standard deviation) for quantitative characteristics of a sample. The main achievement is the practical application of the Student's t-test in spreadsheets. You have learned to formulate and test hypotheses (H_0 and H_1) and make decisions based on p-values.

So, not only have you confirmed that the new analgesic works faster than the standard one, but you have also proven that this difference is statistically significant (less than a 5% chance of being due to chance). This demonstrates how statistical data processing transforms raw test results into the sound evidence needed to make decisions about the release and use of pharmaceuticals.

List of recommended readings
Main:

1 Medical Informatics : textbook / I.Ye. Bulakh, Yu.Ye. Liakh, VP Martseniuk, I.Yo. Khaimzon. — 4 [th] edition. — Kyiv : AUS Medicine Publishing, 2018. — 368 p.

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Electronic information resources

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2. www.uacm.kharkov.ua – Ukrainian Association "Computer Medicine"

3. http://www.drlz.com.ua/ – State Register of Medicinal Products of Ukraine

4. http://www.compendium.com.ua – Compendium, medicines

5. http://www.openoffice.org/ – official OpenOffice.org website

6. https://www.libreoffice.org/ – official LibreOffice.org website

7. www.medinfo.com.ua – medical search engine of Ukraine

8. https://tabletki.ua/uk/ – pharmaceutical search engine of Ukraine

9. https://allchemistry.info/services/onlayn-redaktor-himicheskih-formul – online editor of chemical formulas

10 http://www.apteka.ua – online newspaper "Apteka"

<div align="center">**TOPIC**</div>

<div align="center">« Information systems in healthcare (MAX and hospital systems) »</div>

Objective: . To master skills related to the structure of medical informatics. To know the basic concepts of MAKS; functional capabilities of MAKS; classification of medical hardware and medical systems; basic principles of building MAKS. To be able to understand the principle of operation of an analog-to-digital converter; to use MAKS software

Basic concepts:

Rheosignal is one of the least invasive methods of studying the vascular system, with which almost any organ can be studied. In the methods of studying the hemodynamics of vascular zones, specific volumetric and velocity indicators, as well as general amplitude-time parameters of rheosignals and their correlations, are distinguished.

Hospital information systems (HIS) are a type of hospital information system and are designed to informatize the activities of a medical hospital. Like all hospital information systems, these systems partially or fully reflect the scenario of information events that occur in a medical institution.

An electronic health record **is** meaningless as long as it is accessible via a computer, when and where it is needed. A health record can be transmitted via computer networks or from an established information repository (database) - it is a matter of design and implementation.

<div align="center">**Plan:**</div>

1. Control of the reference level of knowledge .

Question :

1. Stages of creation and main characteristics of a medical information system
2. Classification and classification of medical information systems
3. Automated doctor's workplace
4. Information systems of a medical and preventive institution
5. Information systems for outpatient services (regional and state-level information systems)
6. Concept and historical background of hardware and computer systems
7. Classification of medical hardware and computer systems
8. Hardware support for medical hardware and computer systems
9. Software for medical hardware and computer systems (6 functional modules)
10. Systems for studying circulatory functions (computerized electrocardiography and rheography)
11. Respiratory research systems
12. Brain research systems (Computerized Electroencephalogram)
13. Monitoring systems (Electrocardiographic monitoring)
14. Treatment process management systems (intensive care, biological feedback and prostheses and artificial organs)
15. Hospital information systems (types of systems)
16. Hospital information systems architecture
17. Maintaining medical records using a personal computer
18. The concept of building electronic medical records (3 principles)
19. Degree of protection of patient information
20. Medical document management system for healthcare institutions

21. Structure and stages of medical document flow in healthcare institutions

2. Discussion of theoretical questions to test basic knowledge on the topic
Essay topics:

1. Classification and architecture of MIS: Comprehensive analysis of types of medical information systems (by level: hospital, territorial, state) and their basic architecture.

2. MIS Lifecycle: Stages of creating, implementing, and maintaining a medical information system (from needs analysis to operation).

3. Automated physician workstation (AWP): Functional modules, benefits and challenges of implementing AWP in clinical practice.

4. Electronic health record (EHR): Concept of construction, key principles and standards for ensuring the confidentiality and security of patient medical data (HIPAA, GDPR).

5. Medical document management systems: Structure, stages and automation of medical record keeping processes in healthcare facilities.

6. Medical hardware-computer systems: Classification and application: Historical background, main types and examples of the use of ACS in modern diagnostics and therapy.

7. AKS software: Detailed overview of functional modules (data acquisition, processing, visualization, archiving, control) and requirements for their reliability.

8. AKS Hardware: Specifics of medical sensors, data acquisition devices, and computing power requirements for medical systems.

9. Computerized electrocardiography (ECG) and monitoring: Principles of operation, data analysis, and the role of computer systems in the study of circulatory functions (including rheography and 24-hour monitoring).

10. Computerized electroencephalogram (EEG): Systems for studying the brain, methods for processing and interpreting electrical activity.

11. Information systems in pulmonology: Computer systems for the study of the respiratory system (spirometry, bodyplethysmography) and analysis of their functionality.

12. Medical process management systems: Principles of using biological feedback (BFR), application in intensive care units and management of artificial organs/prostheses.

13. Confidentiality and information protection in healthcare: Modern methods and degrees of protection of electronic medical data about patients from unauthorized access.

14. Hospital Information Systems (GIS): Comparative analysis of GIS types, their main functions and role in improving hospital efficiency.

15. Outpatient Information Systems: Application of MIS at the territorial and state levels to optimize primary health care and patient record management.

3. Formation of professional skills .
Practical task
Development and filling out electronic document forms

Task 1 Development and filling out electronic document forms
1 Launch Microsoft Word.
2 Create a new document: File tab → New → New Document → Create.
3 Save the file: File tab → Save → Documents \ form l.docx → Save.
4 Set page options: Layout tab page → Page settings → Margins (top – 1.5 cm, bottom – 1.5 cm, left – 2 cm, right – 1.5 cm) → Orientation – portrait → Paper size – A5 → OK.
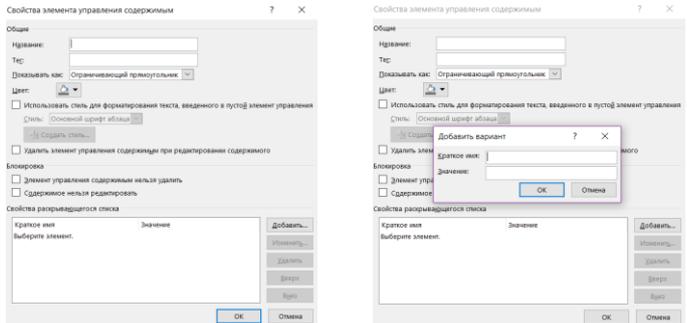5 Set the font size: 11 pt.

6 Insert a table: Insert tab → Tables group → Table → Insert Table → Number of columns (3) → Number of rows (25) → OK.

7 Fill in and format the table according to the example (Appendix A).

8   Add a tab to the ribbon: File tab → Preferences → Ribbon Settings → Ribbon Settings list: Developer → OK

9 Using Forms from previous versions, place text boxes, checkboxes, or combo boxes in the third column of the table as follows:

Columns	Field	Action
Last name, First name, Patronymic, Place of work, Address, e-mail, City, Street, Organization, Manager , TIN, Current account, Bank name	Field, textual ⁞abl	Developer tab → Controls group → Legacy Tools → click the Field button → click the Properties button 🗒 → in the window that appears, select Plain Text from the Type list → OK
Work phone, Home phone, Fax before the words **"yes"** , **"no"**	Flag ☑	Developer tab → Controls group → Legacy Tools → click the Checkbox button
Work phone, Home phone, Fax after the word "is"	Field, numeric ⁞abl	Developer tab → Controls group → Legacy Tools → click the Field button → click the Properties button 🗒 → in the window that appears, select Number from the Type list → OK
Postal money order receipt number. Postcode, House number	Field, numerical ⁞abl	Developer tab → Controls group → Legacy Tools → click the Field button → click the Properties button 🗒 → in the window that appears, select Number from the Type list → OK
Position (student. postgraduate student, intern, assistant, laboratory assistant, senior researcher, senior teacher, associate professor, professor). Academic degree (Candidate of Science, Doctor of Science), Title (Associate Professor, Professor, Academician, Corresponding Member)	Combo box 🗒	Developer tab → Controls group → Legacy tools → click the Combo box button → click the Properties button → in the window that appears, enter possible options in the List item field using the Add button → OK
Date of filling	Field, current date ⁞abl	Developer tab → Controls group → Legacy Tools → click the Text Box button → click 🗒 the Properties button in the window that appears, select Current Date from the Type list → OK

10 In the column next to the field named **Technical means required for demonstrating the report materials** provide the ability to enter a hint when filling out the form. Help should be displayed in the status bar when selecting a field or in a separate window when pressing the **F1 key** . To do this, on **the Developer tab** → **Controls** group → **Legacy Tools**

→ click **the Field button** → click **the Properties button** → in the window that appears, select **Plain text from the Type list** → click the **Help text button** → go to the **Status bar tab** → set the switch to **the Help text position** → enter the text " *Specify the necessary software for the presentation, as well as a list of technical equipment (laptop, projector, etc.)"* → go to the **Key tab F1** → set the switch to **Help text** → enter similar text → **OK** → **OK**

11 In the column next to the Report **Topic field** , provide a note with the following content: *"The report topic should not exceed 10 words . "*

12 Protect the created form: Review tab → Protection group → Restrict Editing → Allow only the specified method of editing the document → in the list, select Enter data into form fields → Yes, enable protection → enter a password.

13 Fill out the form data (Appendix B).

14 Save file: File tab → Save

15 Close a file: File tab → Close

Task 2 Create a template for a doctor's appointment ticket and a medical record

1 Create a new document: File tab → New → New Document → Create.

2 Save the file: File tab → Save → Documents \ form 2.docx → Save.

3 Set page options: Layout tab Page → Page Settings → Margins (top - 2 cm, bottom - 2 cm, left - 1.5 cm, right - 1.5 cm) → Orientation - portrait → Paper size - A5 → OK

a form (Appendix C and D).

5 Protect the created form.

6 Fill in the data.

7 Save the file: File tab → Save.

8 Close the file: File tab → Close

9 Quit Microsoft Word.

<div align="center">

Appendix A

(required)

APPLICATION FOR PARTICIPATION IN THE CONFERENCE

</div>

Participant [14]	Name	
	Name	
	Patronymic	
	Place of work	
	Position	
	Academic degree	
	Rank	
	Address	
	Working phone	there are No
	Home phone	there are No
	Fax	there are No
	e-mail	
	Postal money order receipt number	
	Report topic	
	Required for demonstration technical report materials means	
Organiz ation	Index	
	City	
	Street	
	House number	

	Organization (full name)	
	Manager (position, full name)	
	TIN	
	Current account	
	Bank name	
Date of filling		

Appendix B
(required)
APPLICATION FOR PARTICIPATION IN THE CONFERENCE

	Name	Biden
Participant [14]	Name	Inna
	Patronymic	Anatoliivna
	Place of work	ONU named after I.I. Mechnikov
	Position	Senior lecturer
	Academic degree	PhD
	Rank	Docent
	Address	57 Lunina Street
	Working phone	☒is +380934142458 ☐No
	Home phone	☐there are ☒No
	Fax	☐there are ☒No
	e-mail	balabadj@gmail.com
	Postal money order receipt number	2548547624
	Report topic	"Main characteristics of cyclopentaneperhydrophenanthrene"
	Required for demonstration technical report materials means	Laptop, multimedia projector
Organization	Index	65238
	City	Odesa
	Street	Olhiivska
	House number	4a
	Organization (full name)	Odessa National Medical University
	Manager (position, full name)	Professor, Johnsonyuk V.O.
	TIN	65857458
	Current account	2358 2145 8589 3258
	Bank name	"Private"
Date of filling		11.03.2022

4. Summing up :

During the study of the topic "Information systems in healthcare (MAX and hospital systems)", the structure and classification of medical information and hardware-computer systems, their purpose and functionality were considered . Students were introduced to the principles of building electronic medical records, document management systems, data protection methods and automation of a doctor's work. The practical part was devoted to creating and filling out electronic document forms in Microsoft Word, which made it possible to acquire skills in working with forms and input fields. The knowledge gained contributes to understanding the role of information technologies in increasing the efficiency of medical institutions.

List of recommended readings
Main:

1 Medical Informatics : textbook / I.Ye. Bulakh, Yu.Ye. Liakh, VP Martseniuk, I.Yo. Khaimzon. — 4 th edition. — Kyiv : AUS Medicine Publishing, 2018. — 368 p.

2. G.G. Shvachych, V.V. Tolstoy, L.M. Petrechuk, Y.S. Ivashchenko, O.A. Gulyaeva, O.V. Sobolenko Modern information and communication technologies: Textbook. - Dnipro: NMetAU, 2017. -230 p.

3. Medical informatics in modules. Practical course: practical course for medical (pharmacological) universities of the IV level of accreditation / I. Ye. Bulakh [and others]. ; edited by I. Ye. Bulakh ; NMU named after O. O. Bogomolets. – K.: Medicine, 2012. – 208 p.

4. Computer modeling in pharmacy: a manual for pharmaceutical faculties of universities of the Ministry of Health of Ukraine / I. E. Bulakh, L. P. Voitenko, I. P. Kryvenko. – Kyiv: Medicine, 2017. – 208 p.

Auxiliary

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2. Computers and computer technologies: teaching aids / Yu. B. Brodsky, K. V. Molodetska, O. B. Borysyuk, I. Yu. Grinchuk. – Zhytomyr: Publishing house "Zhytomyr National Agroecological University", 2016. – 186 p.

3. Pharmaceutical Encyclopedia. – Kh.: National University of Pharmacy: LLC "MOR I ON", 2016.

4. Workshop on information technologies in pharmacy [Electronic resource]: teaching aids for university students / S. V. Velma, N. M. Yatsenko, Yu. M. Penkin; National University of Pharmacy. – Kh.: National University of Pharmacy, 2016. F A 1.1-26-295

5. Information technologies in pharmacy: a manual for pharmaceutical universities and pharmaceutical faculties of medical universities of the IV level of accreditation / I. E. Bulakh, L. P. Voitenko, L. O. Kukhar; ed. I. E. Bulakh. – Kyiv: Medicine, 2008. – 224 p.

Electronic information resources

1. https://info.odmu.edu.ua/chair/pharmacognosy/files – website of methodological recommendations of the Department of Pharmacognosy of Odessa National Medical University.

2. www.uacm.kharkov.ua – Ukrainian Association "Computer Medicine"

3. http://www.drlz.com.ua/ – State Register of Medicinal Products of Ukraine

4. http://www.compendium.com.ua – Compendium, medicines

5. http://www.openoffice.org/ – official OpenOffice.org website

6. https://www.libreoffice.org/ – official LibreOffice.org website

7. www.medinfo.com.ua – medical search engine of Ukraine

8. https://tabletki.ua/uk/ – pharmaceutical search engine of Ukraine

9. https://allchemistry.info/services/onlayn-redaktor-himicheskih-formul – online editor of chemical formulas

10 http://www.apteka.ua – online newspaper "Apteka"

<p style="text-align:center">TOPIC
" Ethical and legal principles in the healthcare system "</p>

Objective: . To master skills regarding ethical and legal principles in the healthcare system . To know the basic concepts of information protection; the object of medical information protection; problems of organizing the protection of medical confidentiality. To be able to use means of electronic information protection; to carry out operations to protect personal information in electronic form.

Basic concepts:

Privacy is the right of an individual to control the storage, use, and disclosure of personal information. Privacy advocates insist that the individual be informed about how the information is to be disclosed.

Confidentiality is a tool for protecting confidentiality, which implies limiting access to information. The patient, trusting the doctor with confidential data, expects that this information will not be disclosed.

Protection is the means and methods of preventing accidental or intentional disclosure of information to third parties, as well as destructive actions and losses.

Data integrity - ways and methods of maintaining information in an accurate and complete form.

<p style="text-align:center">Plan:</p>

1. Control of the reference level of knowledge .

Question :

1. Medical information system as an object of protection
2. Problems of organizing the protection of medical confidentiality
3. Threats to information containing medical secrets
4. Problems of implementing complex protection systems
5. Classification of computer viruses.
6. File viruses and macro viruses – purpose and basic principles of action.
7. Network worms – principles of operation and possibilities of use for malicious actions.
8. Ways of infection with computer viruses.
9. The main ways to protect your computer from virus infection.
10. Classification of antivirus programs.
11. The most popular antivirus programs: Kaspersky Antivirus, Avast, DrWeb - functionality.
12. Prospects for using blockchain technologies to protect the medical information system

2. Discussion of theoretical questions to test basic knowledge on the topic

Essay topics:

1. Medical information systems as an object of protection: structure, functions and risks of data leakage.

2. Organizational and legal problems of ensuring the confidentiality of medical secrets in the digital age.

3. Information threats to medical data: risk analysis and ways to minimize them.

4. Implementation of comprehensive systems for protecting medical information resources: challenges and prospects.

5. Classification of computer viruses and their impact on the security of medical systems.

6. File and macro viruses: principles of action, ways of spreading and methods of protection.

7. Network worms as a tool for cyberattacks: mechanisms of operation and means of countermeasures.

8. Ways of infecting computers in medical institutions: causes of vulnerability and methods of prevention.

9. Modern methods of antivirus protection in medical information systems.

10. Comparative analysis of antivirus program classifications and their effectiveness.

11. Overview of the most common antivirus programs (Kaspersky, Avast, Dr.Web): advantages and limitations in the field of medicine.

12. Blockchain technology as an innovative tool for protecting medical data.

13. Cybersecurity in healthcare: challenges of digital transformation.

14. Ethical and legal aspects of protecting patients' personal medical data.

15. The role of artificial intelligence in detecting and preventing cyber threats in medical information systems.

3. Formation of professional skills .

Practical task
Creating and editing anonymous questionnaires in Google forms

1. Create an anonymous survey on the Google form platform on a topic of your choice (pharmacy, medicines, medicinal plants, your own version)

Requirement:

- Availability of the topic;
- from 10 questions;
- questions of different types (test with 1 correct option, test with several correct options, questions with text (line) and text (paragraph));
- The answers are mixed.

With Google Forms, you can create online surveys and quizzes and send them to other users.

Step 1. Create a survey or quiz

1. Go to forms.google.com .
2. Select "Empty file" + .
3. A new form will open.

Step 2: Edit and format your survey or quiz

You can add text, images, and videos to the form, as well as edit and format them.

4. Summing up :

The topic "Ethical and Legal Principles in the Healthcare System" is aimed at developing knowledge and skills in protecting medical information and maintaining the confidentiality of patient data. Students are introduced to the concepts of secrecy, confidentiality, data integrity and methods of information protection. Special attention is paid to the legal aspects of maintaining

medical confidentiality and cybersecurity in medicine. The practical part involves creating anonymous questionnaires in Google Forms as an example of safe work with data. The knowledge gained helps to understand the importance of ethics and legality in healthcare.

List of recommended readings
Main:

1 Medical Informatics : textbook / I.Ye. Bulakh, Yu.Ye. Liakh, VP Martseniuk, I.Yo. Khaimzon. — 4 th edition. — Kyiv : AUS Medicine Publishing, 2018. — 368 p.

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3. http://www.drlz.com.ua/ – State Register of Medicinal Products of Ukraine

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5. http://www.openoffice.org/ – official OpenOffice.org website

6. https://www.libreoffice.org/ – official LibreOffice.org website

7. www.medinfo.com.ua – medical search engine of Ukraine

8. https://tabletki.ua/uk/ – pharmaceutical search engine of Ukraine

<div align="center">

TOPIC

"Forecasting tools. Information technologies for functional approximation and forecasting of statistical data"

</div>

Objective: To master the skills of data approximation using various mathematical models using spreadsheet tools.

Basic concepts:

Linear approximation is an approximation using a linear function of the form $y = ax + b$. Its graph is a straight line. It is used in the simplest cases, when the data points are located close to a straight line.

Logarithmic approximation is an approximation using a function of the form $y(x) = a * \ln(x) + b$. It is used to describe quantities that initially increase or decrease rapidly and then gradually stabilize. Logarithmic approximation uses both negative and positive quantities.

Power approximation is an approximation using a function of the form $y(x) = a * x^{in}$. It is used to describe a monotonically increasing or monotonically decreasing quantity. Using power approximation is not possible if the data contains zero or negative values.

Exponential approximation is an approximation using a function of the form $y(x) = a * e^{b*x}$. It is used in cases where the rate of change of the data is continuously increasing. The use of exponential approximation is not possible if the data contains zero or negative values.

Polynomial approximation is an approximation using a polynomial function of the form $y(x) = a_n * x^n + a_{n-1} * x^{n-1} + \ldots + a_3 * x^3 + a_2 * x^2 + a_1 * x + a_0$, where a_n are coefficients, n is an integer.

<div align="center">

Plan:

</div>

1. Control of the reference level of knowledge .

Question :

    1. What is approximation? What is it used for?

    2. Approximation model. What types of function models are most often used to approximate empirical data?

    3. What types of approximation models (trend lines) are implemented in the spreadsheet processor?

LibreOffice Calc? Give their equations in general form.

    4. How to assess the reliability and quality of the approximation?

    5. What is the coefficient of determination? (Definition, formula for calculation, physical sense)

    6. What is a model residual? What are the residual values used for?

2. Discussion of theoretical questions to test basic knowledge on the topic

Essay topics:

    1. The concept of approximation and its role in scientific research and technical analysis.

    2. Methods of approximating empirical data: comparative characteristics.

    3. Mathematical approximation models: polynomial, exponential, logarithmic, and power functions.

    4. Practical application of approximation in pharmacy, biology and medicine.

    5. Analysis of errors in data approximation: sources and methods of minimization.

    6. Overview of the types of approximation models implemented in LibreOffice Calc.

7. Trendline construction in LibreOffice Calc: algorithm, model types and usage examples.

8. Methods for assessing the reliability and accuracy of approximation models.

9. Coefficient of determination as an indicator of approximation quality: essence and application.

10. The role of model residuals in determining the adequacy of the approximation.

11. Using graphical analysis of residuals to estimate model errors.

12. Comparing the effectiveness of different types of trend lines in forecasting data.

13. Approximation in spreadsheets: a comparative analysis of LibreOffice Calc and Microsoft Excel.

14. Using approximation models in machine learning and data processing.

15. Practical recommendations for choosing the type of function for approximating empirical dependencies.

3. Formation of professional skills .

Practical task
Approximation of experimental data in pharmaceutical research

Learn to use approximation methods to analyze pharmaceutical experiments, build graphs in Excel (or LibreOffice Calc), determine the coefficient of determination (R^2), and draw conclusions about the accuracy of the model.

Theoretical information:

In pharmacy, the approximation method is used to describe the relationships between various parameters of dosage forms, for example:

- the rate of dissolution of the drug depends on **the temperature** or **pH of the environment** ,
- enzyme activity from **substrate concentration** ,
- stability of the drug over **storage time** , etc.

Output data:

During the experiment, **the dependence of the dissolution rate of a paracetamol tablet** on **the pH of the medium was investigated** .

No.	pH of the medium (x)	Dissolution rate, mg/min (y)
1	1.2	1.8
2	2.0	2.5
3	3.5	3.6
4	5.0	5.1
5	6.8	6.4
6	7.4	7.0
7	8.0	7.2

Procedure for performing the work:

1. Open **Microsoft Excel** or **LibreOffice Calc** .

2. Enter the table data in two columns:
   - column X – pH of the medium,
   - column Y – dissolution rate.
3. Construct **a scatter plot (XY Scatter)** .
4. Add **a trendline** , sequentially selecting different types of approximation:
   - Linear
   - Exponential
   - Polynomial (2nd and 3rd order)
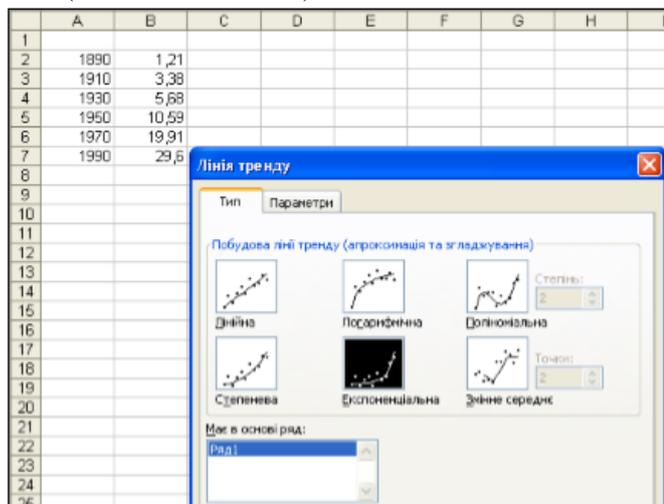
5. For each type of trend:
   - Plot **the model equations** on a graph;
   - Derive **the coefficient of determination (R²)** .
6. Determine which model most accurately describes the relationship between pH and dissolution rate (highest R² value).

Additional task (optional):
- Calculate the residuals (the difference between the experimental and predicted values).
- Plot the residuals and assess whether they are random.

The implementation report must contain:
1. The purpose of the work.
2. A table of source data.
3. Graphs with different types of approximation are constructed.
4. Model equations and R² values.
5. Conclusion on the most optimal approximation model.

4. Summing up :

During the practical session, students consolidated their skills in working with tabular data in Excel , learned to plot experimental dependences and select the optimal approximation model. Methods for determining the equation of the trend line and the coefficient of determination R2R^2 R2 were worked out , which allows assessing the accuracy of the model. The results obtained are of practical importance for pharmaceutical research, in particular when analyzing the kinetics of dissolution of medicinal substances. The acquired skills form the basis for the further use of statistical methods in pharmaceutical analytics.

List of recommended readings

Main:

1 Medical Informatics : textbook / I.Ye. Bulakh, Yu.Ye. Liakh, VP Martseniuk, I.Yo. Khaimzon. — 4 th edition. — Kyiv : AUS Medicine Publishing, 2018. — 368 p.

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8. https://tabletki.ua/uk/ – pharmaceutical search engine of Ukraine

9. https://allchemistry.info/services/onlayn-redaktor-himicheskih-formul – online editor of chemical formulas

10 http://www.apteka.ua – online newspaper "Apteka"

TOPIC

"Types of information systems in the field of healthcare. Hospital information systems and their development"

Objective: . To have in-depth knowledge in the field of information and communication technologies used in professional activities. To know the classification of operational information HCO ; types of information systems in the field of health care ; Types of hospital information systems . Possess skills in working with programs that store and model information in the field of healthcare .

Basic concepts:

Operational requirements - Health care workers—both educators and administrators—require detailed and up-to-date factual data to perform the day-to-day tasks that keep a hospital, clinic, or medical practice running the bread and butter tasks of the organization.

Planning needs - healthcare professionals also need information to make short-term and long-term decisions about patient care and organizational management.

Plan:

1. Control of the reference level of knowledge .

Question :

1. What are the basic requirements for information about medical organizations?

2. What are the clinical, financial, and administrative functions provided by a health care information system (HCIS), and what are the potential benefits of implementing such a system?

3. What changes in the healthcare delivery model have altered the scope and capabilities of HCISs over time?

4. What are the differences between business strategies and organizational structures, the impact of information systems, and choice?

5. What are the main challenges to implementing and managing HCISs?

6. What are some of the health care reforms, technological advances, and changing social norms that may impact HCIS requirements in the future?

2. Discussion of theoretical questions to test basic knowledge on the topic

Essay topics:

1. Basic requirements for information support for medical organizations: Analysis of regulatory, clinical and operational data requirements; data standardization to ensure interaction (interoperability).

2. Business strategies and organizational structures: The impact of a healthcare institution's organizational culture and business strategy on the selection, implementation, and success of a healthcare information system (HCIS).

3. The evolution of the healthcare delivery model: How the shift from episodic care to integrated, patient-centered models has changed the scope and functional requirements for HCIS.

4. HCIS Implementation and Management Challenges: An exploration of key challenges (from financial planning and staff training to change management and implementation resistance) in the process of implementing health information systems.

5.   The role of technological progress and social norms in shaping HCIS requirements: An analysis of the impact of healthcare reforms, the development of artificial intelligence (AI), and increasing data privacy requirements on future HCIS needs.

6.   Integration of clinical HCIS functions: A detailed review of functions aimed at supporting clinical decisions (electronic medical record, decision support systems, telemedicine) and their impact on the quality of care.

7.   Analysis of HCIS financial functions: Review of revenue management, billing, and service coding modules and their contribution to the financial sustainability of healthcare organizations.

8.   HCIS Administrative Functions and Workflow Optimization: Evaluation of functions that provide resource management, meeting scheduling, personnel management, and administrative cost reduction.

9.   Potential benefits of HCIS implementation: Assessment of direct (reduction of errors, paper savings) and indirect (improved treatment outcomes, patient satisfaction) benefits of an integrated healthcare system.

10. HCIS interoperability: The challenge of exchanging medical data between different information systems and the role of international standards (HL7, DICOM) in ensuring continuity of care.

11. Impact of healthcare reforms on HCIS requirements: How changes in legislation (e.g., the shift to payment for quality rather than volume of services) shape the demand for new analytical and reporting capabilities of HCIS.

12. Technological innovations and their place in the HCIS of the future: The role of mobile applications, cloud technologies, machine learning and personalized medicine in the development of HCIS.

13. Ethical and legal aspects of HCIS management: Regulatory requirements for the confidentiality and security of patient data (using the example of legislation in different countries) and the responsibility of medical organizations.

14. Comparative analysis of HCIS architectures: Assessing the advantages and disadvantages of centralized, decentralized, and cloud-based models of healthcare information systems architecture.

15. The role of Big Data and analytics in HCIS: Using big data collected by the system to predict epidemics, manage risks, and optimize clinical protocols.

3. Formation of professional skills .

Practical task
International Statistical Classification of Diseases and Related Health Problems

To familiarize yourself with the content of the ICD-10 Classification of Diseases. To analyze the structure and content.
Sequence of actions to complete the task:
- download MS Word, create a new text document and save it as KOD,
- save the file **Save as** select drive **D** (Work) create a folder for your group, enter the file name **Save** ,
Fill in the table using the codes from the matrix provided below. The option corresponds to the student's list number in the group.

International Statistical Classification of Diseases and Related Health Problems, 10th Revision

Website: https://e-mis.com.ua/mkx-10

Official website: https://icd.who.int/browse10/2016/en

Fig. 1 Home page

Fig. 2 Disease search and example of filling in the table
(1- Section, 2 – Title, 3- Blocks, 4 – Code number, 5 – Disease)

Table 1

No.	Section	Name	Bloc	Code number	Disease
1	XIII	Diseases of the musculoskeletal system and connective tissue	M65-M68	M66.2	Spontaneous rupture of extensor tendons
	XIII	Musculoskeletal and connective tissue diseases	M65-M68	M66.2	Spontaneous rupture of extensor tendons
2					
3					
4					
5					
6					
7					
8					
9					
10					

ICD-10 Coding Matrix

No.	Code									
	1	2	3	4	5	6	7	8	9	10
1	M66.2	G71.1	F63.1	D81.9	L30.0	G00.1	D81.4	F33.0	N31.2	L30.4
2	F23.2	K38.8	E22.0	M87.0	N64.8	D61.3	H31.1	G71.9	F33.8	A31.1
3	N18.5	G00.3	E22.1	F63.2	N64.9	G00.9	F33.9	D81.5	H31.3	B18.2
4	Y74.8	F23.8	K38.9	M87.1	L30.1	F72.9	G25.8	H31.2	N31.8	L30.8
5	D03.7	F33.2	E22.2	M87.2	F72.1	D61.8	H31.9	G25.5	N61	A31.8
6	J34.2	G71.0	F23.3	M87.3	N64.5	H31.4	F63.9	D81.6	N64.0	B16.0
7	O33.5	D61.0	G71.2	F33.1	L30.2	D61.9	K38.1	G25.6	B18.8	L30.9
8	Q85.8	D61.1	K38.2	F72.8	N64.4	G20	D81.2	M87.9	N31.9	A31.9
9	L53.2	F23.2	G71.3	N64.3	A31.0	D81.0	F63.3	D81.7	N64.1	B18.1
10	G71.3	D61.2	F33.4	G00.8	L30.3	G22	D81.1	G25.4	B16.1	B16.9
11	F33.3	G25.9	E22.8	M87.8	N31.0	G25.2	H31.8	D81.8	G00.2	B18.0
12	F72.0	G71.8	E22.9	N31.1	F23.9	G25.3	D81.3	K36	N64.2	B16.2
13	G00.1	D81.4	F33.0	N31.2	L30.4	M66.2	G71.1	F63.1	D81.9	L30.0
14	D61.3	H31.1	G71.9	F33.8	A31.1	F23.2	K38.8	E22.0	M87.0	N64.8
15	G00.9	F33.9	D81.5	H31.3	B18.2	N18.5	G00.3	E22.1	F63.2	N64.9

4. Summing up :

The lesson focused on mastering the theoretical foundations of classification and coding of information in the field of medicine and pharmacy. Types of codes and requirements for building classification systems were studied, as well as their history (including "Enigma"). International classifiers (ICD-10, SNOMED), necessary for the work of a pharmacist, and analyzed national systems in Ukraine. The practical part consolidated the skills of online search and analysis of the

structure of diagnostic codes according to the ICD-10 system. The main goal is to form the ability to use these tools for structuring and archiving professional information.

List of recommended readings
Main:

1 Medical Informatics : textbook / I.Ye. Bulakh, Yu.Ye. Liakh, VP Martseniuk, I.Yo. Khaimzon. — 4 th edition. — Kyiv : AUS Medicine Publishing, 2018. — 368 p.

2. G.G. Shvachych, V.V. Tolstoy, L.M. Petrechuk, Y.S. Ivashchenko, O.A. Gulyaeva, O.V. Sobolenko Modern information and communication technologies: Textbook. - Dnipro: NMetAU, 2017. -230 p.

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8. https://tabletki.ua/uk/ – pharmaceutical search engine of Ukraine

9. https://allchemistry.info/services/onlayn-redaktor-himicheskih-formul – online editor of chemical formulas

10 http://www.apteka.ua – online newspaper "Apteka"

TOPIC

"Individual medical records. Structuring the content of electronic medical records (EMC)."

Objective: To have in-depth knowledge in the field of information and communication technologies used in professional activities. To know the main programs of medical information systems used in Ukraine.

Basic concepts:

Helsi is a fully functional system for managing a medical institution. The system's functionality is developed and adapted taking into account the specifics of the work and requirements of the Ministry of Health, and is free of charge for government institutions.

EMSiMED® — developed in accordance with ISO and Ministry of Health of Ukraine standards, provides technical information protection, contains modules: patient's electronic medical record, medical documents (medical registration forms of the Ministry of Health), medical personnel, polyclinic and registry, hospital, laboratory (integration of laboratory equipment), warehouse and personalized medication accounting, Ministry of Health statistics and reports, services, contact center, PACS, partners, online doctor's appointment, patient's mobile application.

Doctor Elex is the most widespread medical system in Ukraine, operating since 2005. As of 2018, it maintains electronic records of more than 5 million patients. The system automates key processes of a medical institution, including maintaining electronic medical records, generating management reporting and documentation in accordance with the requirements of the Ministry of Health.

MEDSTAR is a cloud-based medical information system that meets the requirements of the KSHI. All functionality for working with the central eHealth component within the framework of the reform is free. The system contains an electronic medical record, a patient registration module, an electronic prescription and drug directory, the ICD-10 classifier, treatment protocols, approved printed forms, and more. As of 2018, the Medstar MIS is already operating in 5 regions of Ukraine for more than 800 doctors.

Health24 is a fully functional cloud-based MIS that combines functional services that ensure the work of a doctor and a medical institution in accordance with existing medical document flow standards.

nHealth is a browser application that allows you to register primary health care facilities, departments and personnel of primary health care facilities, and sign declarations with patients. The program includes work with the patient database, information support for doctors regarding diseases, complaints, and further treatment of patients. Document management meets the requirements of the Ministry of Health of Ukraine.

Plan:

1. Control of the reference level of knowledge .

Question :

1. What groups can MIS be divided into depending on the type of tasks being solved?
2. Depending on the type of information base, MIS are divided into:
3. What medical information systems are registered in Ukraine?
4. What do factual information retrieval systems contain?
5. What is the information support of the medical information system (MIS)?
6. Information support for the MIS consists of:

7. What is the purpose of a medical hardware-computer system?

8. Name typical representatives of a medical hardware-computer system.

9. According to their functionality, medical hardware and computer systems are divided into:

10. By purpose, medical hardware and computer systems are divided into…

2. Discussion of theoretical questions to test basic knowledge on the topic

Essay topics:

1. Functional classification of MIS: Division of medical information systems depending on the type of tasks being solved (clinical, administrative, financial, scientific) and examples of their use.

2. Classification of MIS by type of information base: Analysis of the division of systems into factual, documentary, and database management systems (DBMS), and their place in medical practice.

3. Factographic information retrieval systems in medicine: A detailed study of the structure and content of such systems (e.g., registries, laboratory databases) and their role in decision-making.

4. Register of Medical Information Systems of Ukraine: Overview and analysis of the main MIS registered and implemented in medical institutions of Ukraine, their features and functionality.

5. Information support MIS: The concept, structure and components of information support (classifiers, dictionaries, directories, standards) that form the basis of the operation of any medical system.

6. Purpose and role of MACS in modern diagnostics: Justification of the need for medical hardware and computer systems to automate the processes of collecting, processing and interpreting physiological data.

7. Typical representatives of MAX: A detailed overview of common hardware and computer systems in various fields of medicine (ECG complexes, computed tomography scanners, ultrasound scanners).

8. Functional classification of MAX: Division of systems by functionality (diagnostic, monitoring, therapeutic) and implementation examples.

9. Classification of MAX by purpose: Division of systems by clinical area of application (cardiology, neurology, pulmonology, laboratory diagnostics) and their specialized requirements.

10. Integration of MAKS with MIS: Problems and prospects of combining medical hardware and computer systems with the general medical information system of the clinic (using the example of DICOM and HL7 standards).

11. Components of MIS information support: In-depth analysis of the components of information support (regulatory and reference information, clinical protocols, patient databases) and the mechanism for their updating.

12. Features of the formation of factual databases in MIS: Methods of collecting, structuring and storing quantitative and qualitative medical facts (laboratory results, drug doses, diagnoses).

13. The role of classifiers and coders in MIS: Using international (ICD, LOINC) and national classifiers to ensure standardization of medical data.

14. Monitoring MACS: Purpose, functional requirements and use of hardware and computer systems for continuous monitoring of patient condition (e.g. in intensive care units).

15. Historical development and modern challenges of MAKS: An overview of the evolution of medical hardware-computer systems, from simple ECG devices to modern intelligent diagnostic complexes, and the problems of their cybersecurity.

3. Formation of professional skills .

Practical task
Overview of popular medical apps

1. **Introduction to the task** :
  ➢ Students should find and analyze 3-5 popular mobile apps for monitoring health or taking medication.
  ➢ The main focus is on the functionality of the applications, how they help control medication intake or monitor health indicators (blood pressure, blood sugar levels, physical activity).
2. **Stages of implementation** :
  ➢ **Search for mobile apps** :
  ✓ Students can find apps through app stores (Google Play, App Store) or online reviews. Queries might include "best health monitoring apps" or "medication reminder apps."
  ✓ Examples of apps for research: **MyTherapy** , **Medisafe** , **Pill Reminder** , **Google Fit** , **Apple Health** Fig. 1
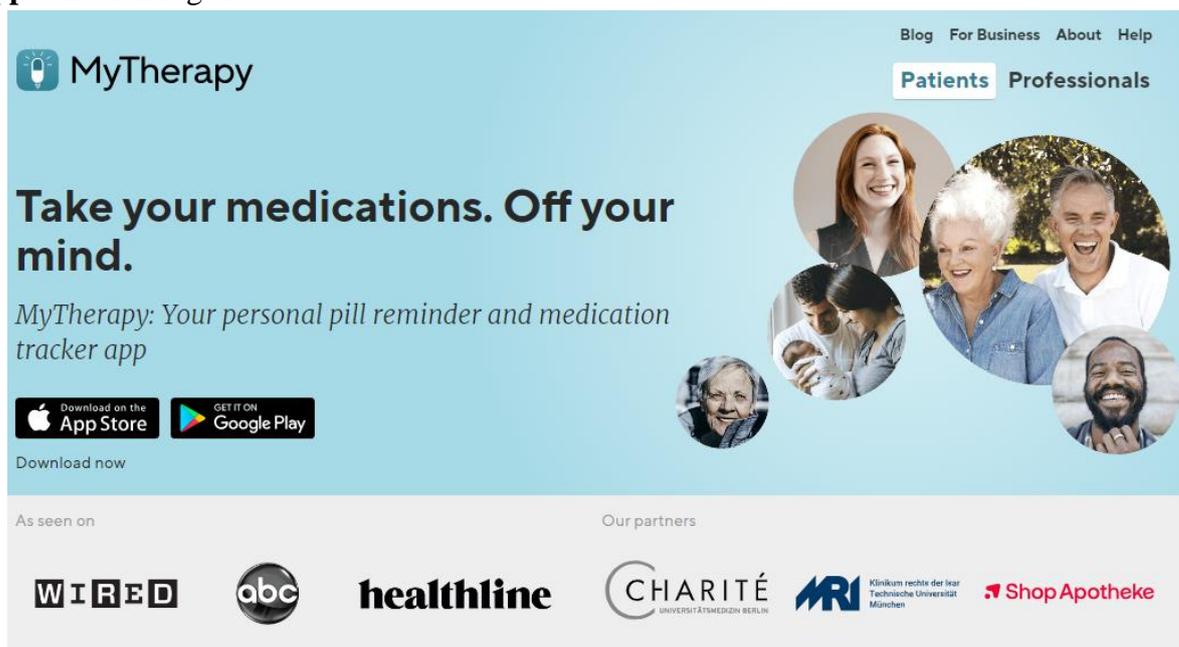

Fig. 1. MyTherapy app homepage

  ➢ **Overview of main functions** :
  ✓ Students should research what features each app offers:
    ✧ **For health monitoring applications** : the ability to measure and track indicators (heart rate, blood sugar, blood pressure, sleep), recommendations for a healthy lifestyle.
    ✧ **For medication reminder apps** : setting reminders for medication times, recording and monitoring appointments, and the ability to track multiple patients or medications at once.
  ➢ **Usability rating** :
  ✓ Students should test the interface of each application:

◇ Is it easy to customize your profile, add new data such as medications or health indicators?

◇ Is there support for different languages, including Ukrainian?

◇ How intuitive is the user interface?

◇ Are reports or graphs available to track progress?

➢ **Assessment of additional capabilities** :

✓ Students should evaluate the availability of additional features, such as synchronization with other devices (e.g., fitness trackers or smartwatches), integration with electronic medical records, or the ability to share data with a doctor.

✓ Is there a reminder function via SMS or email? Does the app work offline?

3.   **Report on work performed** :

➢ After testing each application, students must prepare a short report (1-2 pages).

➢ The report must include:

✓ The name and platform (Android, iOS) of each app.

✓ Description of main functions and capabilities.

✓ Evaluation of usability and interface.

✓ Comparison of applications and conclusions regarding their usefulness for different user groups (patients, pharmacists, doctors).

4.   **Conclusions** :

➢ At the end of the report, students should conclude which of the apps is most useful for monitoring health or managing medication.

➢ Indicate which app they would recommend for use in daily practice or for patients with chronic conditions.

4. Summing up :

The result of the work was a deep assimilation of knowledge about the structuring of electronic medical records (EMC) as a central element of modern digital healthcare and familiarization with key national MIS (in particular, Helsi, Doctor Eleks, MEDSTAR), which are integrated with the eHealth system. The classification of MIS (by tasks solved and type of information base, including factographic systems) and MAKS (by functionality and purpose) was mastered. Knowledge control covered the purpose and typical representatives of hardware and computer systems, as well as components of information support (classifiers, dictionaries). The practical application of ICT is consolidated by a review of mobile applications for health monitoring and medication management, which confirms the importance of the acquired knowledge for professional activities.

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TOPIC
"Information resources of the health care system"

Goal: To have in-depth knowledge in the field of information and communication technologies used in professional activities

Basic concepts:

A local area network (LAN) is a distributed data processing system, a collection of computers, cables, and network adapters that operates under the control of a network operating system and application software.

IP (Internet Protocol) is a network layer protocol that provides packet transmission service between network nodes;

TCP (Transmission Control Protocol) is a connection-oriented transport layer protocol that ensures reliable packet transmission.

Acronym Finder - The largest and most comprehensive reference database of acronyms and abbreviations, containing over 1 million abbreviations and their meanings. Allows you to search or browse abbreviations by the following categories: information technology, military and government, business and finance, science and medicine, organizations and schools, slang and pop culture.

African Index Medicus - Bibliographic database of journal articles and literature published in Africa. This international index of African literature and information sources in the field of health was created by the World Health Organization in collaboration with the Association for Medical Information and Libraries in Africa.

AHFS Consumer Medication Information (EBSCO) - The authoritative source and recognized standard for patient medication information, available in English and Spanish. Published by the American Healthcare Pharmacists Society (AHFS), the resource includes more than a thousand monographs with drug information in consumer-friendly language.

Bio One - Full-text database of publications in the fields of biology, biochemistry, ecology and environmental sciences. Contains 200 titles.

Plan:
1. Control of the reference level of knowledge .
Question :

1) What are the types of computer networks and their main basic topologies?
2) What are the main services of the Internet?
3) What is a hypertext link?
4) How is data searched on the Internet using a browser?
5) What is email?
6) What parts does an email address consist of?
7) What is a Webinar?

2. Discussion of theoretical questions to test basic knowledge on the topic
Essay topics:

1. Classification of computer networks by scale: Detailed analysis and comparison of LAN, MAN, and WAN networks, their applications, and equipment requirements.

2. Basic network topologies: Comparative analysis of star, bus, ring, and mesh topologies: advantages, disadvantages, and optimal usage scenarios.

3. Network devices and communication principles: The role of routers, switches, and network cards in building local and global networks.

4. IP addressing and the Domain Name System (DNS): The principles of operation and interaction of IP addresses and domain names to provide routing on the Internet.

5. Basic Internet network services: Research and functional purpose of the World Wide Web (WWW), File Transfer Protocol (FTP), and their place in modern network communication.

6. The principle of functioning of the WWW and hypertext links: Mechanisms of the HTTP protocol, the concept of URL and hypertext link technology as the basis of web navigation.

7. Technologies for searching for information on the Internet: Search engine algorithms (indexing, ranking), browser functions, and effective data search strategies.

8. E-mail: Architecture, transmission protocols (SMTP, POP3, IMAP) and detailed analysis of the components of an e-mail address.

9. Webinars and remote interaction technologies: Analysis of platforms, tools and their applications in online education, business and distance medicine (telemedicine).

10. Email cybersecurity: Threats (spam, phishing, viruses) and methods for protecting email correspondence.

11. Transmission Control Protocol/Internet Protocol (TCP/IP): The role and functions of the underlying protocols that enable reliable information exchange on the Internet.

12. Wireless networks (Wi-Fi): Standards, architecture, and security challenges of wireless local area networks.

13. Cloud Computing: Basic service models (SaaS, PaaS, IaaS) and their dependence on network infrastructure.

14. Internet of Things (IoT) and its impact on network topologies: Features of building networks to connect intelligent devices in various areas.

15. Network traffic management and quality of service (QoS): Data prioritization mechanisms to ensure stable operation of critical network services.

3. Formation of professional skills .

Practical task
Getting to know the interface of the medicine search portal

Tabletki.ua is a Ukrainian online service that provides information about the availability of medicines and other pharmaceutical products in pharmacies; has a catalog of instructions for using medicines, and also provides the opportunity to search for and reserve medicines in pharmacies online.

The site provides a platform for searching and reserving medicines, as well as products sold in pharmacies. When reserving, the pharmacy has the opportunity to provide the user with a discount.

At the beginning of 2019, 5,400 pharmacies across Ukraine were connected to the service.

The monthly number of visits exceeds 20 million.

The site's data is considered relevant for comparative research on the pharmaceutical market.

Website: https://tabletki.ua/

TASK

On the Tabletki.ua website, search for the specified medicines by variant (*the variant corresponds to the student's number in the group list*):

Version	Name of the medicinal product
1	Fucis, Nimesil granules, Mydocalm, Suprastin.
2	Trichopol, Solpadein active, Muscomed, Edem
3	Biseptol, Tempalgin tablets, Novocaine-Darnitsa, Tavegil.
4	Terbinafine, Citramon-Darnitsa, Sirdalud, Aleron
5	Lamifen, Affida Fort-Nimesulide, Baclofen, Siofor 1000
6	Streptocide, Nurofen forte, Lidocaine spray, Glucophage
7	Sumetrolim, Copacil, Claritin, Diaformin
8	Bactrim, Citropak-Darnitsa, Immunoflazid syrup, Papazol
9	Lacrimation, Tamipul, Laferobion drops, Riabal
10	Optix, Mefenamin, Imusat tablets, Spazmalgon
11	Visital, Panadol, Laferomax, Drotaverin
12	Heferol, Imet tablets, Echinacea tincture, Novigan
13	Gino-Tardiferon, Paracetamol, Remavir, Dibazol-Darnitsa
14	Maltofer, Combispasm, Esberitox tablets, Andipal-B
15	Aktiferrin, Novigan, Arbivir-Zdorovya Forte, Renalgan
16	Pharmaton, Nalgesin, Glutoxim solution, Spazgo
17	Ginsomin, Eurofast, Lavomax tablets, No-x-sha
18	Vigor solution, Efferalgan, Ingavirin, Reonalgon
19	Pantocrin, Kofalgin, Viferon-Feron, Trigan-D
20	Ginseng, Ibufen junior, Arbimax, Tyzalud
21	Rimantadine, Farmadol, Calcemin silver, Brufen
22	Eleutherococcus Extract, Tetramol, Tsinkeral, Piaron
23	Calcium-D3 Nycomed, Brustan, Nazoferon drops, Ascopar
24	Osteocaea, Pyatirachtka IC, Amiksin IC, No-shpa
25	Lyrica, Metamizol, Glutargin, Hepacef Combi.
26	Furosemide, Paracetamol, Amoxil, Ampicillin
27	Omeprazole, Triacutan, Amizon Max, Augmentin
28	Dalacin N, Nimesil, Lyra, Erius
29	Nitroglycerin, Valsartan, Ketolong, Enalapril
30	Metformin, Pregabalin, Analgin amp, Lidocaine amp

I. Generate a report based on the following criteria:

1. Instructions for the drug

- Composition;
- Dosage form;
- Pharmacotherapeutic group;
- Pharmacological properties (brief description);
- Indications for use;
- Contraindications to use;
- Overdose;
- Producer.

2. Analyze the pricing policy of medicines using the example of your city (*3 pharmacies*).

No.	Name of the drug;	Release form, dose;	Quantity per package	Pharmacy name, address	Operating mode	Price of the drug	Online pharmacy, website, price
1							
2							
3							
4							

Save the document as "Tabletki P.I.B."

4. Summing up :

The class focused on the structuring of Electronic Medical Records (EMC) as the basis of digital medicine and an overview of key Ukrainian MIS (Helsi, Doctor Eleks, MEDSTAR) integrated with eHealth. The classifications of Medical Information Systems (by tasks and databases) and Hardware and Computer Systems (MACS) by functionality and purpose were thoroughly mastered. The theoretical block covered the fundamental principles of network technologies (types of networks, topologies, TCP/IP protocols) and basic Internet services (hypertext, e-mail). An important element was familiarization with specialized information resources for scientific activities (African Index Medicus, Bio One) and their application. The practical part consolidated skills in working with the pharmaceutical portal Tabletki.ua, where students practiced searching for detailed instructions and analyzed the pricing policy of medicines. As a result, the class provided a deep understanding of ICT tools (from MIS to mobile applications) necessary for the effective professional activities of a medical professional.

List of recommended readings

Main:

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TOPIC
"Automated pharmacist's workplace. Pharmacist's software. "PC Pharmacy" "

Objective: . To have in-depth knowledge in the field of information and communication technologies used in professional activities. To know the basic terminology of the hardware of the pharmacist's workplace. To be able to use the hardware of the pharmacist's workplace.

Basic concepts:

POS terminal (Point of Sale) Of Sale) is a hardware and software complex in which all peripheral devices of the workstation are integrated.

Prepared Prescription Doors (PPD) To further enhance efficiency, recipes that have already been filled can be returned to the specially designed, pre-filled recipe dispenser doors.

Plan:

1. Control of the reference level of knowledge . Questions to check basic knowledge by topic of the lesson :

1. What does RoboWall consist of ?
2. What are the main RoboWall options you know?
3. What are OTCs used for? Module ?
4. What is "vending"?
5. What is the Rowa pharmacy mini-warehouse? Vmax ?

2. Discussion of theoretical questions to test basic knowledge on the topic
Essay topics:

1. The Pharmacy of the Future Concept: The role of robotics (such as Rowa) in improving efficiency, accuracy, and quality of customer service.
2. Benefits and cost-effectiveness of implementing robotics in the pharmacy business: Return on investment (ROI) analysis when using automated drug storage and dispensing systems.
3. Challenges and issues of integrating pharmacy robots: Difficulties in installation, maintenance, staff training, and integration with existing MIS (medical information systems).
4. Vending in pharmacy: Concept, operating principles and legal aspects of using automated devices for dispensing over-the-counter (OTC) medications.
5. RoboWall structure and main components: A detailed review of the hardware that makes up the RoboWall automated system (robotic manipulator, storage modules, interface).
6. RoboWall basic and additional options: Analysis of the system's functionality: from simple storage and dispensing to expiration management and intelligent sorting.
7. Purpose and functionality of the OTC Module: Using the module for automated dispensing of over-the-counter drugs (Over-the-Counter), its impact on the speed of service.
8. RoboWall interface and interaction with the client: Features of the user interface that ensure fast and error-free search and dispensing of medications.
9. Structure and principles of operation of the Rowa Vmax pharmacy mini-warehouse: Analysis of the internal architecture (shelf system, robotic arm) and storage mechanisms.
10. Storage optimization technologies in Rowa Vmax: Methods used to minimize space, increase access speed, and ensure inventory control.
11. Expiration and Lot Tracking Management with Rowa Vmax: The role of robotics in preventing the sale of expired drugs and quickly recalling substandard batches.

12. Integration of Rowa Vmax with the pharmacy's internal MIS: Study of protocols and data exchange mechanisms between the robotic system and accounting software.

13. Comparative analysis of RoboWall and Rowa Vmax: Evaluation of two different approaches to automation (front office vs. mini-warehouse) and scenarios for their optimal use.

14. The future of pharmacy robotics: Forecasting development, integrating artificial intelligence, and expanding the functionality of pharmacy robots.

15. Robotization of inventory and accounting processes in a pharmacy: How robotic systems minimize the human factor and ensure the accuracy of medication accounting.

2. Formation of professional skills and abilities .

Practical task
Basics of working in the PC interface "Pharmacy"

I. Sale by Check
Start - Movement - "Expense check +"

1. Red plus - new check document.

2. Please note:

a. At the top, after the blue cross, is the number of the current check (CHE-0000020), you can open several checks at once (to do this, switch to the "expense-check" tab and create another one)

b. Under the buttons are two tabs - "content" and "defect". To sell, you need to be in the "content" tab (this is the default).

c. There is an input field at the top - here you can enter the name and scan the barcode. INN button - if you are searching by active substance.

d. In the upper half of the screen - the pharmacy balance, In the lower half of the screen - the contents of the receipt.

3. Optionally, it can display the synonyms panel and the indirect synonyms panel. Turn on/off using the keyboard shortcut Alt + S, Alt + A. With all panels enabled, the expense check looks like this:

Where in the middle are additional panels.

2. To sell a product, find it, position it on the desired line (if necessary), and press Enter:

2. We indicate:

a. Quantity is the number of whole packages

b. Fractional quantity is the number of blisters you sell

c. The divisor is the total number of blisters in the complete package.

d. In the example above, two blisters are sold from a package that originally had six blisters. (Two out of six).

3. Now in the table of contents (below) we see:

a. That is, with the price of a full package of 74.15, the cost of two blisters out of six is 24.72.

2. Add the remaining goods to the contents of the check

3. Click the green arrow (or F9), the following appears:

2. In the example above, we indicated that the buyer gave us 30 UAH, we give change and click OK - the check is printed and a new check with the next number is automatically created.

3. If a payment card is used for payment, then the payment type is indicated as "payment card". The program does not interact with the payment terminal.

4. Jackdaw "don't clean the filter":

a. If it is set, the remaining items according to the entered filter will be displayed continuously until you erase what you typed in the search field. This helps when you need to type several similar names into a check (syringes, for example).

2. If you need to force the second form to be sent to the fiscal device, then press the key combination "Ctlr + Alt + F9"

II Analysis of Check Expense
Start - Analysis - "Analysis: Expense check"

1. If necessary, select the date from / to (by default for the current day), and create a green arrow on top - we see the pharmacy's revenue.

2. Select:

a. On the "Summary of Contents" tab - all medications that have been sold

b. "Document" - list of checks

c. Contents - the contents of the check, highlighted in the previous tab

3. After clicking on the green arrow after clicking on the printer icon, we get access to additional reports:

1. We can also change the parameters:

After changing the settings, you need to press the green button again.
Most other reports work similarly.

4. Summing up :

The lesson provided a deep understanding of the functionality of the PC "Pharmacy" and its key modules ("Movement", "Order", "Directories"), necessary for the automation of the pharmacist's work. Students mastered working with the interface, including the use of icons ("Red plus", "Open book"), display settings and effective sorting of tabular data. The key practical skill was the detailed formation of a payment receipt (sale, taking into account fractional quantities, accepting different types of payment). An understanding of the fiscal and legal significance of a receipt and its mandatory elements in trade was consolidated. Special attention was paid to analytical work - creating reports ("Analysis: Expense-receipt") to assess revenue, sold medicines and effectively control balances. The goal was achieved: the skills were formed to confidently use specialized software to perform all basic operations of the pharmacist's workstation

List of recommended readings
Main:

1 Medical Informatics : textbook / I.Ye. Bulakh, Yu.Ye. Liakh, VP Martseniuk, I.Yo. Khaimzon. — 4 th edition. — Kyiv : AUS Medicine Publishing, 2018. — 368 p.

2. G.G. Shvachych, V.V. Tolstoy, L.M. Petrechuk, Y.S. Ivashchenko, O.A. Gulyaeva, O.V. Sobolenko Modern information and communication technologies: Textbook. - Dnipro: NMetAU, 2017. -230 p.

3. Medical informatics in modules. Practical course: practical course for medical (pharmacological) universities of the IV level of accreditation / I. Ye. Bulakh [and others]. ; edited by I. Ye. Bulakh ; NMU named after O. O. Bogomolets. – K.: Medicine, 2012. – 208 p.

4. Computer modeling in pharmacy: a manual for pharmaceutical faculties of universities of the Ministry of Health of Ukraine / I. E. Bulakh, L. P. Voitenko, I. P. Kryvenko. – Kyiv: Medicine, 2017. – 208 p.

Auxiliary

1. Forkun Y. V. Informatics: a textbook. / Y. V. Forkun, N. A. Dlugunovich. - – Lviv: Publishing house "Novyi svit – 2000", 2018. – 464 p.

2. Computers and computer technologies: teaching aids / Yu. B. Brodsky, K. V. Molodetska, O. B. Borysyuk, I. Yu. Grinchuk. – Zhytomyr: Publishing house "Zhytomyr National Agroecological University", 2016. – 186 p.

3. Pharmaceutical Encyclopedia. – Kh.: National University of Pharmacy: LLC "MOR I ON", 2016.

4. Workshop on information technologies in pharmacy [Electronic resource]: teaching aids for university students / S. V. Velma, N. M. Yatsenko, Yu. M. Penkin; National University of Pharmacy. – Kh.: National University of Pharmacy, 2016. F A 1.1-26-295

5. Information technologies in pharmacy: a manual for pharmaceutical universities and pharmaceutical faculties of medical universities of the IV level of accreditation / I. E. Bulakh, L. P. Voitenko, L. O. Kukhar; ed. I. E. Bulakh. – Kyiv: Medicine, 2008. – 224 p.

Electronic information resources

1. https://info.odmu.edu.ua/chair/pharmacognosy/files – website of methodological recommendations of the Department of Pharmacognosy of Odessa National Medical University.

2. www.uacm.kharkov.ua – Ukrainian Association "Computer Medicine"

3. http://www.drlz.com.ua/ – State Register of Medicinal Products of Ukraine

4. http://www.compendium.com.ua – Compendium, medicines

5. http://www.openoffice.org/ – official OpenOffice.org website

6. https://www.libreoffice.org/ – official LibreOffice.org website

7. www.medinfo.com.ua – medical search engine of Ukraine

8. https://tabletki.ua/uk/ – pharmaceutical search engine of Ukraine

TOPIC
" Basics of Cybersecurity in Pharmaceutical Activities "

Goal: To master the fundamental principles of protecting medical and pharmaceutical information (EMC, personal data of patients) in accordance with the requirements of the law. To learn to identify the main cyber threats (phishing, encryption viruses) and apply basic organizational and technical cybersecurity measures in the workplace of a pharmacist.

Basic concepts:

- **CIA Triad:** Confidentiality, Integrity, Availability.

- **Patient personal data:** Definition and features of protection.

- **Cyber threats:** Phishing, Ransomware, DDoS attacks, Insider threats.

- **Authentication and Authorization:** Difference and Strengthening Methods (MFA).

- **Encryption:** Principles for protecting data stored and transmitted.

- **Backup:** Protocols and importance for recovery.

      .

Plan:

1. Control of the reference level of knowledge .
Question :

- Name the three key components **of the CIA Triad** .

- What law of Ukraine regulates the processing of personal data?

- What is **phishing** and how can you recognize it in an email?

- What is the role **of encryption** in protecting patient data transmitted over the network?

- Why is **ransomware** the biggest threat to pharmacy data **availability ?**

2. Discussion of theoretical questions to test basic knowledge on the topic
Essay topics:

1. • **GDPR and HIPAA:** Comparative analysis of health information protection requirements and their impact on Ukrainian pharmacy.
2. • **Multi-factor authentication (MFA)** methods and tools in pharmacy information systems.

3. • Organizational cybersecurity measures: Development of **a "Clean Desk" Policy** and rules for the use of removable media (USB).
   4. .

3. Formation of professional skills and abilities .

Practical task

Risk analysis and response protocol development

Objective: To learn how to develop safety rules for a typical pharmacist's workplace.

Scenario: Analyze risk situations and propose specific actions (technical or organizational) to address them.

Risk situation	Violation of the CIA principle	Threat	Pharmacist Action Required / Safety Protocol
The pharmacist walked away from the computer, leaving the accounting system open.	Confidentiality, Integrity	Unauthorized access / Data modification.	**Automatic locking** of the workstation after 3 minutes; **Organizational protocol:** Always lock the PC when leaving.
The pharmacy received an email asking them to urgently click on the link to "confirm license details."	Privacy	Phishing / Credential Theft.	**Protocol:** Do not click on the link; Check the sender's address; Notify the system administrator.
The pharmacy uses one simple password ("123456") for all accounts.	Privacy	Brute force attack / Insider threat.	**Technical solution:** Implement **MFA** ; Set password requirements (minimum 12 characters, upper/lower case letters, numbers).
The electronic prescription database is stored only on the pharmacy's local server and nowhere else.	Accessibility	Ransomware / Fire / Equipment Failure.	**Organizational protocol:** Implement **"3-2-1"** backup (3 copies, on 2 different media, 1 copy remotely).

Export to Spreadsheet

4. Summing up:

Discussion of the results of the practical task. Emphasis on the fact that **the human factor** remains the weakest link in the cybersecurity chain.

4. Summing up :

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8. https://tabletki.ua/uk/ – pharmaceutical search engine of Ukraine

9. https://allchemistry.info/services/onlayn-redaktor-himicheskih-formul – online editor of chemical formulas

10 http://www.apteka.ua – online newspaper "Apteka"