MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

Petro Mohyla Black Sea National University

Medical Institute

Department of hygiene, social medicine, public health and medical informatics

«APPROVED»
The first-vice rector
Ishchenko N.M.
«___» _____ 2021 р.

THE WORKING EDUCATIONAL PROGRAM IN THE DISCIPLINE
«MEDICAL INFORMATICS»
in the field of knowledge 22 «Health care»
in the specialty 222 «Medicine»

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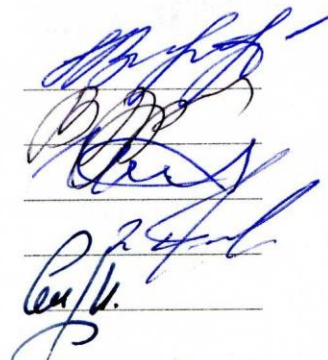
Discription of the educational discipline (annotation)

Title of indices	Characterization of educational discipline	
	«Medical informatics»	
Field of knowledge	22 «Health care»	
Specialty	222 «Medicine»	
Educational program	Master of Medicine	
Higher education level	Master	
Status of discipline	Normative	
Curriculum	2	
Academic year	2020/2021	
Semester number	Full-time	External form of education
	4	-
Total ECTS credits / hours	3 / 90	
Course structure:	Full-time	External form of education
– lectures	10,5	
– seminars (practical)	42	-
– hours of independent work of students	38	
Percentage of classroom load	58 %	
Language of instruction	Ukrainian, english	
Form of final control	exam	

2. Purpose, tasks and results of studying the discipline

The program of the discipline "Medical Informatics" is taught in order to acquaint students with the use of information and communication technologies (ICT) in health care, to teach the processing of medical and biological data using ICT and to ensure the development of information competence in future physicians.

The subject of study of the discipline "Medical Informatics" is information processes that involve the use of ICT in health care.

Interdisciplinary links: the discipline "Medical Informatics" is based on the study by students of the following disciplines: medical and biological physics, medical biology, ECG, morphological disciplines and integrates with these disciplines; promotes students' study of clinical, hygienic and social disciplines; involves the formation of skills to apply knowledge of medical informatics in the process of further training in professional activities.

The purpose of teaching the discipline "Medical Informatics" is: the formation and development of future doctors' competence in the field of ICT to ensure the rational use of modern general and special purpose software in the processing of medical and biological data.

The main tasks of studying the discipline are:

−formation and development of knowledge, skills and abilities necessary for effective use of modern programs of general and special purpose in the field of health care;

−development of the ability to independently master software for various purposes and update and integrate the acquired knowledge;

−explanation of the principles of formalization and algorithmization of medical problems, the principles of modeling in biology and medicine;

−formation of basic skills in working with PCs and searching for medical information using information technology;

−use of methods of medical and biological data processing.

3. The program of the discipline

The educational process is organized according to the European Credit Transfer and Accumulation System (ECTS).

The program of the discipline "Medical Informatics" consists of two blocks:

Block 1. Fundamentals of information technology in the field of health care. Processing and analysis of medical and biological data.

Sections:

1. Basic concepts of medical informatics. Computer in the activity of the future doctor.
2. Medical data. Methodology of information processing and analysis.

Block 2. Medical knowledge and decision making in medicine.

Sections:

3. Medical knowledge and decision making.
4. Patient-centered systems and institutional health information systems.

Block 1. Fundamentals of information technology in the field of health care. Processing and analysis of medical and biological data.
Cection 1.
Basic concepts of medical informatics. Computer in the activity of the future doctor.

Topic 1. Safety. Input control. Introduction and structure of medical informatics.
Safety precautions. Incoming control of residual knowledge from the school course of computer science. The purpose of the course. Course structure. The main tasks and components of medical informatics. Data and information. Computer programs-applications in the health care system.

Topic 2. Basic concepts. Information transfer. Network technologies. Basics of telemedicine.

Standards and basic health programs. Privacy, security and privacy. Databases and data communications. Management support systems: principles and concepts. Communication. Sender, channel, recipient. Receivers and converters of information. Information carriers. Properties of information. Entropy of information. Communications hardware and software. Internet. Communication in the health care system. Basic principles of telemedicine.

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Section 2.

Medical data. Methodology of information processing and analysis.

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Topic 3. Computer data: data types, processing and management.
Information processing systems: user, data entry, user interface, data processing and presentation. Database management systems (DBMS). Data structure. DBMS functions. Data models. Data management. Data storage. DBMS models. Types of models: hierarchical, relational and network type model.

Topic 4. Coding and classification of medical data.
Classification: types, classification, definitions, goals, principles. Codes: coding, numerical and mnemonic codes, hierarchical and combinational codes, comparison codes. History of classification and coding. Classification systems. Problems of classification and coding.

Topic 5. Analysis of biosignals. Methods of processing biosignals. Visualization of medical and biological data. Processing and analysis of medical images.
Analysis of biosignals. Registration, transformation and classification of signals. Bio signals and non-stationary signals. Types of signals. Applied application of biosignal analysis. Means of obtaining images. Medical image processing. Problems of image processing and analysis. Image transformation. General and local image transformation. Modern trends in image processing. Processing of two-dimensional and three-dimensional medical images.

Topic 6. Methods of biostatistics.
Data description: qualitative, ordinal and quantitative data. Estimation of parameters and testing of hypotheses. Statistical data analysis.

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Block 2. Medical knowledge and decision making in medicine.

Section 3.

Medical knowledge and decision making.

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Topic 7. Formalization and algorithmization of medical problems.
Fundamentals of algorithmization of medical problems. Algorithms and their properties. Ways to present algorithms. Types of algorithms. Drawing up a block diagram of a simple (linear) and branched algorithm. Drawing up a block diagram of an algorithm with an internal cycle.

Topic 8. Formal logic in solving problems of diagnosis, treatment and prevention of diseases.
Logical operations and truth tables. Logical operators and expressions. Algebra of logic. Binary number system and logic.

Topic 9. Methods of decision support. Strategies for obtaining medical knowledge. Clinical practice in health care
Types of medical knowledge. Learning people and "learning" computers. Decision support systems. Knowledge base. Information needs and ways to solve them. Types of decision support systems and medical knowledge base. Electronic medical records. Expert systems and decision support. Medical imaging management. Physiological monitoring and remote access.

Topic 10. Clinical decision support systems. Forecasting tools. Modeling of decision support system.
Application of clinical decision-making systems. Types of systems. Forecasting tools. Decision support with simple forecasting tools. Presentation of decision support systems. Expert systems. Building a knowledge base and structuring. Reuse of ontologies. Modern architecture of decision making system.

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Section 4.

Patient-centered systems and institutional health information systems.

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Topic 11. Types of information systems in the field of health care. Hospital information systems and their development.

Public health and health care. Modeling and models of the health care system (POPs). Information requirements. Hospital Information Systems (GIS): clinical use and technical implementation. History of GIS development. The future of GIS. GIS functions. GIS concept. GIS architecture. Application of GIS. Examples of GIS. Data access and protection. Administrative management. Clinical systems in various areas of the health care system.

Topic 12. Individual medical cards. Structuring the content of electronic medical records (EMC).

Traditional and electronic medical records (electronic medical history). History of development. Data entry: strategies and forms of data entry. Data entry structure: dynamics, interface, adaptation to the consumer. General structure of EMC. Implementation of EMC. Use of EMC data.

Topic 13. Information resources of the health care system.

Health Resource Information Resources. Characteristics and features of information resources of the health care system. Areas of information resources of the health care system. Open access health information networks. Information resources. Administrative systems. Registers. Epidemiological surveillance. Banks of organs, tissues and blood. Use of information resources in evidence-based medicine.

The structure of the discipline

Topic names	Number of hours		
	Full-time		
	including		
	lectures	**practicals**	**IWS**
Block 1. Fundamentals of information technology in the health care system. Processing and analysis of medical and biological data.			
Topic 1. Safety. Input control. Introduction and structure of medical informatics.	2	2	2
Topic 2. Basic concepts. Information transfer. Network technologies. Basics of telemedicine.	2	3	3
Topic 3. Computer data: data types, processing and management.	4,5	4	3
Topic 4. Coding and classification of medical data.		2	3
Topic 5. Analysis of biosignals. Methods of processing biosignals. Visualization of medical and biological data. Processing and analysis of medical images.		4	3
Topic 6. Methods of biostatistics.		4	3
Together behind the block 1 – 44,5 год.	**8,5**	**19**	**17**
Block 2. Medical knowledge and decision making in medicine.			
Topic 7. Formalization and algorithmization of medical problems.		3	3

Topic			
Topic 8. Formal logic in solving problems of diagnosis, treatment and prevention of diseases.		3	3
Topic 9. Methods of decision support. Strategies for obtaining medical knowledge. Clinical practice in health care	2	3	3
Topic 10. Clinical decision support systems. Forecasting tools. Modeling of decision support system.		4	3
Topic 11. Types of information systems in the field of health care. Hospital information systems and their development.		4	3
Topic 12. Individual medical cards. Structuring the content of electronic medical records (EMC).		4	3
Topic 13. Information resources of the health care system.		2	3
Together behind the block 2 – 46 год.	**2**	**23**	**21**

4. The content of the discipline

4.1. Lecture topics

№	Topic name	Quantity hours
1	Safety precautions. Input control. Introduction and structure of medical informatics. 1. Definitions and goals of medical informatics 2. Historical excursion into development 3. Health services and information systems 4. Informatics as a science in health care	2
2	Basic concepts. Information transfer. Network technologies. Basics of telemedicine .. 1. Standards and basic health programs. 2. Privacy, security and confidentiality. 3. Databases and data communications. 4. Management support systems: principles and concepts.	2
3	Methods of decision support. Strategies for obtaining medical knowledge. Clinical practice in health care 1. Electronic medical records 2. Expert systems and decision support 3. Management of medical images 4. Physiological monitoring and remote access	2
4	Registration of reports in the field of science and technology according	2,5

	to DSTU 1. Features of creating Styles in MS WORD. 2. Automatic numbering of figures, tables and formulas. 3. Creating footers. 4. The "section break" tool in creating pages from the Landscape Table. 5. Automated: table of contents, lists of figures and tables. 6. Mendeley's application for creating a bibliography. 7. Export to pdf.	
5	Presentation of the report in Power Point and Google Slides 1. Editing design templates in the Master tool. 2. Requirements for creating presentations of scientific reports. 3. Features of insertion: figures, text tables, formulas. 4. Embedding: Excel spreadsheets and charts, video, audio, animated graphics. 5. Notes and Comments tool. Working together on documents. 6. Page Setup and export to pdf.	2
	Together	**10,5**

4.2. Topics of practical classes

№ з/п	Topic name	Quantity hours
1.	Topic 1. Safety. Input control. Introduction and structure of medical informatics.	2
2.	Topic 2. Transfer of information. Network technologies. Basics of telemedicine.	3
3.	Topic 3. Computer data: data types, processing and management.	4
4.	Topic 4. Coding and classification of medical data.	2
5.	Topic 5. Analysis of biosignals. Methods of processing biosignals. Visualization of medical and biological data. Processing and analysis of medical images.	4
6.	Topic 6. Methods of biostatistics.	4
7.	Topic 7. Formalization and algorithmization of medical problems	3
8.	Topic 8. Formal logic in solving problems of diagnosis, treatment and prevention of diseases.	3
9.	Topic 9. Methods of decision support. Strategies for obtaining medical knowledge. Clinical practice in health care	3
10.	Topic 10. Clinical decision support systems. Forecasting tools. Modeling of decision support system.	4
11.	Topic 11. Types of information systems in the field of health care. Hospital information systems and their development.	4
12.	Topic 12. Individual medical cards. Structuring the content of electronic medical records (EMC).	4
13.	Topic 13. Information resources of the health care system.	2
	Together	**42**

Topics of laboratory classes
There are no laboratory classes planned.

4.3. Independent work

№ з/п	Topic name	Quantity hours
1.	Data and information. Computer programs-applications in the health care system.	2
2.	Communications hardware and software. Internet. Communication in the health care system.	3
3.	Information processing systems: user, data entry, user interface, data processing and presentation. DBMS functions. Data models. DBMS models.	3
4.	Analysis of biosignals. Registration, transformation and classification of signals. Means of obtaining images. Medical image processing. Modern trends in image processing.	3
5.	Data description: qualitative, ordinal and quantitative data. Estimation of parameters and testing of statistical hypotheses. Statistical data analysis.	3
6.	Fundamentals of algorithmization of medical problems. Algorithms and their properties. Ways to present algorithms. Types of algorithms. Drawing up a block diagram of a simple (linear) and branched algorithm. Drawing up a block diagram of an algorithm with an internal cycle.	3
7.	Logical operations and truth tables. Logical operators and expressions. Algebra of logic. Binary number system and logic.	3
8.	Types of medical knowledge. Decision support systems. Types of decision support systems and medical knowledge base.	3
9.	Application of clinical decision-making systems. Forecasting tools. Decision support with simple forecasting tools. Expert systems. Modern architecture of decision making system.	3
10.	Public health and health care. Hospital information systems: clinical use and technical implementation, history of development, functions, architecture, applications, examples.	3
12.	Traditional and electronic medical records (electronic medical history). General structure and use of EMC.	3
13.	Health Resource Information Resources. Characteristics and features of information resources of the health care system.	3
14.	Areas of information resources of the health care system. Use of information resources in evidence-based medicine.	3
	Together	**38**

Independent work involves mastering the method of conducting a scientific search for information using Internet resources within the proposed topics, as well as processing and presenting search results using general and special purpose programs.

4.4. Ensuring the educational process

Lectures on "Medical Informatics" are held in classes equipped with the necessary multimedia equipment (projector, laptop), semi-groups - in computer classes.

5. Final control

The course "Medical Informatics" ends with a exam. During the semester, students receive points for completing an independent task and defending reports on practical work.

Questions to prepare for the exam

1. Informatics. Information. Algorithm. Algorithmic languages. Programs.

2. Computer architecture.
3. Computer storage devices and their purpose.
4. External storage devices.
5. Operational FE.
6. Information input devices and their characteristics.
7. Information output devices and their capabilities.
8. Composition and purpose of personal computer units.
9. Technical information carriers and their characteristics (magnetic, magneto-optical, paper).
10. Composition and purpose of personal computer units.
11. Drives (hard drives) and their characteristics.
12. Adapters (audio, video, etc.) and their purpose.
13. Controllers.
14. Monitors, their capabilities and purpose.
15. Printers.
16. Modems.
17. Scanners.
18. Classification of computers and trends in their development.
19. Medical informatics, its purpose. Medical data.
20. Stages of formation of medical informatics as a science.
21. Tasks of medical informatics.
22. The structure of medical informatics.
23. Hardware and software of information technologies of basic informatics.
24. How to get started on a computer?
25. How to properly finish working with a computer?
26. Action when the computer hangs.
27. How is the main menu of the OS called?
28. Assignment of medical data standards.
29. Statistical methods of data processing in medicine.
30. Name the basic statistical characteristics.
31. Functions of a medical specialist in statistical research.
32. Computer networks and their types.
33. Assignment of e-mail.
34. Medical resources Internet.
35. Medical Information System (MIS) and its purpose.
36. Classification of MIS.
37. The main blocks of MIS treatment and prevention facilities.
38. Workstation of a medical worker.
39. Automated systems for disease diagnosis and prediction of treatment results.
40. Functions of health workers in medical information systems.
41. Screening research methods. Expert systems in medicine.
42. Examples of computer systems of professional examination and medical examination of the population.
43. Purpose of computer monitoring systems.
44. Functions of health workers in computer monitoring systems.
45. Medical devices of the bedside complex of computer monitoring systems.
46. What biological parameters are observed with the help of computer monitoring systems?
47. Appointment of Holter monitoring.
48. Medical computer imaging systems.
49. What information rays are used in visualization systems?
50. Computed tomography (CT).
51. Name the contraindications to MRI.
52. Which of the three methods of CT is the safest for humans? Why?
53. Stages of the process of information processing by ultrasound.
54. Areas of application of ultrasound.

55. Dosimetric planning systems and their tasks.
56. Exchange of information in the information space. Telemedicine.
57. Files, directories and work with them. Names and standard extensions.
58. Formatting and testing disks.
59. Algorithms and their properties. Examples.
60. Forms of representation and notation of algorithms. Requirements for algorithms: unambiguity, efficiency, mass.
61. Typical algorithms and their block diagrams (linear, branching, cyclic).
62. Text editors of their use: a set of texts, tables, formulas, formatting, editing, inserting figures and signing them, grouping, № pages, etc.
63. Filling and printing spreadsheets.
64. Plotting in the Excel package.
65. Construction of diagrams in the Excel package.
66. Programming in the Excel package.

Example of a exam ticket

Petro Mohyla Black Sea National University
Educational qualification level - master
Direction of training - 222 "Medicine"
Semester - 4
Educational discipline - Medical Informatics

TICKET № __0___

1. Medical informatics, its purpose. Medical data. (Max number of points - 25)
2. Typical algorithms and their block diagrams (linear, branching, cyclic). (Max number of points - 25)
3. Practical task. Create and fill in Excel cards of two sick people who came to you as a doctor for an appointment. The card should contain personal data about the patient, the results of the doctor's examination, the results of tests and additional examinations, diagnosis and recommendations of the doctor. (Mach number of points - 30)

Head of the Department   Professor Zyuzin V.O.   _____

Examiner   Senior Teacher Zhuk I.Y.   _____

6. Evaluation criteria and diagnostic tools for learning outcomes

№	Type of activity (task)	Maximum number of points
1.	Checking the performance of practical work (13 works of 8 points)	104
2.	Checking independent work (oral examination).	16
3.	Exam	80
	Together	**200**

Students are admitted to the test who have attended all the lectures, classroom classes, performed independent work and in the process of learning scored the number of points, not less than the minimum - 70 points.

The test is conducted in a computer class. The test ticket contains 3 tasks: 2 theoretical questions and 1 practical task. For each theoretical question the number of points is 25, for a practical task - 30.

Assessment of student performance

Type of activity (task)	Max number of points
Topic 1	8
Topic 2	8
Topic 3	8
Topic 4	8
Topic 5	8
Topic 6	8
Topic 7	8
Topic 8	8
Topic 9	8
Topic 10	8
Topic 11	8
Topic 12	8
Topic 13	8
Independent work	16
Exam	80
Together	200

Criteria for assessing knowledge

A student's answer is evaluated with a score of 8 points and 71-80 points on the exam (A on the ECTS scale and 5 on the national scale) if it demonstrates deep knowledge of all theoretical principles and ability to apply theoretical material for practical analysis and has no inaccuracies.

A student's answer is assessed with a score of 6-7 points and 61-70 points on the exam (B and C on the ECTS scale and 4 on the national scale) if it shows knowledge of all theoretical principles, ability to apply them in practice, but some fundamental inaccuracies are allowed.

The student's answer is evaluated with a score of 5 points and 50-60 points on the exam (D and E on the ECTS scale and 3 on the national scale), provided that he knows the main theoretical provisions and can use them in practice.

7. Recommended sources of information

Basic

1. Medical informatics in modules: workshop / IE Bulakh, LP Voitenko, MR Mruga, etc .; for order. IE Bulakh. –K .: Медицина, 2012. - 208 с.
2. Handbook of Medical Informatics. Editors: J.H. van Bemmel, M.A. Musen. – http://www.mieur.nl/mihandbook; http://www.mihandbook.stanford.edu
3. Mark A. Musen B. Handbook of Medical Informatics // Electronic resourse ftp://46.101.84.92/pdf12/handbook-of-medical-informatics.pdf
4. Edward H., Shortliffe J., Cimino J. Biomedical Informatics, 2014 // Electronic rsourse

http://www.rhc.ac.ir/Files/Download/pdf/nursingbooks/Biomedical%20Informatics%20Computer%20Applications%20in%20Health%20Care%20and%20Biomedicine-2014%20-%20CD.pdf

Additional

5. Medical informatics: a textbook / I.E. Bulakh, Yu.E. Lyakh, VP Марценюк, И.И. Haimzon. - К .: ВСИ «Медицина», 2012. - 424 с.
6. Medical Informatics = Медична Информатика: підручник / І.Є. Bulakh, Yu.Ye. Лях, В.П. Martsenyuk, I.Y. Haimzon. - К .: ВСИ «Медицина», 2012. - 368 с.
7. Information technologies in psychology and medicine: textbook / I.Ye. Bulakh, II Haimzon. - К .: ВСВ «Медицина», 2011. - 216 с.
8. Informatics in tables and diagrams: PC and its components, Windows operating system, Internet, basic and auxiliary devices, system and application software, modeling and programming / [Bilousova LI, Olefirenko NV]. - Kharkiv: Torsing Plus, 2014. - 111 p.
9. Fundamentals of computer science. Microsoft Office 2013 (Word, PowerPoint in practice): textbook. way. / MM Drin, NV Romanenko; City of Education and Science of Ukraine, Cherniv. nat. Univ. Yu. Fedkovich. - Chernivtsi: Chernivtsi. nat. University, 2014. - 75 p.
10. Informatics and information technologies: a workshop for org. students' work on practice. and laboratory. classes / Yu. Yu. Bilak, V. O. Laver, Yu. V. Andrashko, IM Lyakh; City of Education and Science of Ukraine, SHEI ”Uzhhorod. nat. University ”, Faculty of Inform. Technologies, Dept. Informatics and Phys.-Math. disciplines. - Uzhhorod: Outdoor Shark, 2015.
11. Informatics: workshop on inform. technologies / Ya. M. Glinsky. - Ternopil: Nearby. and manual., 2014. - 302 p.
12. Mincer OP Informatics and health care / О.П. Minzer // Medical Informatics and Engineering. - 2010. - № 2. - P.8 -21
13. Computer modeling in pharmacy: Textbook. way. for honey. University IV r.a. Recommended by the Ministry of Health / Bulakh IE etc. - K., 2016. - 208 p.

Electronic sources

https://support.office.com/uk-ua/ (Microsoft Office Help and Training)
www.uacm.kharkov.ua (Ukrainian Association of Computer Medicine)
www.mednavigator.net (Medical search engine)
www.rmj.ru (Internet versions of periodicals)
www.medinfo.com.ua (Medical search system of Ukraine)
www.medico.ru (Medical search engine)
www.medinf.nmu.ua (Information resources of educational and methodical materials on discipline "European standard of computer literacy")