

Odesa National Medical University

Department of Biophysics, Informatics and Medical Equipment

Course Syllabus

Medical informatics and mathematical statistics

Amount	90 hours, 3 credits
Semester, year of study	First semester, one year
Day, time and place	The time and place (lecture auditory, classroom, etc.) where lessons are held on are appointed in accordance with the approved schedule of lessons.
Teacher (-s)	Prof. Godlevsky L.S., PhD, MD, chief of the department, associate prof. Mandel O.V., senior teacher Marchenko S.V., associate prof. Ponomarenko A.I.
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Working place	Department of Biophysics, informatics and medical devices. Olgievskaya str., 4.
Consultations	<i>Off-line consultations:</i> Thursday from 15:00 till 17:00; Saturday from 9:00 till 12:00 <i>On-consultations:</i> Consultations are performed by prior agreement with the teacher.

COMMUNICATION

Communication with graduate students will be carried out through face-to-face meetings. In the transition to distance learning, contact with graduate students will be carried out using e-mail and programs: Microsoft Teams, Moodle, Telegram, and Viber.

COURSE ABSTRACT

The subject of discipline study:

The subject of the educational discipline "Medical Informatics and Mathematical Statistics" is computer equipment, personal computer software, modern technologies, and statistical methods of processing medical and biological information.

Course prerequisites and post-requisites (Place of the discipline in the educational program):

The discipline "Medical Informatics and Mathematical Statistics" is based on the study by students of the following educational disciplines: medical and biological physics, higher mathematics, medical biology, morphological disciplines, integrates with these disciplines and forms the ability to apply knowledge in the process of further education and professional activities.

The purpose of the course:

The purpose of the selective educational discipline "Medical Informatics and Mathematical Statistics" is the formation of skills to apply knowledge of medical informatics in the process of further education and in professional activities, as well as to carry out statistical processing of medical and social information using modern methods and information technologies.

Tasks of the discipline:

- provision of knowledge about modern information and communication technologies and trends in their development to those obtaining the degree of Doctor of Philosophy;

- provision of knowledge about the principles of building informational and statistical-mathematical models of medical-biological and social systems to those obtaining the degree of Doctor of Philosophy;

- providing knowledge to those obtaining the degree of Doctor of Philosophy regarding the methods of searching, saving, processing, and transmitting medical and biological data, mastering the basic principles of formalization and algorithmization of medical problems.

Expected results:

According to the results of studying the discipline, graduate students

should know:

- fundamental concepts and terms of medical informatics;

- the role of information, communication, computer technologies, and statistical methods in medicine;

- features of application software for processing medical data and medical information;

- basic principles of telemedicine;
- principles of classification and coding of medical and biological information;
- methods of processing and analysis of medical images;
- types of information and hospital systems in the field of health care;
- principles of construction and operation of decision support systems in medicine;
- the principles of applying statistical methods when processing the results of medical and biological research;
- basic laws of distribution of discrete random variables;
- the main characteristics of the laws of distribution of random variables;
- methods of setting the distribution law for discrete random variables;
- basic laws of distribution of continuous random variables;
- methods of estimating the law of distribution of the studied characteristic according to sample data;
- point methods of evaluating the characteristics of the distribution of the investigated characteristic according to the sample data;
- interval evaluation of the characteristics of the distribution of the studied characteristic according to the sample data;
- methodology of statistical testing of hypotheses;
- one-factor variance analysis of the influence of factors on the investigated feature;
- basics of linear correlation analysis;
- numerical characteristics of the correlation between the features of the system;
- basics of regression analysis;

be able:

- to demonstrate the skills of using Data Bases Managing Systems when processing medical and biological data;
- demonstrate skills in using statistical functions and criteria for the analysis of medical and biological data;
- interpret the main formal models of presentation of medical knowledge;
- interpret the basic concepts of mathematical logic;
- demonstrate the ability to present the conditions of medical and biological problems in a formal form;
- interpret the use of evidence in medical decision-making.

- demonstrate skills in working with electronic medical cards;
- demonstrate the ability to use information resources to search for medical information;
- interpret the ethical and legal principles of medical and biological information management;
- to determine and analyze the empirical function of the distribution density of the studied characteristic;
- to determine and analyze the empirical distribution function of the studied characteristic;
- to determine point and interval estimates of the characteristics of the distribution of the investigated feature;
- calculate and analyze the correlation between system features;
- estimate the parameters of the regression function model;
- to analyze the significance of the factor's influence on the change in the law of distribution and the characteristics of the distribution of the characteristic under study.

COURSE DESCRIPTION

Forms and methods of education

The course will be taught in the form of lectures (4 hours) and practical classes (42 hours), the organization of independent work of graduate students (44 hours), and a total of 90 hours (3 credits).

The study of the discipline should be implemented based on methods of problem presentation, heuristic, research, and interactive (project method).;

Content of the academic discipline:

Topic 1. Basics of information technologies in the health care system. Basic concepts of medical informatics. The computer is the activity of the future doctor.

Topic 2. Computer data: data types, processing, and management.

Topic 3. Coding and classification. Analysis of biosignals.

Topic 4. Methods of biostatistics.

Topic 5. Decision support methods.

Topic 6. Formalization and algorithmization of medical problems.

Topic 7. Formal logic in diagnosing, treating, and preventing disease problems.

Topic 8. Evidence-based medicine.

Topic 9. Types of information systems in the field of health care.

Topic 10. Clinical decision support systems.

Topic 11. Individual medical cards.

Topic 13. Distribution functions and distribution density of a random variable.

Topic 15. Estimating the parameters of the distribution of the characteristic under study.

Topic 16. Study the influence of the factor on the displacement of the center of the characteristic distribution.

Topic 17. Correlation analysis.

Topic 18. One-factor variance analysis.

Topic 19. Principles of application of statistical criteria for processing medical and biological data.

Topic 20. Requirements for clinical research.

Topic 21. Epidemiological studies.

Recommended literature:

The main one:

1. Nanette B. Health Information Management Technology: An Applied Approach / B. Nanette // American Health Information Management Association. – 2016. – 5th ed. – 686 p.
2. Mervat Abdelhak. Health Information: Management of a Strategic Resource, / Mervat Abdelhak, Mary Alice Hanken // Saunders. – 2015. – 5th edition. – 800 p.
3. Higher Mathematics, Second Edition / Robert Barclay, Brian Logan, Mike Smith. Hodder Gibson - Boost, 2021. ISBN: 9781398352230
4. Godlevsky L.S., Marchenko S.V., Lyashenko A.V. and co-author Advanced terminology from the medical informatics course. Educational and methodological manual Odessa- 2020.- 57 p. Access mode: [Посібник-терміни-мед.інфо.doc \(live.com\)](#)

Additional:

1. Godlevsky L.S., Shakun K.S., Martsenyuk V.P., Tatarchuk T.V., Stoeva T.V., Godlevska T.L., Shakun I.K., Klos- Witkowska A. (2019). Dynamic changes of the color intensity of collected urine as a basis for a distant uroflowmetry. In: Proc. The 10 th IEEE International Conference on Intelligent **Data Acquisition and Advanced Computing Systems: Technology and Applications**. 18-21 September, Metz, France. Pp. 308-312. DOI: [10.1109/IDAACS.2019.8924436](#)
2. Godlevsky L. S., Kresyun N. V., Son H. O., Godovan V. V., Nenova O. N., Pervak M. P., Godlevska T. L., Bidnyuk K. A., Prybolovets T. V. (2018). Retina protection with cerebellum activation in experimental diabetes and translational perspectives (**Book Chapter**). In: Development of the Cerebellum, Clinical and Molecular Perspectives, Severina Fabbri (Editor). Nova Science Publishers Inc., New York, USA. Pp. 147-173. ISBN: 978-1-53614-317-1 URL: <https://novapublishers.com/shop/development-of-the-cerebellum-clinical-and-molecular-perspectives/>
3. Buzinovsky A.B., Kovalenko O.S., Bayazitov N.R., Godlevsky L.S. The effectiveness of surgeon decision on pain syndrome of pelvic origin treatment in women estimated with the model of decision tree. **Кибернетика и вычислительная техника**.- 2018.- №2(192).- С.60-72
4. Bayazitov D.N., Kresyun N.V., Buzinovsky A.B., Bayazitov N.R., Lyashenko A.V., Godlevsky L.S., Prybolovets T.V., Bidnyuk K.A. (2017). The effectiveness of automatic

- laparoscopic diagnostics of liver pathology using different methods of digital images classification. *Pathologia*. Vol.,14. Issue 2. Pp182-187. URL: <http://pat.zsmu.edu.ua>
5. Lyashenko A.V., Bayazitov N.R., Godlevsky L.S., et al. Informational -technical system for the automatized laparoscopic diagnostics. *Radio Electronics, Computer Science, Control [Ukraine]*. 2016; 4: 90-96.
 6. Leonid S Godlevsky, Oxana N Nenova, Katerina A Bidnyuk, Tamara L Godlevska, Artur B Buzinovsky: Mobile Medicine and General Trends in Medical Informatics. *Applied Medical Informatics* 03/2016; 38(1):49-52.
 7. Godlevsky, Leonid, Kalinchuk, Sergey, Bayazitov, Nikolay, Smirnov, Igor, Adeyinka, Michael, Samchenko, Igor and Bayzakov, Usen. "First Results of the Implementation of Telemedical Service in The Odessa Region" *Polish Journal of Medical Physics and Engineering*, vol.13, no.2, 2008, pp.105-114. <https://doi.org/10.2478/v10013-007-0009-2>

EVALUATION:

Methods of current control: Evaluation of the success of studying each topic of the discipline is performed according to a traditional 4-point scale.

The current academic performance is calculated as the average current score, i.e., the arithmetic average of all grades received by the graduate student on a traditional scale, rounded to 2 (two) decimal places, for example, 4.75.

Assessment of current discipline control:

The value of the grade "**excellent**": the graduate student shows special creative abilities, knows how to acquire knowledge independently, finds and processes the necessary information without the help of a teacher, and knows how to use the acquired knowledge and skills to make decisions in non-standard situations, convincingly argues answers, independently reveals his gifts and inclinations.

The meaning of the grade "**good**": the graduate student has a good command of the studied material, applies it in practice, solves exercises and problems in familiar situations, and independently corrects the mistakes made, the number of which is insignificant.

The value of the assessment is "**satisfactory**": the graduate student reproduces a significant part of the theoretical material and demonstrates knowledge and understanding of the main provisions; with the help of the teacher, he can analyze the educational material, correct errors, among which there are a significant number of significant ones.

The value of the assessment is "**unsatisfactory**": the graduate student has mastered the material at the level of individual fragments, which constitute a small part of the educational material.

Only graduate students with no academic debt and an average score for the current educational activity of at least 3.00 are admitted to the final certification.

Forms and methods of final control:

Differential assessment is the final control of knowledge in the academic discipline:

The average score for the discipline is translated into a traditional evaluation of the discipline on a 4-point scale and is considered as the ratio of this arithmetic average to the percentage of assimilation of the required amount of knowledge in the given subject.

A graduate student (seeker) is admitted to the final examination (differential credit) only if there is no academic debt and the average score for the current educational activity is not less than 3.00.

The grade for the discipline is the arithmetic average of two components:

- 1) average current score as the arithmetic average of all current grades;
- 2) traditional assessment for differential credit.

The average score for discipline	The relation obtained by the graduate student the average score for the discipline to the maximum possible value of this indicator	Score with disciplines on a 4-point scale (traditional assessment)
4,45 – 5,0	185-200	5
3,75 – 4,44	151-184	4
3,0 – 3,74	120-150	3

Independent work of graduate students (self-preparing).

The independent work of graduate students, which is provided by the lesson's topic and the classroom work, is evaluated during the current control of the topic in the corresponding lesson. The last lesson checks the mastery of topics presented only for independent work.

COURSE POLICY ("rules of the game")

Policy on deadlines and rescheduling: if the student of higher education was absent from classes for any reason, then the practice is carried out within the deadlines set by the teacher, following the Regulation on the organization of the educational process at ONMedU <https://onmedu.edu.ua/wp-content/uploads/2020/01/osvitnij-proces.pdf>. All tasks provided by the program must be completed within the deadlines set by the teacher.

Academic Virtue Policy:

The policy of the educational component is based on the principles of academic virtue (link to the regulations on the university website: <https://onmedu.edu.ua/wp-content/uploads/2020/07/polozhennja-pro-dobrochesnist.pdf>). It is determined by the requirements that the teacher presents to the applicant when studying the educational component:

◆ independent performance of educational tasks, tasks of current and final control of learning results (for persons with special educational needs, this requirement is applied taking into account their individual needs and capabilities);

◆ links to sources of information in the case of using ideas, developments, statements, and information.

Attendance and Tardiness Policy: Attendance and work in classroom classes (lectures and seminar classes) are mandatory for obtaining a satisfactory grade. A graduate student is allowed to be late for no more than 10 minutes.

Mobile devices: you can use mobile devices in class with the teacher's permission.

Behavior in the audience: While in the audience, the following are important: respect for colleagues; tolerance for others; receptivity and impartiality; the ability to disagree with an opinion, but respect the personality of the opponent (during discussions); thorough argumentation of one's opinion; compliance with the ethics of academic relationships.