Odessa National Medical University
Faculty of Medicine №2.
Department of Biophysics, Informatics and Medical Equipment

Syllabus course
Higher mathematics

Amount	**105 hours**
Semester, year of study	**1 semester, 1 year**
Days, time, place	**The time and place (number of the lecture hall, auditorium, laboratory, studio, etc.) of the discipline is determined in accordance with the approved schedule.**
Teacher (s)	**Full Prof. Godlevsky LS, M.D., Head of Department** **Assoc. Prof.Zhumatiy PG, Ph.D** **Senior Lecturer Marchenko SV** **Senior Lecturer Tatarchuk TV**
Contact phone	**(048) 717-89-16; (048) 712-31-02**
E-mail	**medphys@onmedu.edu.ua**
Workplace	**Department of Biophysics, Informatics and Medical Equipment, Olgiivska Str 2**
Consultations	***Face-to-face consultations*** **: Thursday from 15:00 to 17:00; Saturday from 9:00 to 12:00** ***Online consultations:*** **By prior arrangement with the teacher.**

COMMUNICATION

Communication with students can be done via e-mail, social networks, telephone, face-to-face meetings.

COURSE ANNOTATION

The subject of study of the discipline

The subject of study of the discipline "Higher Mathematics and Statistics" is knowledge of the elements of higher mathematics, the basics of probability theory and mathematical statistics used in pharmacy.

According to the curriculum, "Higher Mathematics and Statistics" is one of the fundamental general education disciplines that form the theoretical basis for the training of highly qualified specialists in pharmacy.

The study of this discipline forms in students the basic ideas about the general
opportunities to collect and statistical evaluation of medical and pharmaceutical information, methods and
methods of their analysis, as well as the ability to predict based on regression analysis.

Prerequisites and post-requisites of the course (Place of discipline in the educational program):

Higher mathematics as an academic discipline:

· Integrates with such disciplines as biophysics, physical methods of analysis and metrology in pharmacy, physical and biological chemistry, pharmacokinetics, analytical chemistry, bioinorganic chemistry, information technology in pharmacy.

· Lays the foundation for students to study physical methods of analysis and metrology in pharmacy, physical and biological chemistry, pharmacokinetics, analytical chemistry, organization and economics in pharmacy, information technology in pharmacy.

The purpose of the course.

The purpose of studying the discipline "Higher Mathematics and Statistics" is
deepening and improving students' knowledge, skills and practical skills
pharmacists to evaluate biophysical and medical-pharmaceutical processes through
mathematical and statistical analysis.

In the process of studying the discipline "Higher Mathematics and Statistics" students

master the theory and practice of analysis of pharmaceutical and biomedical information.

Students learn to analyze and solve problems of pharmaceutical and medico-biological content, independently use the relevant mathematical literature.

Mathematical education contributes to the formation of an abstract way of thinking, skill

systematically analyze the studied phenomena. To study this discipline are necessary

basic knowledge of mathematics for high school.

Tasks of the discipline :

2.1 **Integral competence**

Ability to solve typical and complex specialized problems and practical problems in professional activities in the field of health care and / or in the process of further training using modern physical theories and methods of research of living organisms, biological objects and processes occurring in living nature using a set of interdisciplinary knowledge and in the absence of information.

2.2 **General competencies**

1. Ability to apply knowledge of medical and biological physics in practical situations.

2. Knowledge and understanding in the field of sciences that form the basis of biological and medical physics.

3. Ability to communicate on topics related to the problems of biophysics in the native language both orally and in writing.

4. Ability to understand the principles and methods of graphical and analytical presentation of scientific information.

5. Ability to use information technology to study medical and biological processes.

6. The ability to acquire new knowledge and be modernly educated, aware of the possibility of lifelong learning.

7. Ability to work both independently and in a team.

8. Life safety skills.

9. The desire to preserve the natural environment and ensure sustainable development of society.

10. Recognition of moral and bioethical aspects of research and the need for intellectual integrity, as well as professional codes of conduct.

2.3 **Special (professional) competencies**

1. The ability to replenish knowledge and understanding of the basic physical characteristics of medical and biological systems, the physical basis of the processes occurring in living organisms.

2. Ability to integrate basic knowledge of physics, chemistry, biology, mathematics, information technology to create a foundation of professional competencies.

3. Ability to collect, record and analyze data from biomedical research using appropriate methods and technological means.

4. Ability to apply quantitative methods in the study of medical and biological processes.

5. The ability to interpret the general physical and biophysical patterns that underlie the functioning of the human body.

6. Ability to explain the physical basis and biophysical mechanisms and effects of the interaction of physical fields with the human body.

7. Ability to explain the physical basis of operation and use of modern (electronic) medical devices.

8. Ability to analyze the composition and physical principles of operation of medical devices and equipment.

9. Ability to conduct laboratory tests and observations.

10. Have an idea of modern methods of mathematical modeling and the possibility of their use in the study of medical and biological processes.

11. Knowledge and use of specific for biological and medical physics theories, paradigms, concepts and principles.

12. Ability to plan, organize and conduct medical and biological research and reporting.

Expected results

COURSE DESCRIPTION

Forms and methods of teaching

The course will be presented in the form of lectures (20 hours) and practical (50 hours), organization of independent work of students (35 hours).

The content of the discipline

THEMATIC PLAN OF LECTURES

1. Differential calculus

2. Integral calculus
3. Differential equations
4. Analysis of random variables
5. Laws of distribution of random variables
6. Laws of distribution of sampling statistics.
7. Analysis of variation series
8. Statistical testing of hypotheses
9. Correlation and regression analysis
10. Analysis of variance

THEMATIC PLAN OF SEMINAR CLASSES

1. Introduction to analysis. Functions
2. Differentiation of functions. The use of a derivative
3. Application of the differential
4. Differentiation of functions of many variables
5. Methods of integration. Indefinite integral
6. Methods of integration. Defined integral
7. Differential equations
8. Modeling of processes by differential equations
9. Analysis of discrete random variables
10. Function of distribution of a random variable
11. The density function of the distribution of a random variable
12. Laws of distribution of discrete random variables
13. Laws of distribution of continuous random variables
14. Laws of distribution of sampling statistics
15. Analysis of variation series
16. Estimation of parameters of distribution of the investigated sign
17. Algorithms for statistical testing of hypotheses
18. Correlation analysis
19. Modeling of regression equations
20. One-way analysis of variance
21. Differential credit

THEMATIC PLAN OF INDEPENDENT (INDIVIDUAL) WORK OF STUDENTS

1. Elaboration of topics that are not studied in the classroom in full.
    1.1. Calculating the boundaries of functions

1.2. Analysis of continuity of functions

1.3. Application of differential calculus of a function of one variable

1.4. Application of differential calculus of a function of many variables

1.5. Integral calculus

1.6. Modeling of processes in pharmacy and medicine by differential equations

1.7. Probabilities of random events

1.8. Laws of distribution of random variables

1.9. Boundary laws of probability theory

1.10. Estimation of random measurement errors

1.11. Testing statistical hypotheses about the distribution parameters of normal populations

1.12. Modeling of linear interdependence of signs on factors

1.13. Modeling of curvilinear dependence of signs on factors

2. Preparation of theoretical material for classroom classes and mastering practical skills when doing homework on their own and with the help of a teacher in consultations.

3. Preparation for the differential test.

Recommended literature

1. Higher Mathematics: A Text-Book for Classical and Engineering Colleges / Edward Howard Griggs. Forgotten Books, 2012.
2. A TextBook of Higher Mathematics: Learning Calculus, Integration and Differentiation in A Simple Way / S.P Thompson. Kindle Edition, 2017
3. Transition to Higher Mathematics: Structure and Proof (Second Edition) / Bob A. Dumas, University of Washington - Seattle Campus, John E. McCarthy, Washington University in St Louis, 2015. ISBN 978-1-941823-03-3.
4. Higher Mathematics, Second Edition / Robert Barclay, Brian Logan, Mike Smith. Hodder Gibson - Boost, 2021. ISBN: 9781398352230
5. Higher Mathematics / M.Mackison, Zeta Maths Publishing, 2021. ISBN-10: 1838141030. ISBN-13: 978-1838141035

EVALUATION

The university uses various forms of control of classes in a particular discipline (oral, written, combined, testing, practical skills, etc.). The results of students' academic performance are presented in the form

of assessment on the national scale, 200-point and ECTS scale and have standardized generalized criteria for assessing knowledge:

National scale:

- the grade **"excellent" is given** to the student who systematically worked during a semester, showed during examination various and deep knowledge of a program material, is able to successfully carry out tasks which are provided by the program, has mastered the maintenance of the basic and additional literature, has understood interrelation of separate sections of discipline. importance for the future profession, showed creative abilities in understanding and using educational material, showed the ability to independently update and replenish knowledge; level of competence - high (creative);

- a grade of **"good" is given** to a student who has shown full knowledge of the curriculum, successfully completes the tasks provided by the program, mastered the basic literature recommended by the program, showed a sufficient level of knowledge in the discipline and is able to independently update and update during further study and professional activity; level of competence - sufficient (constructive-variable);

- the grade **"satisfactory" is given** to the student who has shown knowledge of the basic educational program material in the volume necessary for the further training and the subsequent work on a profession, copes with performance of the tasks provided by the program, has made separate mistakes in answers on examination and at performance of examination tasks, but has the necessary knowledge to overcome mistakes under the guidance of a researcher; level of competence - average (reproductive);

- the grade **"unsatisfactory" is given** to the student who did not show sufficient knowledge of the basic educational program material, made fundamental mistakes in performance of the tasks provided by the program, cannot without knowledge of the teacher to use knowledge at the further training, failed to master skills of independent work; level of competence - low (receptive-productive).

The final control in the form of tests is evaluated on a two-point scale:

- grade **"credited" is given** to a student who has completed the curriculum of the discipline, has no academic debt; level of competence - high (creative);

- the grade **"not credited" is given** to a student who has not fulfilled the curriculum of the discipline, has an academic debt (average score below 3.0 and / or absences); level of competence - low (receptive-productive).

The multi-point scale characterizes the actual success of each student in mastering the discipline. Conversion of the traditional grade from the discipline to 200-point is performed by the information and computer center of the university program "Contingent" according to the formula:

average grade point average (current / discipline) x 40

national grade	points
«5»	185 - 200
«4»	151 - 184
«3»	120 - 150

The ECTS rating scale evaluates the achievements of students in the discipline who study in one course of one specialty, in accordance with the points obtained by them, by ranking, namely:

ECTS	Statistical indicator
"A"	The best 10% of students
"B"	The next 25% of students
"C"	The next 30% of students
«D»	The next 25% of students
"E"	The last 10% of students

The ECTS scale establishes the student's belonging to the group of the best or worst among the reference group of classmates (faculty, specialty), ie his rating. When converting from a multi-point scale, as a rule, the limits of grades "A", "B", "C", "D", "E" do not coincide with the

limits of grades "5", "4", "3" on the traditional scale. Grade "A" on the ECTS scale cannot be equal to grade "excellent", and grade "B" - grade "good" and so on.

Students who have received grades "Fx" and "F" ("2") are not included in the list of ranked students. Such students automatically receive a score of "E" after reassembly.

The grade "Fx" is given to students who scored the minimum number of points for the current educational activity, but who did not pass the final 30 control. Grade "F" is given to students who have attended all classes in the discipline, but did not score a grade point average (3.00) for current educational activities and are not admitted to the final control.

Criteria for assessing the current performance of students should be reflected by the departments in the work programs in the disciplines, indicating a clear structure of student receipt in the assessment class.

COURSE POLICY ("rules of the game")

Deadline and recompilation policy:

Deadlines and transfers are set by the dean's office.

Attendance and lateness policy :

In the absence of the student in class or when he is late, the student receives a mark n / b (was not), which requires further practice in the prescribed manner.

Mobile devices

During practical classes, the use of a smartphone, tablet or other device for storing and processing information is allowed only with the permission of the teacher.

The use of mobile devices and their accessories is strictly prohibited during any form of control.

Behavior in the audience: observance of silence among students at lectures, exceptions - students' questions to the teacher regarding the explanation of the material; working discussion atmosphere in practical classes during the survey; adherence to the ethics of academic relations.