MINISTRY OF HEALTH OF UKRAINE
National University of Pharmacy
Department of physics

HIGHER MATHEMATICS AND STATISTICS

DISCIPLINE CURRICULUM

studying   **the second (master)**
studying domain   **22 Health care**
specialty   **226 Pharmacy**
program   **Pharmacy**
direction

2016 year

The work program of discipline "Higher Mathematics and Statistics" 226 specialty "Pharmacy" Educational Program "Pharmacy" for foreign students **(English department)** for the 1st year students

Developers: Dyagileva F.G., Senior Lecturer of physics Department

The work program reviewed and approved at a meeting of Department of Physics
Protocol № 3 on "22" September 2016

Acting Head Department of Physics _____ Dr. Sci. (phys.-math.), Prof. Storozhenko I.P.

The work program approved at the meetings of methodical commission on technical subjects
 Protocol №1 from "28" September 2016

Head of the profile commission _____ Dr. Pharm. Science professor. Yarnyh T.G.

1. Description of discipline

The program mandatory study discipline "Higher Mathematics and Statistics" prepared in accordance with standards of higher education Ukraine training specialists second (master's) level of higher education

22 area of expertise "Healthcare"
226 specialty "Pharmacy"
educational program "Technology of perfumery and cosmetics"

The curriculum for the course content matching industry standards of higher education, through direct communication content subject to the objectives of higher education (skills and abilities professional defined in EQC); and licensing and accreditation conditions and requirements; compliance "standards and guidelines for quality assurance in the European Higher Education"; the use of disciplinary competencies as an information base for formation evaluation tools pharmaceutical and biomedical research; unambiguous criteria for assessment of student achievement.

The curriculum for the course content is a document that defines the amount of knowledge that should a student learn accordance with the educational qualification characteristics of future expert algorithm study course training material based interdisciplinary connections, eliminating the duplication of educational material for the study of various joint rate problems, necessary methodological provision of technology and assessment of student learning.

According to the curriculum of discipline "Higher Mathematics and Statistics" is studied in the first year. The program is aligned to the order of MES of Ukraine of 26.01.2015 № 47 "On peculiarities of formation curricula" and is structured in two thematic modules.

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

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

Interdisciplinary connections. "Higher Mathematics and Statistics" as the subject matter is integrated with such disciplines as biological physics, medical chemistry, medical biology, technology, drugs, organization economics in pharmacy, etc., and lays the foundation for the study of physical methods of analysis and metrology in pharmacy, physical and biological chemistry, pharmacokinetics, analytical chemistry, organization and economy of pharmacy information technology in pharmacy.

Information amount of discipline. In studying the discipline given 105 hours 3.5 ECTS credits.

2. The purpose and objectives of discipline

The goal of teaching "Higher Mathematics and Statistics" is to enhance and improve knowledge, skills and practical skills of students of pharmacists to evaluate the biophysical, medical, and pharmaceutical processes through mathematical and statistical analysis.

In studying the course, "Higher Mathematics and Statistics" students learn the theory and practice of analyzing pharmaceutical and biomedical information. In addition, tapped the basic theoretical information on methods of mathematical analysis, probability theory, mathematical statistics necessary for the study of general and professional disciplines and their further application, study the appropriate mathematical tools, including methods of processing and analyzing the results of chemical experiments and biomedical research.

Students learn to analyze and solve problems of pharmaceutical and medical-biological content independently use appropriate mathematical literature. Mathematics education contributes abstract thinking, the ability to systematically analyze the phenomenon. To study the discipline necessary basic knowledge of mathematics at high school.

The main tasks of Discipline "Higher Mathematics and Statistics" are:
- The development of the students basic principles and theoretical positions of higher mathematics and statistics;
- Pharmaceutical process modeling differential equations;
- A description and assessment of probability distributions for discrete and continuous random variables;
- Processing of pharmaceutical research statistical methods;
- Formation of students' abstract thinking, the ability to systematically analyze the phenomenon.

Achieving these goals will enable students to master-pharmacists mathematical knowledge and skills

necessary to direct the formation of pharmacist-professionals as well as to explore other educational theoretical and applied sciences.

3. Competence and planned learning outcomes

Discipline "Higher Mathematics and Statistics" provides applicants acquiring education competencies:

- *Integrated:*
• the ability to solve common and complex specialized tasks and practical problems in professional activities using pharmaceutical regulations, theories and methods of fundamental, chemical, technology, medical, pharmacological, social and economic sciences;
• integrate knowledge and handle complexity, formulate judgments with incomplete or limited information;
• clearly and unambiguously communicate their findings and knowledge rationale underpinning these, to professional and non-professional audience.

- *General:*
•the ability to act socially responsible and conscious citizenship;
• the ability to apply knowledge in practical situations;
• the ability to abstract thinking, analysis and synthesis; ability to learn and be trained in modern;

- *Special* (professional, substantive):
• ability to organize statements and accounting (managerial, statistical, accounting and finance) in pharmacies carry commodity analysis, administrative paperwork, documentation and quality management of legal acts of Ukraine;
• ability to organize and carry out general and marketing management product line, innovative

 A *study of educational discipline applicant must know:*
 • basics of differential calculus and its application;
 • fundamentals of integral calculus and its application;
 • theory of differential equations and methods of solution;
 • modeling of processes in physics, chemistry, pharmacy, biology and medicine differential equations;
 • probability theory as the basis of genetics, metrology and mathematical statistics;
 • basic laws of distribution of discrete random variables and their characteristics;
 • basic laws of distribution of continuous random variables and their characteristics;
 • limiting laws of probability theory and their practical value;
 • evaluation methodology law and distribution characteristics of the studied characteristics according to the sample;
 • methodology of statistical hypothesis testing;
 • analysis of variance influence factors on the studied traits;
 • correlation and regression analysis.

 Be able:
 • identify the characteristics of the phenomenon based on the differential calculus;
 • error count limit direct and indirect measurements;
 • calculate and apply integral characteristics;
 • obtain solutions of differential equations;
 • determine the probability of random events;
 • calculate and apply probability and distribution characteristics of random variables;
 • identify and analyze the empirical distribution function and density distribution function empirical study features;
 • evaluate and integral point value distribution characteristics of the studied traits;
 • calculate and analyze the correlation between the features of the system;
 • estimate model parameters functions by least squares regression.

Have:
 • mastery of methods, main ideas, technologies, theoretical concepts and basic application rate, formation of general philosophy and education mathematical culture necessary future cosmetologists for deep understanding of the goals and objectives of the basic course subjects "Higher Mathematics and Statistics", as well as for research in within the professional field.

4. Structure of discipline

modules and topics content	Total hours					
	Full-time					
	Pharmacy(5,0)					
	total	including				
		L	S	PR	LAB	SW
1	*2*	*3*	*4*	*5*	*6*	*7*
Module 1. Mathematical Analysis						
Topic 1. Limit of the functions	11	1	2	2	-	6
Topic 2. Differential calculus	11	1	2	6	-	2
Topic 3. Integral calculus	11	1	2	6	-	2
Topic 4. Differential equations	9	1	2	4	-	2
Total hours by 1-st semester	**42**	**4**	**8**	**18**	**-**	**12**
Module 2. Probability and Mathematical Statistics						
Topic 5. Basics of Probability theory	19	1	2	4	-	12
Topic 6. Random variables	16	1	2	8	-	10
Topic 7. Descriptive Statistics	9	1	2	2	-	4
Topic 8. Hypothesis Testing	7	1	2	2	-	2
Topic 9. Correlation and regression analysis	7	1	2	2	-	2
Total hours by 2-d semester	63	5	10	18	-	30
final module control						
Total hours	**105**	**9**	**18**	**36**	**-**	**42**

5. The contents of the program of discipline
Module 1 Mathematical Analysis
Topic 1. Limit of the function

Theoretically set-examination of functional dependencies. The functions of one variable, general information, basic elementary functions and their properties. The inverse function and composite function.

The limit of the function. Infinitely small and infinitely large functions. Limit's rules. Continuity functions, basic properties of continuous functions.

Topic 2. Differential calculus

The original function, differentiation rules of basic elementary functions, rules of differentiation. Derivatives of higher orders. The physical meaning of the first and second derivative, geometric meaning of derivative. Definitions differ, differential geometric meaning. The use of derivative to determine the intervals of monotony and extremes functions, the use of second derivative for research and convexity curve of inflection points. Disclosure of the uncertainties at L'Hôpital's rule. The use of differential, for an approximate calculation of growth functions for approximate calculation of the function.

The function of many variables, complete and partial increments. Partial derivatives and differentials of first order. Total differential. Applying a total differential margin of error for the evaluation of indirect measurements. Gradient. The concept of extremes of functions of two variables.

Topic 3. Integral calculus

Indefinite integral and its properties, the table of basic integrals. Methods of integration: "step by step", substitution method, by parts. Definite integral and its properties. Newton-Leibniz formula. Improper integrals. Application of definite integral: calculation of the area of a plane figure, in uneven path of movement of variable strength. Applying the theorem of the average value in the calculation of average concentrations, the average speed.

Topic 4. Differential Equations

Basic concepts. Differential equations of the first order, the total consideration. Differential equations of the first order with separated variables. Linear differential equations of the first order. Linear homogeneous second order differential equations with constant coefficients. Modeling of linear differential equations of the first order: the radioactive decay law of cooling model the dynamics of reproduction. Single-chamber pharmacokinetic model.

Module 2. Probability and Mathematical Statistics
Topic 5. Basics of probability theory

Classification of events. Algebra of events. The classic definition of statistical and probability and its properties. Dependent and independent events, conditional probability. Multiplication theorem of probability. Addition theorem for compatible and incompatible events. Chart independent repeated trials Bernoulli formula.

Topic 6. Random variables

The notion of a discrete random variable. Law and distribution function of a discrete random variable and their properties. The main characteristics of discrete numeric values and their properties.

The concept of continuous random variable. Function and density distribution of continuous random variables and their properties. Distribution's quantile. Numerical characteristics of continuous random variables.

Binomial distribution law. Approximation formula Poissona. Uniform distribution law. Exponential distribution law. The normal distribution law. Student's, Pearson's and Fisher-Snedekora's Distributions.

Topic 7. Descriptive Mathematical Statistics

The problems of mathematical statistics. Sampling method. Variation row. Empirical distribution function and the empirical density function distribution. Spot evaluating the expectation and variance (sample variance and unbiased variance estimate). Interval estimation medium normally distributed trait.

Topic 8. Statistical Hypotheses Testing

General principles of statistical hypothesis testing. Test sample homogeneity and to identify failures. Check the method of analysis for the presence of bias. Testing hypotheses about the variance of a normal population. Testing the hypothesis of equality of variances of two normal populations. Testing hypotheses about the equality of the distribution centers of two normal populations.

Topic 9. Correlation and regression analysis

The statistical relationship between continuous values. Correlation, the correlation coefficient. Evaluation and analysis of the correlation coefficient correlation significance. General principles of regression analysis. Building a model of linear regression by least squares.

The final module control.

6. Topics of lectures

№ з/п	Topics content	Number of hours
		Pharmacy(5,0)
	Mathematical analysis	
1.	Limit of the function.	1
2.	Differential calculus.	1
3.	Integral Calculus.	1
4.	Differential Equations.	1
	Probability Theory and Mathematical Statistics	
5.	Fundamentals of Probability Theory.	1
6.	Random variables.	1
7.	Descriptive Mathematical Statistics.	1
8.	Testing statistical hypotheses. Analysis of variance.	1
9.	Correlation and regression analysis. Final test control.	1
Total hours		9

Lecture's plan

Topic 1. Limit of the function
Plan
1.1. Defining limit of the functions. Theorems of the limit. Infinitely small and infinitely large quantities
1.2. The first and second important limit

Topic 2. Differential calculus
Plan
2.1. Determination of the derivative. Geometric and physical meaning of the derivative. Differential function. Rules and formulas differentiation. Table of derivative elementary functions. The original composite function
2.2. Derivatives of higher orders. The use of derivative functions for research on extreme
2.3. The function of many variables. Partial. Total differential. Extreme of the functions of two variables

Topic 3. Integral calculus
Plan
3.1. Indefinite integral. Properties indefinite integral. The basic formula of integral calculus. Methods of integration.
3.2. A definite integral. Newton-Leibniz formula. Properties of the definite integral. The use of the definite integral

Topic 4: Differential Equations
Plan
4.1. Basic concepts of the theory of differential equations
4.2. Differential equations of the first order with separated variables. Homogenous and linear differential equations of the first order
4.3. Linear homogeneous second order differential equations with constant coefficients

Topic 5. Basics of probability theory
Plan
5.1. Random events. Statistical and classical definition of probability of random events
5.2. Conditional probability. Theorem addition and multiplication of probabilities
5.3. Law of total probability

Topic 6. Random variables

Plan

6.1. Random variables and their common characteristics. Numerical characteristics: mean, expectation, variance, standard deviation

6.2. Basic laws of distribution of discrete (binomial, Poisson, geometric) and continuous (continuous uniform, exponential, normal) random variables

Topic 7. Descriptive Mathematical Statistics

Plan

7.1. General and selective collection. Discrete variation series. Polygon and histogram frequencies. The empirical density function.

7.2. Confidence intervals

Topic 8. Testing statistical hypotheses

Plan

8.1. The formulation of hypotheses. Criterion validation. Errors of the first and second kind. The wording of the statistical report

8.2. The total consideration for testing hypotheses about equality parameters independent normal populations

8.3. Concepts variance analysis, model analysis; formulating hypotheses; the experimental design; Criteria for testing hypotheses; formulating conclusions

Topic 9. Correlation and regression analysis

Plan

9.1. Correlation dependence

9.2. The regression equation. Empirical regression line

9.3. Evaluation of the correlation coefficient according to the sampling and analysis of its significance

7. Topics of seminars

№	Topics content	Number of hours
		Pharmacy(5,0)
	Mathematical analysis	
1.	Limit of the function.	2
2.	Differential calculus.	2
3.	Integral Calculus.	2
4.	Differential Equations.	2
	Probability Theory and Mathematical Statistics	
5.	Fundamentals of Probability Theory.	2
6.	Random variables.	2
7.	Descriptive Mathematical Statistics.	2
8.	Testing statistical hypotheses. Analysis of variance.	2
9.	Correlation and regression analysis.	2
Total hours		**18**

Seminar's plan
Topic 1. Limit function

The purpose of classes: to promote the overall development of students' knowledge about the history of the number, including complex, to give the concept of Fibonacci numbers and examples

of their use in medicine and biology, consolidate knowledge of boundary features.
Plan
1.1. History number's history. The concept of a complex number
1.2. The concept of function. Basic elementary functions
1.3. The concept of numerical sequence. Fibonacci's numbers
1.4. The first and second importing limit

Topic 2. Differential calculus

The purpose of classes: to give historical information about the development of differential calculus, reveal chemical and biological content derivative, examples of differential calculus in pharmacy
Plan
2.1. The history of differential calculus. Chemical and biological content of the derivative
2.2. The use of differential calculus in the pharmaceutical industry
2.3. The use of differential linear approximation to the function and approximate calculations.
2.4. Application for assessing differential limiting errors indirect measurements

Topic 3. Integral calculus

The purpose of classes: to give historical information about the development of integral calculus and give examples of integral calculus to solve problems in physics, biology and medicine.
Plan
3.1. The history of the integral calculus.
3.2. Improper integrals and their applications.
3.3. The use of integral calculus to solve problems in physics, biology and medicine

Topic 4. Differential Equations

The purpose of classes: examples of modeling processes in biophysics, chemistry, pharmacokinetics differential equations, analyze the solutions of differential equations as causal relationships between the studied traits
Plan
4.1. Modeling of differential equations:
- physical processes: free vibrations, diffusion, absorption of light and ionizing radiation, radioactive decay
- kinetics of chemical reactions
- processes in pharmacy, biology and medicine

Topic 5. Basics of probability theory

The purpose of classes: to give historical information about the development of the theory of probability, to form the basic problems of probability theory in the pharmaceutical industry.
Plan
5.1. The history of probability theory
5.2. Fundamentals of Probability Theory

Topic 6. Random variables

The purpose of classes: to use probability theory to analyze biomedical traits that are considered as random variables learn the basic provisions on local and integral Laplace expansion, as well as the law of large numbers.
Plan
6.1. Local and integral Laplace theorem.
6.2. The law of large numbers

Topic 7. Descriptive Mathematical Statistics

The purpose of classes: to give historical information about mathematical statistics as a science, to hear reports and define the main issues concerning the use of mathematical statistics.
Plan
5.1. History of Mathematical Statistics as a science
5.2. The use of mathematical statistics in biology and medicine

Topic 8. Testing statistical hypotheses. Analysis of variance

The purpose of classes: to acquaint students with the basics of formulating hypotheses and methods of using unilabiate analysis of variance results in the processing of chemical and pharmaceutical research
Plan

8.1. Basic concepts of analysis of variance
8.2. Application of analysis of variance in medical research

Topic 9. Correlation and regression analysis

The purpose of classes: The formula for the correlation. The Linear model Assumption defines the population. Confidence intervals for Regression Coefficients.

Plan

9.1. Simulation of linear correlations relations

8. Topics of practice

№	Topic of the practice	Number of hours
		Pharmacy(5,0)
Mathematical analysis		
1.	Limit of the function	2
2.	Differential calculus	6
3.	Integral calculus	6
4.	Differential Equation	4
Probability Theory and Mathematical Statistics		
5.	Basics of probability theory	4
6.	Random variables	8
7.	Descriptive Mathematical Statistics	2
8.	Testing statistical hypotheses. Analysis of variance	2
9.	Correlation and regression analysis	2
Total hours		**36**

Practical lessons
Topic 1. Limit of the function

The purpose of classes: to form the basic information about the features and functions of the limit. Acquire practical skills for finding limits, comparison infinitely small and infinitely large functions, calculation parameters asymptote

Plan

1.1. The concept of function's limit. Infinitely small and large quantities
1.2. Basic theorems about limits
1.3. Finding the limit of the functions
1.4. Examples of continuous functions in medicine and biology

Topic 2. Differential calculus

The purpose of classes: to learn the concept of derivative and differential functions and their mechanical content, the basic rules of differentiation of simple and compound functions. Acquire practical skills in differentiation of functions and its applications, conduct research function using differential calculus, approximate calculation of the function and growth. Master the skills to use L'Hôpital's rule to calculate the boundary functions. To master the basic provisions of the differential calculus function of several variables: the concept of n-dimensional space; function of many variables, like the surface of a n-dimensional (two-dimensional) space; total and partial derivative of function; partial derivatives; total and partial differentials. Acquire practical skills in differentiation

of function of many variables, use total differential margin of error for the evaluation of indirect measurements.

Plan

      a. The derivative of sum, product, fraction. The Chain Rule

2.2. Derivative of higher order

2.3. Challenges for geometrical and physical meaning of the derivative

2.4. Differential function. Differentials of higher orders

2.5. The use of derivative to determine the intervals of monotony, extremes of functions

2.6. The use of derivative to determine the intervals of convexity and points of inflection of the curve

2.7. L'Hôpital's rule

2.8. Optimization problems in pharmacy and medicine

2.9. Finding the partial derivatives of first and higher orders

2.10. Calculations full and partial differentials of functions and their comparison with the corresponding function increments

2.11. The use of total differential, for linear approximation functions approximate calculations and limiting errors indirect measurements

2.12. Gradient

Topic 3. Integral calculus

The purpose of classes: to form the basic information about the indefinite integral and its properties. Acquire practical skills direct integration method, replacement parts and variable. To generate basic information about the definite integral and its properties. Acquire practical skills in applying Newton-Leibniz formula. By Master replacement by parts and substitution methods in the definite integral.

Plan

3.1. Direct integration

3.2. Integration by substitution variable

3.3. The method of integration by parts

3.4. Definite Integration for Newton-Leibniz formula

3.5. Method replacement parts and variable in the definite integral

3.6. The use of the definite integral average calculation functions and areas of flat figures.

Topic 4. Differential Equations

The purpose of classes: to master the basic information theory of differential equations, differential equations, order equations, general and particular solutions, methods of solving differential equations of first and second order. Acquire practical skills in finding common and partial solutions of differential equations the first order with separated variables, linear and homogeneous second order differential equations with constant coefficients. Modeling processes in biophysics, chemistry, pharmacokinetics by differential equations.

Plan

4.1. Differential equations of the first order with separated variables. Finding the general and particular solutions

4.2. Homogeneous differential equations of the first order. Finding the general and particular solutions

4.3. Linear differential equations of the first order. Finding the general and particular solutions

4.4. Linear homogeneous differential equations of second order with constant coefficients

Topic 5. Basics of probability theory

The purpose of classes: to master the basic provisions of the theory of probability of random events. To learn addition and multiplication theorem of probability. Acquire practical skills in calculations of probabilities of random events based on the classic definitions and formulas of combinatorics, the use of addition and multiplication theorems of probability, Bernoulli formula.

Plan

5.1. Algebra of events. The classic definition of probability.

5.2. The basic formula of combinatorics. Theorem multiplying probabilities.

5.3. Theorem addition and multiplication of probabilities. The probability of the opposite event.

5.4. Law of total probability. Bayes' formula.

Topic 6. Random variables

The purpose of classes: to learn the basic tenets of the theory of random variables, random variable distribution law of its properties, characteristics of random variables and their properties. Acquire

practical skills describe discrete and continuous random variables; calculation of basic characteristics: expectation, variance and standard deviation, and probability of values of random variables. Master the basics of the laws of distribution: binomial; Poisson; uniform; exponential; normal.

Plan

6.1. Discrete random variables. Several distribution. The law of distribution of discrete random variables. The distribution function of a discrete random variable. Calculations distribution characteristics: expectation, variance, standard deviation

6.2. Continuous random variables. The functions of distribution and density distribution of a random variable. The calculations of probabilities of random variables distribution function. Calculation of the probability of a random variable density function. Calculations expectation and variance of continuous random variable function for a given density

6.3. Binomial distribution law

6.4. Uniform distribution law, exponential distribution

6.5. Normal distribution law

Topic 7. Descriptive Mathematical Statistics

The purpose of classes: to form basic information about problems of mathematical statistics, sampling method, variation series, empirical distribution function and density distribution. Acquire practical skills in building empirical distribution functions and their histograms and graphical representations. To understand the concept of statistical parameter estimation distribution, know the basic properties of estimates and formula unbiased estimates of the expectation and variance. Form information about interval estimation of parameters normally distributed trait. To be able to calculate point and interval estimation of parameters normally distributed populaton.

Plan

7.1 Histograms looking of the Distribution of the Date. Construction of interval variation series, empirical distribution function, the empirical density function distribution.

7.2. Check the sample to homogeneity

7.3. Calculating point estimates expectation, variance, standard deviation and standard deviation of the mean

7.4. Determining a confidence interval for the expectation, variance and standard deviation discretely distributed signs for normally distributed trait

Topic 8. Testing statistical hypotheses

The purpose of classes: to form the basic information about the basic principles of statistical hypothesis testing. Acquire practical skills test hypotheses average and variances of normal populations; presence of failures among the studied data, species distribution.

Plan

8.1. Statistical hypothesis testing, variance and mean of normal distribution population

8.2. Testing statistical hypotheses about the type of distribution

8.3. Basic concepts of variance analysis

Topic 9. Correlation and regression analysis

The purpose of classes: to form the basic information about the correlation relationship between signs; building models by least squares regression. Acquire practical skills in the calculation of the model parameters of linear regression by least squares, correlation coefficient and sampling to verify the significance of correlation.

Plan

9.1. Calculation of the correlation coefficient evaluation and analysis of the significance of the linear correlation

9.2. Modelling the relationship between signs and factors based on the method of least squares

9.3. A linear regression model. Analysis of the significance linear relationship based on analysis of variance

Topic 9. Laboratory classes

Laboratory classes unpredictable in the working curriculum.

10. Individual out-of-class student's work

№	Topics content	Number of hours
		Pharmacy(5,0)
	Mathematical analysis	
1.	.Limit of the functions	6
2.	Differential calculus	2
3.	Integral Calculus	2
4.	Differential Equations	2
	Probability Theory and Mathematical Statistics	
5.	Basics of probability theory	12
6.	Random variables	10
7.	Descriptive statistics Mathematical	4
8.	Testing statistical hypotheses	2
9.	Correlation and regression analysis	2
Total hours		**42**

Tasks for student's work out-of-class

For First Module.

1. Complex numbers in algebraic, trigonometric and exponential forms. Solving problems calculating limits of function.
2. Calculation of limits by the first and second important limits
6. Continuity of a function. Finding breakpoints of function
7. Solving problems asymptotes for function
8. The task of finding derivatives of functions
9. The task to study the methods of differential calculus functions
10. The task of finding indefinite integrals and identified using the methods of replacement parts and variables
11. Tasks for calculating improper integrals and establishing their differences
12. Finding common solutions and partial differential equations first order

For second modules

1. The task of finding the probability of a random event
2. The challenge for the construction of the distribution of discrete random variables and of their numerical characteristics
3. The task to determine the distribution function of continuous distribution density function of the random variable and its numerical characteristics
4. The task of finding the mathematical expectation and variance for the basic laws of distribution of discrete and continuous random variables
5. Solving problems on finding the sample mean and variance
6. The task to determine the confidence intervals on the expectation and variance
7. Tasks for calculating the coefficient of correlation between random variables
8. The tasks to determine the regression equation

11. Individual out-of-class students work

For First Module

1. Calculating limits of functions (first and second impotent limit, L'Hôpital's rule)
2. Applications of Derivatives and limits (extremes, inflection points, asymptotes)
3. Preparation of differential equations in problems of pharmaceutical and medical-biological content and their solution

4. Tasks for determining errors indirect measurements (maximum absolute and relative errors).
For second modules
1. Random sampling. Discrete and continuous random variables. Distribution function or Density
2. Testing of population mean, variants.
3. Hypotheses. The Null Hypotheses. Interpreting a Hypotheses test
4. Correlation and Regression. Linear Relationship.

12. Methods, techniques and technology education

During the teaching discipline "Higher Mathematics and Statistics", the following
• *teaching methods:*
- Verbal methods (lectures, discussions)
- Visual methods (illustration, demonstration)
- Practices
  - Individual out-of-class work of students with comprehension and learning
  - Using an educational computer programs in the discipline
  - The use of project method for interdisciplinary integration
  • teaching methods by learning methods of discipline
  • Technology training:
  - Interactive (video lectures, lecture presentations)

13. Check point

Current control based on control of theoretical knowledge and skills.
Forms current control are
- Exaination (frontal, individual, combined)
- Practical test existing professional skills
- Test control (open and closed tests).
Individual out-of-class students work as a part of the final grade of the student.

14. Final checkpoint

Final module control is estimated at maximum 40 points for a successful and theoretical training on mastering of practical skills and is considered passed if the student scored at least 24 points.

Current testing and out-of-class work									Final check point	Grade
Module 1				**Module 2**						
T1	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	**T8**	**T9**	**40**	**100**
4	8	10	8	6	10	6	4	4		
30				30						
60										

15. Supportive

1. Syllabus of the course.
2. Tutorial.
3. Manual.
4. Set multimedia presentations of lectures.
5. Supporting lectures on.
6. Tests for all topics.
7. Questions and tasks for the final control

2.

17. Reading books

1. Elias Zakon. Concepts of Mathematics.-The Trillia Group, West Lafayette, Indiana, USA, 2006.-340p.
2. Andrew F. Siegel. Practical Business Statistics, 1990.-752 p.
3. Berman G.N., Problem Book in Mathematical Analysis, (Translation), MIR Publishers, Moscow, 1980.
4. Piskunov, N., Differential and Integral Calculus, MIR Publishers, Moscow, 1969.

18. Information resources, including the Internet

1. Center for Distance Learning Technologies pharmacy. Access: http://nuph.edu.ua/centr-distancijjnih-tehnologijj-navcha/.
2. VSMU repository. Access: http://elib.vsmu.by/handle/123/228.