



APPROVED

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scientific and pedagogical work
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CURRICULUM ON THE OPTIONAL DISCIPLINE
FUNDAMENTALS OF CHEMICAL METROLOGY

for students of the second year of the Pharmacy Faculty


training of specialists of the second (master's) level of higher education
education sector 22 " Public Healthcare "

Specialty 226 " Pharmacy, Industrial Pharmacy "

Discussed and approved

at the methodical meeting of the Department
of Toxicological and Analytical Chemistry,
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«Approved»

by profile methodical commission
in chemical and pharmaceutical disciplines
Protocol No. 3 from 21.06.2022

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INTRODUCTION

Curriculum of the optional discipline "**Fundamentals of chemical metrology**" is made in accordance with the draft Standard of Higher Education of Ukraine for the training of specialists of *the second (master's) level*

education sector 22 " Public Healthcare"

specialty 226 " *Pharmacy, Industrial Pharmacy* "

educational program of *Master of Pharmacy*

DESCRIPTION OF THE OPTIONAL DISCIPLINE (ABSTRACT)

The curriculum on discipline "Fundamentals of chemical metrology " is intended for students of higher education institutions of the pharmaceutical profile of Ukraine and is an integral part of the state standard of education. This is a discipline for methods of mathematical processing of chemical analysis results.

The curriculum of optional discipline contains the modern mathematics methods for qualitative and quantitative analysis and chemometrics.

Structure of the discipline	Amount of credits, hours				Year of study / semester	Type of control
	Total credits / h	Auditory		ISW		
		Lectures (hours)	Practical classes (hours)			
Fundamentals of the chemical metrology	3,0 credits / 90 hours	10	20	60	Second year (3-4 semesters)	Credit

The subjects of the discipline study are:

- the theoretical basis of chemical metrology;
- statistical analysis of the results of the chemical experiments in accordance with the requirements of State Pharmacopoeia of Ukraine 2.0.

Interdisciplinary connections:

Fundamentals of chemical metrology as an educational discipline:

- a) is based on knowledge of mathematics, physics and analytical chemistry;
- b) establishes the basis for the study of pharmaceutical and toxicological chemistry and involves the formation of skills for the use of the knowledge acquired for the study of special disciplines and professional activities.

1. Purpose and tasks of the discipline

1.1. The Fundamentals of chemical metrology as an educational discipline aims to train specialists who have the theoretical basis and practical skills in processing the results of research in accordance with modern statistical methods for assessing the reliability of the information obtained , its accuracy; planning an experiment, constructing its regression model and evaluating its parameters.

1.2. The main tasks of studying the discipline "Fundamentals of chemical metrology " are:

- formation of students 'knowledge and skills, practical skills from the Fundamentals of chemical metrology , which is the discipline of choice in the system of preparation of the pharmacist ;
- preparation of students for a better study of special pharmaceutical disciplines: pharmaceutical chemistry, pharmacy and factory technology of medicines, pharmacognosy, toxicological chemistry, etc.

1.3. Competencies and learning outcomes, the formation of which is facilitated by the discipline

(interrelationship with the normative content of the training of higher education applicants, formulated in terms of learning outcomes in the draft Standard).

According to the requirements of the Standard project, the optional discipline ensures that students acquire the following competencies:

integral:

- the ability to solve typical and complex specialized tasks and practical problems in the learning process, which involves conducting research, implementing innovations and is characterized by the complexity and uncertainty of conditions and requirements;

general:

- the ability to apply knowledge in practical situations (GC 2);

- the ability to abstract thinking, analysis and synthesis, the ability to learn and be modernly educated (GC 4);

- knowledge and understanding of the subject area and understanding of the profession (GC 6);

- the ability to adapt and act in a new situation (GC 7);

- skills in using information and communication technologies (GC 9);

- the ability to choose a communication strategy, the ability to work in a team and with experts from other fields of knowledge/types of economic activity (GC 10);

- the ability to evaluate and ensure the quality of performed works (GC 11);

- the ability to conduct research at the appropriate level (GC 12);

special (professional, subject):

- the ability to use knowledge of regulatory and legislative acts of Ukraine and recommendations of proper pharmaceutical practices in professional activity (PC 12);

- the ability to organize and conduct quality control of medicinal products in accordance with the requirements of the current State Pharmacopoeia of Ukraine and proper practices in pharmacy, to determine sampling methods for medicinal product control and to carry out their standardization in accordance with current requirements, to prevent the distribution of falsified medicinal products (PC 19);

- the ability to develop methods of quality control of medicinal products, including active pharmaceutical ingredients, medicinal plant raw materials and auxiliary substances using physical, chemical, physico-chemical, biological, microbiological, pharmacotechnological and pharmaco-organoleptic control methods (PC 20);

- the ability to interpret and evaluate the results of drug analysis in accordance with the requirements of DFU 2.0.

Detail of competencies according to the descriptors of the NQF in the form of "Matrix of competencies".

Matrix of competencies

No.	Competency	Knowledge	Ability	Communication	Autonomy and liability
1	2	3	4	5	6
Integral competencies					
the ability to solve typical and complex specialized problems and practical problems in professional pharmaceutical activity with the application of theoretical principles of the basics of chemical processes and methods of chemical and physical-chemical analysis (qualitative and quantitative) that involves conducting experimental research, introducing innovative methods of analysis, reasonably to substantiate the results of definitions and to unambiguously communicate their findings and knowledge to the professional and non-physical audience..					
General competencies					
1	the ability to apply knowledge in practical situations	have specialized conceptual knowledge in practical situations	to be able to solve complex tasks and problems that arise in practical situations	clear and unambiguous presentation of one's own conclusions, knowledge and explanations, which justify them to specialists and non-specialists.	to be responsible for making decisions in difficult conditions
2	the ability to abstract thinking, analysis and synthesis, the ability to learn and be modernly educated	have in-depth knowledge of the structure of professional activity	to be able to carry out professional activities that require updating and integration of knowledge	the ability to effectively form a communication strategy in professional activities	to bear responsibility for professional development, the ability for further professional training with a high level of autonomy
3	knowledge and understanding of the subject area and understanding of the profession	to know the basic principles of the subject area and understanding of the profession	to be able to apply the tools of the subject area in the profession of a pharmacist/pharmacist	establish appropriate connections to achieve the result	be responsible for the professional activities of the pharmacist/pharmacist
4	ability to adapt and act in a new situation	know the basic concepts of adaptation and the ability to act in a new situation	to be able to apply ways of adaptation and act in a new situation	ability to communicate, adapt to new situations	be responsible for professional communication and adaptation in new situations
5	skills in using information and communication technologies	have deep knowledge in the field of information and communication technologies used in professional activities	to be able to use information and communication technologies in a professional field that requires updating and integration of knowledge	use information and communication technologies in professional activities	be responsible for the development of professional knowledge and skills
6	the ability to choose a communication strategy, the ability to work in a team and with experts from other fields of knowledge/types of	to know communication tactics and strategies, laws and methods of communicative behavior	be able to choose communication methods and strategies to ensure effective teamwork	use communication strategies and interpersonal skills	be responsible for the choice and tactics of the communication method

	economic activity				
7	the ability to evaluate and ensure the quality of the work performed	to know methods of analysis, synthesis and further modern education	to be able to analyze information, to make informed decisions, to be able to acquire modern knowledge	establish appropriate connections to achieve goals.	to be responsible for the timely acquisition of modern knowledge.
8	the ability to conduct research at the appropriate level	to know the methods of evaluating performance quality indicators	to be able to ensure quality performance of work	establish connections to ensure quality performance of work	to be responsible for quality performance of works
Special (professional, substantive) competencies					
1	the ability to use knowledge of regulatory and legislative acts of Ukraine and recommendations of proper pharmaceutical practices in professional activities	to know and use knowledge of regulatory and legislative acts of Ukraine and recommendations of proper pharmaceutical practices in professional activities	to be able to use knowledge of regulatory and legislative acts of Ukraine and recommendations of proper pharmaceutical practices in professional activities	the ability to establish communication links in professional activities when considering regulatory and legislative acts of Ukraine.	Be responsible for knowledge of regulatory and legislative acts of Ukraine and recommendations of proper pharmaceutical practices
2	the ability to organize and conduct quality control of medicinal products in accordance with the requirements of the current State Pharmacopoeia of Ukraine and proper practices in pharmacy, to determine sampling methods for medicinal product control and to carry out their standardization in accordance with current requirements, to prevent the distribution of falsified medicinal products	to know the modern requirements for the organization and provision of quality control of medicines in the conditions of a pharmacy and a pharmaceutical enterprise	to be able to apply chemical and instrumental methods of analysis, to conduct biopharmaceutical research for the control of medicinal products	reasonably evaluate the results of chemical, physico-chemical and biopharmaceutical methods used in the quality control of medicinal products	to be responsible for the organization, provision and quality control of medicinal products in the conditions of a pharmacy and a pharmaceutical enterprise
3	the ability to develop methods of quality control of medicinal products, including active pharmaceutical ingredients, medicinal plant raw materials and auxiliary substances using physical, chemical, physico-chemical, biological, microbiological,	to know chemical and instrumental methods of analysis for the development of methods of quality control of medicinal products using physical, chemical, physico-chemical, control methods	to be able to prepare the necessary reagents and work with modern equipment of chemical laboratories	ensure the operation of the laboratory in accordance with the requirements of the State Federal Office of Ukraine and other regulatory documents	to be responsible for the organization of quality control of medicinal products in accordance with the requirements of the Federal Drug Administration and other regulatory documents

	pharmacotechnological and pharmacorganoleptic control methods				
4	the ability to interpret and evaluate the results of the analysis of medicinal products in accordance with the requirements of DFU 2.0	know the standard procedures of statistical analysis for evaluating the results of the analysis of medicinal products in accordance with the requirements of DFU 2.0 and other regulatory documents	be able to justify the size of the sample, apply methods of statistical analysis, and present the results of statistical data processing	reasonably evaluate and interpret the obtained results of drug analysis	be responsible for conducting the analysis and obtaining reliable and reproducible results

Learning outcomes:

Integrative final program learning outcomes, which contributes to the formation of a training course "Fundamentals of chemical metrology":

PLO 2. Apply knowledge from general and specialized disciplines in professional activity.

PLO 4. Demonstrate the ability to independently search, analyze and synthesize information from various sources and use these results to solve typical and complex specialized tasks of professional activity.

PLO 8. Carry out professional communication in the state language, use oral communication skills in a foreign language, analyzing specialized texts and translating foreign language information sources.

PLO 9. To carry out professional activities using information technologies, "Information databases", navigation systems, Internet resources, software and other information and communication technologies.

PLO 10. Adhere to the norms of communication in professional interaction with colleagues, management, consumers, work effectively in a team.

PLO 11. Use methods of evaluating indicators of the quality of activity; identify reserves for increasing labor efficiency.

PLO 12. Analyze information obtained as a result of scientific research, summarize, systematize and use it in professional activities.

PLO 17. To use the data of clinical, laboratory and instrumental studies to monitor the effectiveness and safety of the use of medicinal products.

PLO 24. Plan and implement professional activities on the basis of normative legal acts of Ukraine and recommendations of proper pharmaceutical practices.

PLO 31. Carry out all types of quality control of medicinal products; draw up quality certificates of a series of medicinal products and a certificate of analysis, taking into account the requirements of current regulatory documents, the State Pharmacopoeia of Ukraine and the results of quality control. Develop specifications and quality control methods in accordance with the requirements of the current State Pharmacopoeia of Ukraine.

PLO 32. Determine the main organoleptic, physical, chemical, physicochemical and pharmacotechnological indicators of medicinal products, justify and choose methods of their standardization, carry out statistical processing of the results in accordance with the requirements of the current State Pharmacopoeia of Ukraine.

Learning outcomes for the discipline " Fundamentals of chemical metrology":

Know:

- subject and tasks of chemical metrology;
- general metrological characteristics of chemical analysis;
- classification of errors in chemical analysis and the reasons for their occurrence ; methods of their detection;
- statistical analysis of the results of the chemical experiment in accordance with the requirements of the SPF 2.0;
- Subject and objectives of chemometrics and the application of its main provisions in analytical chemistry .

Be able:

- independently work with educational and reference literature on chemical metrology and analytical

chemistry ;

- carry out calculations of the basic metrological characteristics of the chemical analysis in accordance with the requirements of the State Pharmacopoeia of Ukraine 2.0;
- perform the processing of the results of the experiment and formulate the conclusions using the methods of mathematical methods.

2. Information volume of educational discipline

To study the discipline is given 90 hours 3 ECTS credits.

The organization of the educational process is carried out under the credit transfer system in accordance with the requirements of the European Credit Transfer and Accumulation System.

The discipline program is structured into one module, which includes one content module.

The amount of student workload is described in ECTS credits - credit credits, which are enrolled to students with the successful mastering of their modules (credits).

Topic	Number of hours			
	lectures	Practical classes	ISW	Individual tasks
1	2	3	4	5
Semantic module 1. Metrology in chemical analysis				
Topic 1. Metrological analysis of the analysis.	4	8	20	–
Topic 2. Statistical analysis of the results of the chemical experiment	3	6	20	–
Topic 3. Chemometrics	3	6	20	–
Total	10	20	60	–
Final control				Credit

4. Thematic plan of lectures

No	The theme of the lecture	Hours
Module 1. Metrology in chemical analysis		
1.	Chemical metrology as a science. Subject of chemical metrology, purpose, tasks, methods. Types of quantities. Chemical experiment, as a metrological procedure, its features. Metrological characteristics of the analysis: sensitivity, minimum (limit) concentration, limiting dilution. open minimum and others.	2
2.	The notion of error and uncertainty of measurement. Errors in chemical analysis, their classification and causes of occurrence. Methods of finding and eliminating systematic errors. Means of measurement, their main characteristics and methods of checking their accuracy .	2
3.	Basic concepts, subject and tasks of mathematical statistics. Random mistakes of chemical analysis. General and sample aggregate. Functions and laws of the distribution of random variables, their relation to random errors of chemical analysis. Normal distribution law. Reasons for rejecting results from the normal distribution law. Use of statistical analysis to process the results of a chemical experiment in accordance with the SPF 2.0. Trust intervals and estimation of their magnitude. Methods of comparing the results of the analysis.	2
4.	Dispersion analysis. His criteria and tasks. Fundamentals of regression analysis. The concept of a regression model, evaluation of its characteristics.	2
5.	Chemometrics, Goal and Tasks. Ways of using computers in analytical chemistry. Calculation and statistical estimation of parameters of linear dependence . Correlation analysis. Estimation of the correlation coefficient.	2

	Total	10
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5. Thematic plan of practical classes

No	Topic	Hours
<i>Module 1. Metrology in chemical analysis</i>		
1.	General and sample aggregate. The method of sampling in chemical research. Results of chemical analysis as random variables. Statistical processing of the results of chemical analysis according to PFU 2.0.	4
2.	Systematic errors that may occur during research. Failures as gross analysis errors. Methods of checking the results of the study on failures . Statistical processing of the results of a chemical analysis containing failures .	4
3.	Using Student's and Fisher's criteria to compare the results of the analysis . Use of these criteria in chemical analysis.	4
4.	The main ideas of correlation and regression analysis. The estimation of the relationship between two features using correlation analysis and the construction of the regression equation using the least squares method .	4
5.	The concept of validation of analytical techniques. The order of its conducting. Conducting calculation of values that are not necessary for validation of the analytical technique in accordance with the SPF 2.0.	4
	Total	20

6. Thematic plan of individual work of students

Type of control - current control in practical classes

No	Topic	Hours
<i>Module 1. Metrology in chemical analysis</i>		
1.	Classification of errors: absolute and relative, constant and proportional; Error of unit measurement, average; method errors, generalized error; errors are direct and indirect. Ways to minimize errors.	6
2.	Systematic errors in chemical analysis. Three types of systematic error, constant and proportional systematic errors. Methods of their determination. Instrumental errors (techniques for minimizing instrumental errors - randomization and relationalization) reactive (classes of purity of reagents), methodical, their interpretation.	8
3.	Basic types of statistical data. Means of measurement, their classes of accuracy. The main measurement scales, their characteristics.	6
4.	Planning a chemical experiment and filtering data. Peculiarities of the application of methods of experiment planning in the study of complex chemical objects.	8
5.	Reproducibility of the result of chemical analysis. Methods for determining reproducibility. Criteria for Bartlett, Fisher, Cochran.	6
6.	Theory of errors and their use for processing the results of chemical analysis. Distribution of mistakes in calculations.	6
7.	Theory of pattern recognition. Fundamentals of cluster and discriminatory analysis.	6
8.	International metrological organizations and their main tasks and functions. International and national standards of physical quantities. Transmission of information on unit size from the reference to measuring instruments.	6
9.	Systems of units. Principles of dimensional systems construction. International system of units Si. Systems that existed before Si. Units not included in Si, but widely used.	8
	Total	60

7. Individual tasks for full-time students are not provided.

Tasks for individual work

- Subject of chemical metrology, purpose, tasks, methods.
- Specificity of chemical analysis as a metrological discipline.
- General metrological characteristics of the analysis: sensitivity, minimum (marginal) concentration, marginal dilution. opened minimum.
- Errors in chemical analysis, their classification.
- Absolute and relative error, constant and proportional.
- Uncertainty of single measurement, average measurement.
- Method errors, generalized error; errors are direct and indirect.
- Absolute and relative errors.
- Different types of connection between the measured value and its error .
- The main stages and sources of errors in chemical analysis .
- Ways to minimize errors.
- Systematic mistakes of chemical analysis. Three types of systematic error, constant and proportional systematic errors. Methods of their determination.
- Instrumental errors (techniques for minimizing instrumental errors - randomization and relationalization)
- Random errors (classes of purity of reagents) methodical, interpretations.
- Statistical analysis of the chemical experiment according to the SPF .
- Sampling, evaluation of its homogeneity.
- Trust intervals and an estimate of their magnitude .
- Comparison of two methods of analysis for reproduction .
- Reproducibility of the result of chemical analysis. Methods for determining reproducibility. Criteria of Bartlet, Fisher, Cochran.

8. Teaching methods

In the process of studying the discipline "Fundamentals of Chemical Metrology" the following teaching methods are used:

explanatory and illustrative - (verbal and visual - lectures, theoretical part of the seminar)

partial-search method - preparation for a seminar, testing, monitoring the performance of independent work;

research method - performing experimental work.

Advantage is given to active and interactive methods and multimedia tutorials (multimedia lectures, educational films).

9. Methods of control

The mastering of the topic is controlled by seminars in accordance with specific goals, mastering the content module (intermediate control) - in the final lesson. The following means of controlling the level of students' training are used:

- oral questioning and written assignments

- solving situational problems,

- verification of the ability to interpret and evaluate the results of various methods of quantitative determination of medicinal substances , control of practical skills .

Forms of current control:

theoretical knowledge - individual interviews, interviews;

practical skills and abilities - solving typical and situational problems and controlling practical actions .

The final control is carried out on the basis of control of theoretical knowledge , practical skills and abilities.

At each lesson, an assessment is made of the level of students' knowledge on the 4-point scale ("5", "4", "3", "2") according to the criteria for assessing the student 's current activity . Obtained scores are converted to

corresponding scores.

10. Distribution of points received by students

Current control is carried out at each seminar session. At each lesson, the student answers 3 questions and solves 1 task on the theme of the seminar, whose knowledge is necessary for understanding the current topic, the issue of a lecture course and independent work that relate to the current occupation; demonstrates knowledge and skills of practical skills in accordance with the topic of practical training.

10.1. Criteria for evaluation

I. Current control. At each lesson, an assessment is made of the level of knowledge of students on a 4-point scale

Excellent ("5"). A student correctly, clearly, logically and fully responds to standardized issues of the current topic, including issues of independent work. Closely connects the theory with practice and correctly demonstrates the fulfillment (knowledge) of practical skills. Freely solves situational problems of increased complexity, is able to generalize the material.

Well ("4"). The student correctly and in essence answers standardized questions of the current topic, independent work. Demonstrates performance (knowledge) of practical skills. Correctly uses theoretical knowledge in solving practical problems. Is able to solve light and medium complexity situational tasks. Has the necessary practical skills and methods of their implementation in an amount that exceeds the required minimum.

Satisfactory ("3"). The student is incomplete, with additional questions, responsible for standardized issues of the current topic, lecture course and independent work. Students can't independently build a clear, logical answer. When answering and demonstrating practical skills, the student makes mistakes. Student solves only the easiest tasks, has only a minimum of research methods.

Not satisfactory ("2"). The student does not know the material of the current topic, can not construct a logical answer, does not answer additional questions, does not understand the content of the material. During the response and demonstration of practical skills makes significant, gross mistakes.

11. The form of final control of academic performance in the study of the discipline of choice is a credit. The final control consists of a written answer to the test tasks of format A (blank). The student answers 40 test tasks of format A on each topic of the module and is evaluated with 2 points for each correct answer.

The credit score is determined by the sum of points for answers to test tasks. The maximum number of points in the test is 80. The minimum number of points is 50.

12. Scheme of accrual and distribution of points received by students:

The maximum number of points a student can receive for the current activity is 200 points.

The minimum number of points a student can score for the current activity for a score is 120 points.

The calculation of the number of points is based on the student's assessment of the traditional scale during the study of discipline, by calculating the average arithmetic (CA), rounded to two decimal places. The resulting value is converted to a score on a multi-scale scale in the following manner:

$$x = CA \times 120 / 5$$

Recalculation of the average for current activity in a multi-scale scale is carried out according to the table:

Recalculation of the average score on «Fundamentals of the chemical metrology» for current activities multipoint scale

4- points scale	5	4.97	4.95	4.92	4.9	4.87	4.85	4.82	4.8	4.77	4.75	4.72	4.7
200- points scale	200	199	198	197	196	195	194	193	192	119	190	189	188
4- points scale	4.67	4.65	4.62	4.6	4.57	4.52	4.5	4.47	4.45	4.42	4.4	4.37	4.35
200-	187	186	185	184	183	181	180	179	178	177	176	175	174

points scale													
4- points scale	4.32	4.3	4.27	4.24	4.22	4.19	4.17	4.14	4.12	4.09	4.07	4.04	4.02
200- points scale	173	172	171	170	169	168	167	166	165	164	163	162	161
4- points scale	3.99	3.97	3.94	3.92	3.89	3.87	3.84	3.82	3.79	3.77	3.74	3.72	3.7
200- points scale	160	159	158	157	156	155	154	153	152	151	150	149	148
4- points scale	3.67	3.65	3.62	3.57	3.55	3.52	3.5	3.47	3.45	3.42	3.4	3.37	3.35
200- points scale	147	146	145	144	143	142	141	140	139	138	137	136	135
4- points scale	3.32	3.3	3.27	3.25	3.22	3.2	3.17	3.15	3.12	3.1	3.07	3.02	3
200- points scale	133	132	131	130	129	128	127	126	125	124	123	121	120
4- points scale	Less than 3												
200- points scale	Not enough												

Student's independent work is assessed during the current control of the topic at the appropriate classroom session. The evaluation of the topics submitted for independent study and not included in the topics of classroom training is monitored during the final control work.

The form of the final control of studying at the discipline "Fundamentals of Chemical Metrology" is a score that is presented to a student who has completed all types of works provided for by the curriculum, worked out all the training sessions and, when studying the module, scored points that were not less than the minimum .

13. Methodical support

1. Multimedia texts of lectures
2. Computers
3. A set of situational tasks for employment.
4. Recommended literature.

14. Recommended literature

Basic

1. Law of Ukraine "On Metrology and Metrological Activity". (Bulletin of the Verkhovna Rada (BD), 1998, No. 30-31, p.194) (as amended in accordance with the Law No. 762-IV (762-15) of 15.05.2003, VVR, 2003, No. 30 Art. 247)
2. Derffel K. Statistics in Analytical Chemistry. M.: Mir, 1994.

3. Sergeev AG Metrology: Textbook. - M: Logos, 2005. - 272 p.
4. Dvorkin VI Metrology and quality assurance of quantitative chemical analysis. M.: Chemistry, 2001 -263 p.
5. Validation of analytical techniques and tests // State Pharmacopoeia of Ukraine / State Enterprise "Scientific-Expert Pharmacopoeial Center". - 1st kind.- Supplement 2. - Kharkiv: State Enterprise "Scientific Experimental Pharmacopoeia Center", 2008. - P. 85-100.
6. Validation of Analytical Techniques for Drug Producers: Typical Guide for Drug Producers / Edited by VV Beregovyh - Moscow: Litterra, 2008. -132 p.
7. Sharaf MA, Illman DL, Kovalsky BR Chemometrics. - L .: Chemistry, 1989. - 272 p.

Auxiliary

1. DSTU ISO \ IEC 17025-2006 General requirements for the competence of testing and calibration laboratories .
2. DSTU 3514-97. Statistical methods of quality control and regulation. Terms and definitions.
3. DSTU ISO 3534-1: 2008 Statistics. Glossary of terms and designations.Part 1. General statistical terms and probability theory terms (ISO 3534-1: 2006, IDT).
4. DSTU ISO 3534-2: 2008 Statistics. Glossary of terms and designations. Part 2. Applied statistics (ISO 3534-2: 2006, IDT).
5. DSTU ISO 3534-3: 2005 Statistics. Glossary of terms and designations. Part 3. Experiment Planning (ISO 3534-3: 1999, IDT).
6. DSTU ISO 9000: 2007 Quality management systems. Basic Terms and Glossary (ISO 9000: 2005, IDT).
7. DSTU ISO 2854-2008 Statistical processing of data. Methods for evaluating and testing hypotheses about mean values and dispersions (ISO 2854: 1976, IDT).
8. DSTU ISO 3301: 2006 Statistical processing of data.Comparison of two mean values obtained in the case of pair observation (ISO 3301: 1975, IDT).
9. DSTU ISO 2602: 2006 Presentation of test results is statistical. Estimation of the average value. Trust interval (ISO 2602: 1980, IDT).
10. Applied statistics. Textbook / AI Orlov. - Moscow: "Examiner" Publishing House, 2004 - 656 pp.

15. Information resources:

1. <http://zakon2.rada.gov.ua/laws/annot/2408-14> - Law of Ukraine "On Standardization".
2. <http://www.dtk.com.ua/documents/ukr/2000/33/33nov4c.html> - Regulations on the State Committee for Standardization, Metrology and Certification of Ukraine.
3. www.dssu.gov.ua - Website of the State Inspectorate of Ukraine for the Protection of Consumer Rights.
4. <http://csm.kiev.ua/> — Information support in the field of technical regulation of state enterprises