



The National Technical University of
Ukraine "Igor Sikorsky Kyiv Polytechnic
Institute"



Ecology and technology of
plant polymers

Basics of standardization

Working program of the academic discipline (Syllabus)

Details of the academic discipline

Level of higher education	<i>Second (master's)</i>
Branch of knowledge	<i>10 Natural sciences</i>
Specialty	<i>101 Ecology</i>
Educational program	<i>Ecological safety</i>
Discipline status	<i>Selective</i>
Form of education	<i>full-time (day)//distance/mixed</i>
Year of training, semester	<i>1st year, spring semester</i>
Scope of the discipline	<i>5.0 credits (150 hours)</i>
Semester control/control measures	<i>Exam/Modular test papers</i>
Lessons schedule	<i>4 hours per week (3 hours of lectures + 1 hour of practical classes)</i>
Language of teaching	<i>Ukrainian</i>
Information about the course leader / teachers	Lecturer: https://eco-paper.kpi.ua/pro-kafedru/vykladachi/vizytky/Ploskonos-Victor-Grigorovych.html Practical / Seminar: https://eco-paper.kpi.ua/pro-kafedru/vykladachi/vizytky/Ploskonos-Victor-Grigorovych.html
Placement of the course	<i>https://do.ipk.kpi.ua</i>

Program of educational discipline

1. Description of the educational discipline, its purpose, subject of study and learning outcomes

The knowledge acquired in the process of studying the academic discipline provides an opportunity to acquire the skills of the basics of standardization and assessment of product compliance with the requirements of state standards, the basics of metrology and maintenance of measuring equipment in the appropriate condition for the proper metrological support of the technological processes of processing plant raw materials and development of new and improvement of existing systems of environmental protection and protection of the environment from negative anthropogenic influence. The ability to process and analyze and apply the basics of measurement accuracy in the process of conducting experimental research is formed; performance of statistical analysis of repeated measurements carried out in industrial and laboratory conditions.

Subject of the educational discipline "Fundamentals of standardization"- basics and principles of development of state standards of Ukraine (DSTU), technological regulations and technical conditions (TU U) for manufacturing products and development of new and improvement of existing environmental protection systems; the basics of organizing standardization activities in Ukraine and the leading countries of Europe and the world; basic principles of product conformity assessment in an accredited testing center; the main achievements in the field of metrological support and the unity of measurements with minimal error in order to improve the quality of finished products *and protection of the environment from negative anthropogenic influence; basic principles and regularities of statistical analysis of multiple measurements with random errors and the influence of the obtained results on quality indicators and product properties and environmental protection systems.*

To a large extent, the solution of the set tasks will be determined by the level of training of specialists who solve the issue of resource conservation, including scientific institutions and organizations, enterprises.

In order to successfully solve tasks, specialists must be fluent in information, able to solve complex problems of modeling situations at the highest scientific level.

The purpose of the educational discipline "Basics of standardization"

The goal of the educational discipline is the formation of students' competencies:

- awareness at the level of the latest achievements, necessary for research and/or innovative activities in the field of ecology, environmental protection and balanced nature management;*
- the ability to apply new approaches to the analysis and forecasting of complex phenomena, critical understanding of problems in professional activity;*
- the ability to organize works related to the assessment of the ecological state, environmental protection and optimization of nature use, in conditions of incomplete information and conflicting requirements;*
- the ability to assess the level of negative impact of natural and anthropogenic factors of ecological danger on the environment and people.*

1.2. According to the requirements of the educational discipline program after mastering it, students must demonstrate the following learning outcomes:

- to be able to use modern information resources on issues of ecology, nature management and environmental protection;*
- apply new approaches to develop a decision-making strategy in complex, unpredictable conditions;*
- choose the optimal management and/or nature management strategy depending on environmental conditions.*

2. Pre-requisites and post-requisites of the discipline (place in the structural and logical scheme of training according to the relevant educational program)

Studying the discipline "Fundamentals of standardization" is based on the principles of integration of various knowledge acquired by students during the bachelor's and the 1st semester of master's studies during the study of engineering disciplines. The "Fundamentals of Standardization" discipline is the foundation that should provide resolution of technical problems and aimed at deep rethinking of existing and creation of new holistic knowledge and professional practice.

3. Content of the academic discipline

CHAPTER 1 STANDARDIZATION

Topic 1 Standardization, purpose, principles and objects of standardization

Brief history of standardization, metrology and certification. Main results, purpose, principles and objects of standardization.

Topic 2 Standardization bodies, their functions

Standardization bodies, their functions. Types of standards. Procedure for development and approval of standards. Basics of standardization. National standardization system. Scientific and methodical bases of standardization. Organization of work on standardization in Ukraine. The essence of standardization and its role in increasing the efficiency of the development of the national economy. Classification and coding of scientific, technical, economic and social information.

Topic 3 Organization of standardization work in Ukraine

Organization of standardization work in Ukraine. General provisions, rules and tasks of standardization. Marking of products with signs of compliance with DSTU requirements. Liability for violation of mandatory requirements of standards. State control and supervision of compliance with the mandatory requirements of the standards. International cooperation in the field of standardization. Financing of standardization works. Information provision of standardization, its services and ownership of standards. Improvement of the state standardization system and Ukraine's entry into the WTO. Harmonization of standards.

Topic 4 Standardization in international organizations

Standardization in international organizations. Standardization in ISO. Standardization in IES. Standardization in European organizations. Standardization in the CIS. Prospects of international standardization.

Topic 5 Standardization in foreign countries

Standardization in foreign countries. Standardization in the USA. Standardization in Great Britain. Standardization in France. Standardization in Germany. Standardization in Japan.

Topic 6 Procedure for development, approval and implementation of technological regulations and TU U in Ukraine

Procedure for development, approval and implementation of Technical Specifications in Ukraine. Introduction. Normative references. Terms. Construction rules. Teaching and design. Rules of consent and acceptance. Marking rules.

Procedure for development, approval and implementation of technological regulations. Terms. Composition of technological regulations. Requirements for the content of the main section of the technological regulation. Procedure for developing technological regulations. The procedure for drawing up technological regulations. The procedure for agreeing technological regulations. The procedure for approval and registration of technological regulations. Term of validity of the technological regulation. The procedure for canceling the technological regulation. Control over implementation and responsibility for violations of technological regulations.

Topic 7 Confirmation of conformity of products in Ukraine

Confirmation of conformity of products in Ukraine. General provisions, terms and definitions. Basic principles of state policy in the field of conformity confirmation. Confirmation procedure and national mark of conformity. Funding of compliance activities. International cooperation of Ukraine in the field of compliance verification.

Topic 8 Organization of testing laboratories

General requirements for testing laboratories. Technical competence. Laboratory staff. Premises and environment. Testing equipment and measuring equipment. Test methods and procedures.

Quality system. Products and products being tested. Testing equipment and measuring equipment. Accreditation of testing laboratories. Inspection control over the activities of accredited laboratories.

SECTION 2. STANDARDIZATION AND ACCURACY OF INDICATORS OF STANDARDS

Topic 1 Preliminary acquaintance with the accuracy of measurements

Mistakes are like mistakes. The inevitability of errors. How important it is to know mistakes. Estimation of the error when counting from the scale. Estimation of errors in the case of multiple direct measurements.

Topic 2 The main provisions of ensuring the accuracy of measurements

Best estimate \pm deviation. Significant numbers with defined deviations. The difference between the measurement results. Comparison of two values: measured and theoretically known. Comparison of two measured values. Multiplication of two measured values.

Topic 3 Statistical analysis of multiple measurements with random deviations

The sum and difference of the measured values. Multiplication and division of measured quantities. Multiplication of the measured value by an exact number. Raising the measured value to the power. Generalizing formulas for calculating the sum, difference, product, and fraction of measured values. Accuracy of measurements using a satisfactory function of one variable. Step-by-step accuracy calculation method. The general formula for calculating the accuracy of measurements in indirect measurements.

Topic 4 Statistical analysis of multiple measurements

Random and systematic errors. Average value and standard deviation. Standard deviation is like the error of a unit measurement. Standard deviation of the mean. Systematic errors for experimental research in educational laboratories.

Topic 5 Normal distribution of statistical value

Histograms and distribution of random variables. Limit distribution of random variables. The normal distribution of a random variable.

Topic 6 Justification of error calculation formulas based on the law of normal distribution

Standard deviation as 68% confidence interval. Justification of the average \bar{x} as the best estimate and σ - the width of the marginal distribution.

Topic 7 Calculation and justification of the confidence interval

Calculation and justification of the confidence interval.

Topic 8 The problem of screening and combining measurement results

The problem of sifting data. Chauvet's criterion. The problem of combining the results of different measurements.

Topic 9 The χ^2 criterion for marginal distributions

The concept of the χ^2 criterion. Degrees of freedom and reduced value of χ^2 . Probabilities for χ^2 .

Topic 10 Methods of assessing the accuracy of measurements based on the concept of uncertainty

General concepts and definitions of the concept of uncertainty. An example of estimating error characteristics and calculating measurement uncertainty. Comparative analysis of two approaches to determining the characteristics of measurement accuracy.

4. Educational materials and resources

Basic literature

1. Yermilova N.V., Kyslytsia S.G. "New sources of standardization and methodology" : Study guide / – Poltava: PoltNTU, 2017. - 141 p.
2. Bozhenko L.I. Metrology, standardization, certification and accreditation. – Lviv: Afisha, 2006. - 324 p.
3. Vasilevskiy O.M., Kucheruk V.Yu., Volodarskiy E.T. Basics of the theory of measurement uncertainty: Textbook / – Vinnytsia: VNTU, 2015. – 230 p.

Additional literature

4. DSTU 3410-96 UkrSEPRO certification system. Substantive provisions.
5. Volodarskiy Y.T., Kuharchuk V.V., Podzharenko V.O., Serdyuk G.B. Standards and assurance of measurement and control. Study guide for technical students. university - Vinnytsia: Published. State, Technical University, 2001.-220 p.
10. Primakov SP., Barbash V.A. Technology of paper and cardboard. K.: ECMO, 2002.-396 p.
11. DSTU 2926-94 Quality systems. Complexes of quality management are system and technological. Substantive provisions.
12. ISO 9000 series standards.
- thirteen. European standards of the EN 4500 series.

Information resources on the Internet

1. Ministry of Environmental Protection and Natural Resources of Ukraine -<https://mepr.gov.ua/>
2. Industrial ecology. Community of environmental specialists -<http://www.eco.com.ua/>
3. **Professional Association of Environmentalists of Ukraine (PAEU)** –<https://paeu.com.ua/>
4. Library named after V.I. Vernadsky -www.nbu.gov.ua
5. Ecological portal of Ukraine -www.ecologya.com.ua

Educational content

5. Methods of mastering an educational discipline (educational component)

Lecture classes

Lectures are aimed at:

- provision of modern, integral, interdependent knowledge in the discipline "Fundamentals of standardization", the level of which is determined by the target attitude to each specific topic;
- ensuring creative work of students together with the teacher during the lecture;
- education of students' professional and business qualities and development of their independent creative thinking;
- forming the necessary interest in students and providing direction for independent work;
- definition at the current level of scientific development in the field of standardization, metrology and accuracy of measurements;
- reflection of the methodical processing of the material (highlighting of the main provisions, conclusions, recommendations, their wording is clear and adequate);
- the use of visual materials for demonstration, combining them, if possible, with the demonstration of research results;
- teaching research materials in clear and high-quality language with observance of structural and logical connections, clarification of all newly introduced terms and concepts;
- accessibility for perception by this audience.

No. z/p	The name of the topic of the lecture and a list of the main questions (a list of didactic tools, references to the literature and tasks on the SRS)	Hour
1	<p style="text-align: center;">CHAPTER I BASICS OF STANDARDIZATION</p> <p>Topic 1 Standardization. Basic concepts. Terms and definitions Lecture No. 1. Standardization. Basic terms and definitions. Condensed historical information about standardization. Literature: [4] p12-21; [1] pp. 6-14. Tasks on SRS Main results, purpose, principles and objects of standardization.</p>	2
2	<p>Topic 2 Classification of regulatory documentation (ND), procedure for development and approval of standards Lecture No. 2. Standardization bodies, their functions. Types of standards. Procedure for development and approval of standards. Literature: [2] pp. 34-41; [4] pp. 29-44. Tasks on SRS Fundamentals of standardization. National standardization system. Scientific and methodical bases of standardization. Organization of work on standardization in Ukraine. The essence of standardization and its role in increasing the efficiency of the development of the national economy. Classification and coding of scientific, technical, economic and social information.</p>	2
3	<p>Topic 3 Organization of standardization work in Ukraine Lectures No. 3-4. General provisions, rules and tasks of standardization. Marking of products with signs of compliance with DSTU requirements. Liability for violation of mandatory requirements of standards. State control and supervision of compliance with the mandatory requirements of the standards. International cooperation in the field of standardization. Literature: [2] pp. 43-51; [4] pp. 46-54. Tasks on SRS Financing of standardization works. Information provision of standardization, its services and ownership of standards. Improvement of the state standardization system and Ukraine's entry into the WTO. Harmonization of standards.</p>	4
4	<p>Topic 4 Standardization in international organizations Lecture No. 5. Standardization in ISO. Standardization in IES. Standardization in European organizations. Standardization in the CIS. Literature: [2] p.44-64; [4] pp. 59-74. Tasks on SRS Perspectives of international standardization.</p>	2
5	<p>Topic 5 Standardization in foreign countries Lecture No. 6. Standardization in the USA. Standardization in Great Britain. Standardization in other Asian countries. Literature: [2] p.66-79; [4] pp. 49-64. Tasks on SRS Standardization in France. Standardization in Germany. Standardization in Japan.</p>	2
6	<p>Topic 6 Basic provisions of the technological regulations and TU U in Ukraine Lectures No. 7-8. Procedure for development, approval and implementation of Technical Specifications in Ukraine. Introduction. Normative references. Terms. Construction rules. teaching and design. Rules of consent and acceptance. Marking rules. Literature: [4] p.69-84. Tasks at the SRS Procedure for development, approval and implementation of technological regulations. Terms. Composition of technological regulations. Requirements for the content of the main section of the technological regulation. Procedure for developing technological regulations. The procedure for drawing up technological regulations. The procedure for agreeing technological regulations. The procedure for approval and registration of technological regulations. Term of validity of the technological regulation. The procedure for canceling the technological regulation. Monitoring of implementation and responsibility for violations of technological regulations; (Technological regulation of newsprint production.</p>	4

7	<p>Topic 7 Regulations on conformity of products in Ukraine Lectures No. 9-10. General provisions, terms and definitions. Basic principles of state policy in the field of conformity confirmation. Law on Technical Regulations. Confirmation procedure and national mark of conformity. Literature: [4] p.86-104, [17] p.16-45. Tasks on the SRS Funding of compliance verification activities. International cooperation of Ukraine in the field of compliance verification.</p>	4
8	<p>Topic 8 Testing laboratories for products Lecture No. 11. General requirements for testing laboratories. Technical competence. Laboratory staff. Premises and environment. Testing equipment and measuring equipment. Test methods and procedures. Literature: [4] p.108-126; [6] p.19-35, [17] p.66-83. Tasks on SRS Quality system. Products and products being tested. Testing equipment and measuring equipment. Accreditation of testing laboratories. Inspection control over the activities of accredited laboratories.</p>	2
9	<p>SECTION 2. STANDARDIZATION AND ACCURACY OF STANDARDS INDICATORS Topic 1 Preliminary acquaintance with the accuracy of measurements Lecture No. 1-2. Mistakes are like mistakes. The inevitability of errors. How important it is to know mistakes. Estimation of the error when counting from the scale. Estimation of errors in the case of multiple direct measurements. Literature: [5] pp. 21-29; [7] pp. 16-21; [8] pp. 25-37. Tasks on SRS. General provisions and classification of errors.</p>	4
10	<p>Topic 2 Basic provisions of measurement accuracy Lecture No. 3. Best estimate \pm accuracy. The difference between the measurement results. Comparison of two values: measured and theoretically known. Comparison of two measured values. Lecture No. 4. Comparison of two values: measured and theoretically known. Comparison of two measured values. Lecture No. 5. Relative errors. Significant figures in relative errors. Multiplication of two measured values Literature: [5] p.31-57; [7] pp. 23-54; [8] pp. 39-68. Tasks on SRS. Comparison of two values: measured and theoretically known. Comparison of two measured values.</p>	4
11	<p>Topic 3 Accuracy in indirect measurements Lecture No. 6. Errors of the sum and difference of measured quantities. Multiplication and division of measured quantities. Multiplication of the measured value by an exact number. Raising the measured value to the power. Lecture No. 7. Independent errors when calculating the sum of measured values. Generalizing formulas for calculating the sum, difference, product, and fraction of measured values with independent errors. Lecture No. 8. Errors when using a satisfactory function of one variable. Step-by-step error calculation method. General formula for calculating errors in indirect measurements. Literature: [5] p.61-77; [7] pp. 63-85; [8] pp. 69-88. Tasks on SRS. General information about errors in indirect measurements. Understanding errors in indirect measurements using examples. The principle of the arithmetic mean.</p>	4
12	<p>Topic 4 Statistical analysis of multiple measurements with random errors Lecture No. 9. Random and systematic errors. Average value and standard deviation. Lecture No. 10. Standard deviation is the error of a unit measurement. Standard deviation of the mean. Systematic errors for experimental research in</p>	4

	<p>educational laboratories.</p> <p>Literature: [5] c.106-130, [10] c.54-72, [6] c. 88-101.</p> <p>Tasks on SRS. Determination of the guarantee interval of measurement results. Summary of measurement errors. Errors of direct equal-precision measurements. Processing and assessment of the accuracy of exact measurements. Standard deviation of the mean in examples.</p>	
thirteen	<p>Topic 5 Normal distribution of statistical value</p> <p>Lecture No. 11. Histograms and distribution of random variables. Limit distribution of random variables. The normal distribution of a random variable.</p> <p>Literature: [5] c.136-155, [3] c.54-72, [10] c. 88-101.</p> <p>Tasks on SRS. The law of probability distribution for multiple measurements. Random variables. The use of elements of the theory of probabilities to the results of measurements. Repetition of tests - binomial distribution.</p>	2
14	<p>Topic 6 Justification of error calculation formulas based on the law of normal distribution</p> <p>Lecture No. 12. Standard deviation as a 68% confidence interval. Justification of the average \bar{x} as the best estimate and σ - the width of the marginal distribution.</p> <p>Lecture No. 13. Justification of calculation of errors in indirect measurements. Justification of the standard deviation of the mean.</p> <p>Literature: [5] c. 148-172; [7] c. 78-95.</p> <p>Tasks on SRS. Quadratic sum of errors and its justification. General case. Determination of the mean squared error.</p>	4
15	<p>Topic 7 Calculation and justification of the confidence interval</p> <p>Lecture No. 14. Calculation and justification of the confidence interval.</p> <p>Literature: [6] c. 123-155; [7] c. 108-123.</p> <p>Tasks on SRS. Confidence intervals. The required number of random variable measurements.</p>	2
16	<p>Topic 8 The problem of screening and combining measurement results</p> <p>Lecture No. 15. The problem of data screening. Chauvet's criterion. The problem of combining the results of different measurements.</p> <p>Literature: [5] c. 178-192; [13] c. 98-137.</p> <p>Tasks on SRS. The problem of data screening using the Chauvenet criterion on examples. The problem of combining the results of various measurements on examples.</p>	2
17	<p>Topic 9 Criterion χ^2 for marginal distributions</p> <p>Lecture No. 16. Concept of the χ^2 criterion. Degrees of freedom and reduced value of χ^2. Probabilities for χ^2.</p> <p>Lecture No. 17. An example of the development of a typical method of performing measurements to determine the mass fraction of kaolin in an aqueous suspension.</p> <p>Literature: [5] c. 198-222; [7] c. 218-141.</p> <p>Tasks on SRS. Linear correlation coefficient. quantitative criterion of significance r.</p>	4
18	<p>Topic 10 Methods of assessing the accuracy of measurements based on the concept of uncertainty</p> <p>Lecture No. 18. General concepts and definition of the concept of uncertainty. An example of estimating error characteristics and calculating measurement uncertainty. Comparative analysis of two approaches to determining the characteristics of measurement accuracy.</p> <p>Literature: [6] c. 168-182.</p> <p>Tasks on SRS. Comparative analysis of two approaches to determining the characteristics of measurement accuracy.</p>	2
	In total	54

Practical training

In the system of professional training of master's students in this discipline, practical classes occupy 25% of the classroom load. Being a supplement to the lecture course, they lay and form the foundations of the master's qualification. The content of these classes and the method of conducting them should ensure the development of the creative activity of the individual. They develop scientific thinking and the ability to use special terminology, allow you to check knowledge, therefore this type of work is an important means of operational feedback. Practical classes should perform not only cognitive and educational functions, but also contribute to the growth of graduate students as creative workers.

The main tasks of the cycle of practical classes:

- to help master's students to systematize, consolidate and deepen knowledge of a theoretical nature in the field of waste paper recycling technology
- to teach master's students in methods of solving practical tasks, to promote the mastery of skills and abilities to perform calculations, graphic and other tasks;
- to teach their work with scientific and reference literature and schemes;
- to form skills to learn independently, that is, to master the methods, methods and techniques of self-learning, self-development and self-control.

No. z/p	Name of the subject of the practical session and list of main questions (a list of didactic support, references to the literature and tasks on the SRS)	Hour
1	General principles of development of technological regulations. Causes of errors in the measurement of indicators. The main provisions of measurement accuracy. Solving problems for the purpose of general estimation of errors in the case of multiple measurements. Relative errors and significant figures. Literature: [1] p22-31; [7] pp. 6-14; [8] p. 16-23. Tasks on SRS. Solving problems with the aim of general assessment of errors in the case of multiple measurements in the process of developing regulations.	4
2	Solving practical problems in the process of developing regulations. Errors in indirect measurements. Determining errors when using measurement results in sum, difference, multiplication, and division operations Literature: [3] c. 33-54; [7] c.16-22. Tasks on SRS. Errors in indirect measurements in laboratory conditions.	4
3	Solving problems with the occurrence of random errors in the process of developing regulations. Calculation of mean and standard deviation. Literature: [5] c.87-91, [7] c.34-43, [8] c. 49-54. Tasks on SRS. Calculation of mean and standard deviation in laboratory conditions.	4
4	Practical analysis of occurrence of random errors. Calculation of the standard deviation of the mean. Systematic errors. Literature: [5] c.92-101, [10] c.44-63, [13] c. 55-64. Tasks on SRS. Calculation of the standard deviation of the mean in laboratory conditions.	4
5	Modular control works	2
	In total	18

6. Independent work of the student

Independent work takes approximately 50% of the time of studying the credit module, including preparation for the exam. The main task of students' independent work is the mastery of scientific knowledge in areas that are not included in the list of theoretical foundations through personal search for information, formation of active interest in a creative approach in educational work. In the process of

independent work within the framework of the educational component, the student must learn to analyze modern methods of developing mathematical models.

No. z/p	The name of the topic submitted for independent processing	Number of hours of SRS
Chapter 1 Basics of standardization		
1	<p>Topic 1 Standardization. Basic concepts. Terms and definitions SRS to topic 1 Main results, purpose, principles and objects of standardization. Literature: [4] p12-21; [1] pp. 6-14.</p> <p>Topic 2 Classification of regulatory documentation (ND), procedure for development and approval of standards. SRS to topic 2 Basics of standardization. National standardization system. Scientific and methodical bases of standardization. Organization of work on standardization in Ukraine. The essence of standardization and its role in increasing the efficiency of the development of the national economy. Classification and coding of scientific, technical, economic and social information. Literature: [2] pp. 34-41; [4] pp. 29-44.</p> <p>Topic 3 Organization of standardization work in Ukraine. SRS to topic 3 Financing of standardization works. Information provision of standardization, its services and ownership of standards. Improvement of the state standardization system and Ukraine's entry into the WTO. Harmonization of standards. Literature: [2] pp. 43-51; [4] pp. 46-54.</p> <p>Topic 4 Standardization in international organizations SRS to topic 4 Prospects of international standardization. Literature: [2] p.44-64; [4] pp. 59-74.</p> <p>Topic 5 Standardization in foreign countries SRS to topic 5 Standardization in France. Standardization in Germany. Standardization in Japan. Literature: [2] p.66-79; [4] pp. 49-64.</p> <p>Topic 6 Basic provisions of the technological regulations and TU U in Ukraine SRS to topic 6 Procedure for development, approval and implementation of technological regulations. Terms. Composition of technological regulations. Requirements for the content of the main section of the technological regulation. Procedure for developing technological regulations. The procedure for drawing up technological regulations. The procedure for agreeing technological regulations. The procedure for approval and registration of technological regulations. Term of validity of the technological regulation. The procedure for canceling the technological regulation. Monitoring of implementation and responsibility for violations of technological regulations; (Technological regulation of newsprint production. Literature: [4] p.69-84.</p> <p>Topic 7 Regulations on conformity of products in Ukraine. SRS to topic 7 Funding of compliance activities. International cooperation of Ukraine in the field of compliance verification. Literature: [4] p.86-104, [17] p.16-45.</p> <p>Topic 8 Testing laboratories for products Quality system. Products and products being tested. Testing equipment and measuring equipment. Accreditation of testing laboratories. Inspection control over the activities of accredited laboratories. SRS to topic 8 Quality system. Products and products being tested. Testing equipment and measuring equipment. Accreditation of testing laboratories. Inspection control over the activities of accredited laboratories. Literature: [4] p.108-126; [6] p.19-35, [17] p.66-83.</p>	15

Section 2. Standardization and accuracy of indicators of standards

3	<p>Topic 1 Preliminary acquaintance with the accuracy of measurements SRS to topic 2 General provisions and classification of errors. Literature: [5] pp. 21-29; [7] pp. 16-21; [8] pp. 25-37.</p> <p>Topic 2 Basic provisions of measurement accuracy SRS to topic 2 Comparison of two values: measured and theoretically known. Comparison of two measured values. Literature: [5] p.31-57; [7] pp. 23-54; [8] pp. 39-68.</p> <p>Topic 3 Errors in indirect measurements SRS to topic 3 General information about errors in indirect measurements. Understanding errors in indirect measurements using examples. The principle of the arithmetic mean. Literature: [5] p.61-77; [7] pp. 63-85; [8] pp. 69-88.</p> <p>Topic 4 Statistical analysis of multiple measurements with random errors SRS to topic 4 Determination of the guarantee interval of measurement results. Summary of measurement errors. Errors of direct equal-precision measurements. Processing and assessment of the accuracy of exact measurements. Standard deviation of the mean in examples. Literature: [5] c.106-130, [10] c.54-72, [6] c. 88-101.</p> <p>Topic 5 Normal distribution of statistical value SRS to topic 5 The law of probability distribution for multiple measurements. Random variables. The use of elements of the theory of probabilities to the results of measurements. Repetition of tests - binomial distribution. Literature: [5] c.136-155, [3] c.54-72, [10] c. 88-101.</p> <p>Topic 6 Justification of error calculation formulas based on the law of normal distribution SRS to topic 6 Quadratic sum of errors and its justification. General case. Determination of the mean squared error. Literature: [5] c. 148-172; [7] c. 78-95.</p> <p>Topic 7 Calculation and justification of the confidence interval CRS to topic 7 Confidence intervals. The required number of random variable measurements. Literature: [6] c. 123-155; [7] c. 108-123.</p> <p>Topic 8 The problem of screening and combining measurement results SRS to topic 8 The problem of screening data using the Chauvenet criterion with examples. The problem of combining the results of various measurements on examples. Literature: [5] c. 178-192; [13] c. 98-137.</p> <p>Topic 9 Criterion χ^2 for marginal distributions SRS to topic 9 Coefficient of linear correlation. quantitative criterion of significance r. Literature: [5] c. 198-222; [7] c. 218-141.</p> <p>Topic 10 Methods of assessing the accuracy of measurements based on the concept of uncertainty SRS to topic 10 Comparative analysis of two approaches to determining the characteristics of measurement accuracy. Literature: [6] c. 168-182.</p>	17
4	Preparation for modular control works	4
5	Performing homework control work	12
6	Preparation for the exam	30
	Hours in general	78

7. Policy of academic discipline (educational component)

Master's students are obliged to take an active part in the educational process, not to be late for classes and not to miss them without a good reason, not to interfere with the teacher conducting classes, not to be distracted by activities unrelated to the educational process.

Rules for assigning incentive and penalty points

- Incentive points can be awarded by the teacher exclusively for the performance of creative works in the discipline or additional completion of online specialized courses after agreement with the teacher and obtaining the appropriate certificate:
 - <https://prometheus.org.ua/>,
 - <https://www.coursera.org/>.

But their sum cannot exceed 10% of the rating scale.

- Penalty points are not provided within the academic discipline.

Policy of deadlines and rescheduling

In the event of arrears from the academic discipline or any force majeure circumstances, master's students should contact the teacher in a timely manner through the available (provided by the teacher) communication channels to resolve problematic issues and agree on the algorithm of actions for practice.

Policy of academic integrity

Plagiarism and other forms of dishonest work are unacceptable. Plagiarism refers to the absence of references when using printed and electronic materials, quotes, opinions of other authors. Inadmissible tips and write-offs during writing tests, conducting classes; passing the exam for another master's student; copying materials protected by the copyright system without the permission of the author of the work.

The policy and principles of academic integrity are defined in Chapter 3 of the Code of Honor of the National Technical University of Ukraine "Ihor Sikorsky Kyiv Polytechnic Institute". More details:<https://kpi.ua/code>

Policy of academic behavior and ethics

Students should be tolerant, respect the opinion of others, formulate objections in the correct form, constructively support feedback during classes. Standards of ethical behavior of students and employees are defined in Chapter 2 of the Code of Honor of the National Technical University of Ukraine "Ihor Sikorskyi Kyiv Polytechnic Institute". More details:<https://kpi.ua/code>

8. Types of control and rating system for evaluating learning outcomes (RSO)

Distribution of study time by types of classes and tasks in the discipline according to the working study plan:

Semester	Training time		Distribution of study hours				Control measures		
	Credits	Acad. hours	Lectures	Practical	Lab. practice	SRS	MKR	DKR	Semester control
3	5.0	150	54	18	-	78	1	-	examination

The student's rating in the discipline consists of the points he receives for:

- implementation and defense of practical tasks (4 works);
 - writing two test papers (1 MKR is divided into two one-hour test papers MKR-1 and MKR-2).
- Semester control is an exam.

System of rating (weighted) points and evaluation criteria

The system of rating points and evaluation criteria:

Performing tasks in practical classes.

The weighted score for the performance of one practical task is 8 points. The maximum number of points for all practical tasks is equal to: 8 points x 4 tasks = 32 points.

Criteria for evaluating the performance of a practical task:

Completeness and signs of task completion	Points
The task is fully completed	8
Minor flaws	6-7
Errors during task execution or protection	5
Late completion of the task, incomplete completion of the task and/or gross errors	1-4
Failure to complete the task	0

Writing modular control papers.

Weighted point for each modular control work - 9 points.

The maximum number of points for all test papers: 9 points x 2 papers = 18 points.

Criteria for evaluating the performance of control work

Completeness and signs of task completion	Points
The task is fully completed	9
Minor flaws	7-8
Runtime errors	6
Incomplete completion of tasks and/or gross errors	1-5
Failure to perform work	0

Thus, the starting rating from the credit module is:

$$R_s = 4 \cdot 8 + 2 \cdot 9 = 50 \text{ points}$$

According to the results of educational work for the first 7 weeks, the "ideal student" should score 20 points. At the first certification (8th week), the student receives "credited" if his current rating is at least 10 points.

According to the results of the academic work for 13 weeks of study, the "ideal student" should score 34 points. At the second certification (14th week), the student receives "credited" if his current rating is at least 17 points.

The maximum number of rating points is 50. In order to take the exam from the credit module "automatically", you need to have a starting rating of at least 40 points, complete and defend all practical tasks and homework. In this case, the final points are calculated according to the formula:

$$R = 60 + \frac{40 \cdot (R_i - R_d)}{R_c - R_d}$$

The final grade is obtained by transferring the points according to the table (below).

A necessary condition for admission to the exam is the enrollment of all practical tasks, modular test papers and a starting rating of at least 25 points.

Master's students who scored a rating of less than 0.5 R during the semester perform the test work. At the same time, all the points they received during the semester are cancelled. Test tasks contain questions that refer to different sections of the credit module. A list of questions is provided in Chapter 9.

At the exam, students perform a written test.

The examination component is equal to 50% of R: RE = 50 points.

Each task contains the first two - theoretical tasks and one (third) - practical. Each theoretical task is evaluated at 15 points, each practical task at 20 points according to the following criteria:

- "excellent", complete answer, at least 90% of the required information (complete, error-free solution of the task) - 15-14 (20-18) points;
 - "good", sufficiently complete answer, at least 75% of the required information or minor inaccuracies (complete solution of the task with minor inaccuracies) - 13-11 (17-15) points;
 - "satisfactory", incomplete answer, at least 60% of the required information and some errors (the task was completed with certain shortcomings) - 10-9 (14-12) points;
 - "unsatisfactory", the answer does not meet the conditions for "satisfactory" - 8-0 (11-0) points.
- To obtain the final grade, the sum of all rating points R received during the semester ($R_c + R_e = 50 + 50 = 100$ points) is translated according to the table:

Scores	Rating
95...100	perfectly
85...94	very good
75...84	fine
65...74	satisfactorily
60...64	enough
RD < 60	unsatisfactorily
Admission conditions not met	not allowed

8. Additional information on the discipline (educational component)

An approximate list of questions that are submitted for semester control:

1. Analyze and provide the main terms and definitions in the field of standardization established by the Law of Ukraine "On Standardization".
2. To evaluate and characterize the types of standards in accordance with the Law of Ukraine "On Standardization".
3. To give an assessment of the main principles in the field of standardization, to list and characterize the current tasks and functions of standardization.
4. Analyze and give definitions regarding the order of organization of development of the standard.
5. To give an assessment of standardization in the ISO international standardization organization, to define: the main function, the generally recognized task, the goal, promising (main) directions of ISO work. List ISO committees and their main functions.
6. Give an assessment and name the standardization bodies of Ukraine in accordance with the Law "On Standardization".
7. To evaluate, characterize and name the main tasks of State control and supervision of compliance with the mandatory requirements of the standards.
8. Define and reasonably explain the object, purpose, main task, essence and main results of standardization in accordance with the Law of Ukraine "On Standardization".
9. Analyze and define mandatory and voluntary product certification. Provide a list and justification of mandatory requirements in Ukraine and EU countries.
10. Give an assessment of technological regulations: definition of technological regulations, types of technological regulations
11. Give an assessment of the general requirements for testing laboratories.
12. Provide an assessment of standardization in European organizations.
13. Define what the difference between measurement results is, give an estimate of the significance (insignificance) of the difference, based on the concept of best estimate and error.
14. Analyze and provide a formula for calculating the standard deviation of the average.
15. Analyze and provide a rule for calculating the error of the difference of measurement results.

16. Analyze and provide formulas for calculating the value of the χ^2 criterion.
17. To justify the essence of the problem of unifying the results of the experiment and to decide on the formulas for calculating the weighted average.
18. Analyze and provide a sequence of formulas for calculating a confidence interval.
19. Justify the scheme of using the Chauvenet criterion.
20. To justify the essence of the problem of combining the results of the experiment and to decide on the formulas for calculating the weighted average.
21. Analyze and provide formulas for statistical processing of measurement results, namely: calculation of the average value and standard deviation of the average.
22. Analyze the error estimation formula for using a satisfactory function of one variable in cases of indirect measurements.
23. Justify the scheme of using the Chauvenet criterion.
24. Analyze and provide formulas and determine the sequence (algorithm) of using formulas to prove whether a certain sample of observations corresponds to the Gaussian normal distribution.
25. Analyze and provide formulas for calculating the value of the χ^2 criterion.
27. Analyze and provide formulas for statistical processing of measurement results, namely: calculation of the average value and standard deviation of the average.

List of questions of modular control works
Modular control work (mkr: mkr1 + mkr2)

1. Define what STANDARDIZATION is.
2. Define what a STANDARD is.
3. Define what areas of activity and forms of ownership are covered by the Law of Ukraine "On Standardization"?
4. Define what is the main task of standardization?
5. Define what is the essence of standardization?
6. Define what is the priority direction of standardization in Ukraine?
7. Bring types of standards depending on the objects of standardization?
8. Bring types of standards depending on the level of the subject of standardization, which adopted the standard?
9. Show how long the standards that were used during the production of products should be kept?
10. Name the standardization bodies established by the Law "On Standardization".
11. lead What is the national mark of conformity of products to national standards?
12. Name the main tasks of state control and supervision of compliance with the mandatory requirements of standards.
13. Show who carries out state control and supervision of compliance with the mandatory requirements of the standards?
14. What is harmonization of standards?
15. Bring generally recognized task of ISO ?
16. lead what is the national standards body in uk ?

Working program of the academic discipline (syllabus):

Compiled associate professor, Ph.D., Ploskonos V.G.

Approved department ___E and TRP___ (protocol No. 14 dated 08.06.2022)

Agreed by the IHF Methodical Commission (protocol No. 10 dated 06.24.2022)