

Syllabus educational component

Metrology, standardization, certification and accreditation

Discipline name:	Metrology, standardization, certification and accreditation
Level of higher education:	first (bachelor's)
Course page in Moodle:	https://dl.khadi.kharkov.ua/course/view.php?id=529
The volume of the educational component	4 credits (120 hours)
Form of final control	Passed
Consultations:	on schedule
Name of the department:	Department of Metrology and Life Safety
Language of instruction:	English
Course leader:	Olga Maletska, Ph.D.
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Summary of the educational component:

The purpose is to acquaint students with metrology and metrological activity, the use of measuring instruments, measurements, metrological characteristics of measuring instruments, ensuring the reliability of measurements, general principles of unification of international and national standardization systems, the application of international and national standards, as well as standards enterprises, technical regulations, providing students with knowledge on the system of theoretical and practical knowledge in the field of conformity assessment of products, processes and services, accreditation of conformity assessment bodies.

Subject: theoretical and methodological foundations of metrology, standardization and conformity assessment, application of international and national standards, their application at the enterprise, establishment of requirements for products, conformity assessment modules, technical regulations and their application, voluntary conformity assessment, conformity assessment bodies, their accreditation, declaration and certification of products at the enterprise.

The main tasks of studying the discipline are:

study of the basic concepts of metrology, standardization, their legal and methodological foundations, types of regulatory documents, the procedure for developing and implementing regulatory documents at the enterprise, the peculiarities of international and national principles of metrology, standardization, requirements of standards for management systems, the concept of voluntary conformity assessment and conformity assessment with technical regulations, confirmation of conformity, certification of products, processes and services; requirements for conformity assessment bodies and the procedure for their accreditation; the procedure for certification of products; the procedure for applying and implementing conformity assessment procedures.

Prerequisites for the study of the discipline: Study of the disciplines "Physical quantities and measurements", "Fundamentals of metrology and measuring technology", "Fundamentals of qualimetry".

Competences that the applicant acquires:

General competencies:

- Ability to apply professional knowledge and skills in practical situations.
- Ability to communicate in the state language both orally and in writing.

Skills in the use of information and communication technologies.
 Ability to search, process and analyze information from various sources.
 The ability to learn and master modern knowledge.
 The ability to be critical and self-critical.
 Ability to evaluate and ensure the quality of work performed.
 The ability to realize their rights and obligations as a member of society.

Special (professional) competencies:

Ability to use international standards to provide assurance and provide services in compliance with the requirements of professional ethics in the process of practical activities.

Ability to apply standard calculation methods in the design of modules, parts and assemblies of measuring instruments and their computational components and modules.

Ability to perform technical operations when testing verification, calibration and other operations of metrological activity.

Ability to provide metrological support of technological processes and certification tests.

Ability to carry out technical measures to ensure metrological traceability, correctness, repeatability and reproducibility of measurement and test results according to international standards.

Ability to develop a regulatory and methodological framework for ensuring quality and technical regulation, develop regulatory documents, organize conformity assessment of products, including certification tests.

Learning outcomes:

Know and understand the basic concepts of metrology, standardization and conformity assessment, apply them in various fields of activity.

Understand the broad interdisciplinary context of metrology, standardization and conformity assessment, their place in the theory of cognition and evaluation of objects and phenomena.

Be able to choose, based on the technical task, the method of evaluation and measurement control of the characteristic properties of products and parameters of technological processes.

Be able to organize and carry out the development of documents on technical control and testing.

Be able to establish a rational nomenclature of technical characteristics of products.

Be able to organize a conformity assessment procedure.

Thematic plan

oN o te- mi	Title of topics (LK, LR, PR, SZ, WED)	Number of hours	
		Eye	Corres ponden ce
1	LUKE. Ensuring unity in Ukraine. Legislation of Ukraine in the field of metrology and metrological activity.	2	
	PR 1. Determination of the basic principles of ensuring unity in Ukraine.	2	
	WED. The study of the material of the topic LC 1. Preparation for the implementation of PR 1. Study of the Law of Ukraine "On Metrology and Metrological Activity". Registration of the report on PR 1.	11	
2	LUKE. Measuring instruments. Classification. Metrological characteristics.	2	
	PR 2. Determination of the suitability of use from asobov measuring equipment. The use of metrological characteristics.	2	
	WED. The study of the material of the topic LC 2. Preparation for the implementation of PR 2. Registration of the report on PR 2.	11	

3	LUKE. Organization and carrying out of verification and calibration of measuring equipment. Calibration and intercalibration intervals.	2	
	PR 3. Registration of the results of verification and calibration from the aids of measuring equipment.	2	
	WED. The study of the material of the topic LC 3. Preparation for the implementation of PR 3. Registration of the report on PR 3.	11	
4	LUKE. Organization and conduct of measurements at the enterprise. Measurement techniques. Errors and uncertainty of measurements.	2	
	PR 4. Evaluation of measurement error and uncertainty. Registration of measurement results.	2	
	WED. The study of the material of the topic LC 4. Preparation for the implementation of PR 4. Registration of the report on PR 4.	11	
5	LUKE. International and national standardization. Standardization in the enterprise.	2	
	PR 5. Types of regulatory documents and their application.	2	
	WED. The study of the material of the topic LC 5. Preparation for the implementation of PR 5. Study of the Law of Ukraine "On Standardization". Study of DSTU 1.5: 2015. Registration of the report on PR 5.	11	
6	LUKE. European and national system of technical regulation.	2	
	PR 6. Determination of the basic principles of technical regulation in Ukraine.	2	
	WED. The study of the material of the topic LC 6. Preparation for the implementation of PR 6. Study of the Law of Ukraine "On Technical Regulations and Conformity Assessment". Registration of the report on PR 6.	11	
7	LC Technical regulations and their application in the enterprise. Conformity assessment modules. Requirements for product certification bodies.	2	
	PR 7. Conformity assessment of asobov measuring equipment.	2	
	WED. The study of the material of the topic LC 7. Preparation for the implementation of PR 7. . Study of the Technical Regulations on asobov measuring equipment. Registration of the report on PR 7.	11	
8	LUKE. Conformity assessment bodies. Accreditation. Requirements for testing and calibration laboratories	2	
	PR 8. Development of a laboratory management system.	2	
	WED. The study of the material of the topic LC 8. Preparation for the implementation of PR 8. Study of the requirements of DSTU EN ISO / IEC 17026: 2019. On the formation of a report on PR 8.	11	
Tog eth er	LUX	16	
	PR (LR, NW)	16	
	WED	88	

Individual educational and research task (if any):

Teaching Methods:

verbal (lectures, explanations, narration, conversation, discussion, work with a book, etc.) visual (method of illustration and demonstration), practical tasks.

Grading system and requirements:

Current success

1 The current success of applicants for the performance of educational types of work in training sessions and for the performance of tasks of independent work is assessed using a four-point scale of grades, followed by recalculation into a 100-point scale. During the assessment of current performance, all types of work provided for by the curriculum are taken into account.

1.1 Lectures are evaluated by determining the quality of the specified tasks.

1.2 Practical classes are assessed by the quality of the control or individual task, the performance and design of practical work.

1.3 Laboratory classes are assessed by the quality of the implementation of reports on the performance of laboratory work.

1.4 Seminars are evaluated by the quality of the individual task / abstract.

2 Evaluation of the current performance of applicants for higher education is carried out at each practical lesson (laboratory or seminar) on a four-point scale ("5", "4", "C", "2") and recorded in the journal of accounting for academic performance.

– "excellent": the applicant perfectly mastered the theoretical material, demonstrates deep knowledge of the relevant topic or academic discipline, the main provisions;

– "good": the applicant has well mastered the theoretical material, owns the main aspects from primary sources and recommended literature, reasonably teaches it; has practical skills, expresses his reasoning about certain problems, but assumes certain inaccuracies and errors in the logic of presenting theoretical content or in the analysis of practical;

– "satisfactory": the applicant has mainly mastered the theoretical knowledge of an educational topic or discipline, is oriented in primary sources and recommended literature, but unconvincingly answers, confuses concepts, uncertainly answers additional questions, does not have stable knowledge; answering questions of a practical nature, reveals inaccuracies in knowledge, does not know how to evaluate facts and phenomena, connect them with a future profession;

– "unsatisfactory": the applicant has not mastered the educational material of the topic (discipline), does not know scientific facts, definitions, is almost not oriented in primary sources and recommended literature, there is no scientific thinking, practical skills are not formed.

3 The final score for current activities is recognized as the arithmetic average sum of points for each lesson, for individual work, current tests according to the formula:

$$K^{nomou} = \frac{K1 + K2 + \dots + Kn}{n},$$

where K^{nomou} is the final assessment of success based on the results of current control;

$K1, K2, \dots, Kn$ – assessment of the success of the -th measure of current control; n

n – the number of measures of current control.

Scores are converted to points according to the recalculation scale (Table 1).

Table 1 – Recalculation of the average score for current activities into a multi-point scale

4-point scale	100- point scale	4- point scale	100- point scale	4- point scale	100- point scale	4- point scale	100- point scale
5	100	4,45	89	3,90	78	3,35	67
4,95	99	4,4	88	3,85	77	3,3	66
4,9	98	4,35	87	3,80	76	3,25	65
4,85	97	4,3	86	3,75	75	3,2	64
4,8	96	4,25	85	3,7	74	3,15	63
4,75	95	4,20	84	3,65	73	3,1	62
4,7	94	4,15	83	3,60	72	3,05	61
4,65	93	4,10	82	3,55	71	3	60
4,6	92	4,05	81	3,5	70	from 1,78 to 2,99	from 35 to 59
						Reassembly	
4,55	91	4,00	80	3,45	69	from 0 to 1,77	from 0 to 34
4,5	90	3,95	79	3,4	68	Re-study	

Final assessment

1 The applicant for higher education receives credit at the last lesson in the discipline based on the results of the current assessment. The average score for current activities is converted into points on a 100-point scale, according to the recalculation table (Table 1).

Applicants for higher education who have an average current grade in a discipline lower than "3" (60 points) in the last lesson can increase their current score by passing tests in the discipline.

Assessment of knowledge of applicants by testing is carried out on a scale:

- "Excellent": at least 90% of correct answers;
- "Very good": from 82% to 89% of correct answers;
- "Good": from 74% to 81% of correct answers;
- "Satisfactory": from 67% to 73% of correct answers;
- "Satisfactory enough": from 60% to 66% of correct answers;
- "Unsatisfactory": less than 60% of correct answers.

2 The condition for obtaining the test is:

- working out all missed classes;
- the average current score in the discipline is not lower than "3" (60 points).

3 For the implementation of individual independent work and participation in scientific events, applicants are awarded additional points.

3.1 Additional points are added to the sum of points scored by the higher education student for current academic activities (for disciplines for which the test is the final form of control), or to the final grade in the discipline for which the exam is the final form of control.

3.2 The number of additional points awarded for different types of individual tasks depends on their volume and significance:

- prizes in the discipline at the international / all-Ukrainian competition of scientific student works – 20 points;
- prizes in the discipline at the All-Ukrainian Olympiads – 20 points;
- participation in the international / all-Ukrainian competition of scientific student works – 15 points
- participation in international / all-Ukrainian scientific conferences of students and young scientists – 12 points;
- participation in all-Ukrainian olympiads in the discipline – 10 points
- participation in olympiads and scientific conferences of KhNADU in the discipline – 5 points;
- implementation of individual research (educational and research) tasks of increased complexity – 5 points.

3.3 The number of additional points may not exceed 20 points.

4 The result of training is evaluated (*choose the right one*):

- on a two-point scale (credited/not credited) according to table 2;
 - on a 100-point scale (for differentiated standings) according to Table 3.
- The final score, together with additional points, cannot exceed 100 points.

Table 2 – Scale of transfer of points to the national grading system

On a 100-point scale	On a national scale
from 60 points to 100 points	enrolled
less than 60 points	unzached

Table 3 – Scale of assessment of applicants' knowledge based on the results of the final control in the discipline

Score in points	National scale score		ECTS score	
	Exam	Passed	Score	Criteria
90-100	Perfectly	Enrolled	A	The theoretical content of the course is mastered entirely, without gaps, the necessary practical skills of working with the mastered material are formed, all the training tasks provided by the training program have been completed, the quality of their implementation is estimated by the number of points close to the maximum
80-89	Well	Enrolled	B	The theoretical content of the course is mastered entirely, without gaps, the necessary practical skills in working with the mastered material are mainly formed, all the training tasks provided by the training program have been completed, the quality of most of them is estimated by the number of points close to the maximum
75-79			With	The theoretical content of the course is mastered entirely, without gaps, some practical skills of working with the mastered material are not sufficiently formed, all the training tasks provided by the training program have been completed, the quality of none of them is assessed by the minimum number of points, some types of tasks are performed with errors
67-74	Satisfactory		D	The theoretical content of the course is partially mastered, but the gaps are not significant, the necessary practical skills in working with the mastered material are mainly formed, most of the training tasks provided by the training program have been completed, some of the tasks performed may contain errors
60-66			And	The theoretical content of the course is partially mastered, some practical skills of work are not formed, many of the training tasks provided by the training program have not been completed, or the quality of some of them is estimated by the number of points close to the minimum.

Score in points	National scale score		ECTS score	
	Exam	Passed	Score	Criteria
35–59	Disappointing	Not credited	FX	The theoretical content of the course is partially mastered, the necessary practical skills of work are not formed, most of the provided training programs have not been completed, or the quality of their implementation is estimated by the number of points close to the minimum; with additional independent work on the course material, it is possible to improve the quality of the training tasks (with the possibility of re-compilation)
0–34	Unacceptable		F	The theoretical content of the course has not been mastered, the necessary practical skills of work are not formed, all completed training tasks contain gross errors, additional independent work on the course material will not lead to any significant improvement in the quality of the training tasks (with a mandatory repeated course)

Course Policy:

- the course involves teamwork, the environment in the audience is friendly, creative, open to constructive criticism;
- mastering the discipline involves the obligatory attendance of lectures and practical classes, as well as independent work;
- independent work involves the study of individual topics of the discipline, which are made in accordance with the program for independent study, or were considered briefly;
- all tasks envisaged by the program must be completed within the prescribed period;
- if the applicant for higher education is absent from the classroom for a good reason, he presents the completed tasks during the independent preparation and consultation of the teacher;
- course work must be protected no later than a week before the start of the examination session (**indicated if available**);
- while studying the course, applicants for higher education must comply with the rules of academic integrity set forth in the following documents: "Rules of academic integrity of participants in the educational process of KhNADU" (https://www.khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz_67_01_dobroch_1.pdf), "Academic integrity. Verification of the text of academic, scientific and qualification works for plagiarism" (https://www.khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz_85_1_01.pdf), "Moral and ethical code of participants in the educational process of KhNADU" (https://www.khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz_67_01_MEK_1.pdf).
- in case of detection of the fact of plagiarism, the applicant receives 0 points for the task and must re-complete the tasks provided for in the syllabus;
- write-offs during tests and exams are prohibited (including using mobile devices). Mobile devices are only allowed to be used during online testing.

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Recommended literature:

Bazova

1. O.E. Maletskaya Lecture notes "Metrology, standardization, certification, accreditation" [Electronic resource] / distance course:
<https://dl.khadi.kharkov.ua/course/view.php?id=897>.
2. Law of Ukraine "On Metrology and Metrological Activity": <https://zakon.rada.gov.ua>.
3. Law of Ukraine "On Technical Regulations and Conformity Assessment": <https://zakon.rada.gov.ua>.
4. «Согласно «Согласно»»: <https://custom.you're shaving. Gov. ua>.
5. "The " " you're shaving. Gov. ua.
6. DSTU EN ISO/IEC 17025:2019 General requirements for the competence of testing and calibration laboratories.
7. DSTU EN ISO/IEC 17065:2014 Conformity assessment. Requirements for

