Syllabus selective educational component

Basics of measurements of geometric quantities

Name of the discipline:	Basics of measurements of geometric quantities
Higher education level:	First (bachelor's)
Course page in Moodle:	https://dl2022.khadi-kh.com/course/view.php?id=5181
Scope 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:	Medvedovska Yana Serhiivna, Ph.D.
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Summary of the educational component:

The goal is to develop research skills in the field of theory and methodology of measurements of geometric quantities at industrial enterprises, to instill practical skills and abilities to apply the basic methods and approaches for reliable measurements of geometric quantities at industrial enterprises.

Subject: theoretical and methodological foundations of measurements of geometric quantities.

The main tasks of studying the discipline are:

— substantiation and presentation of uniform theoretical and methodological foundations of the principles of measurements of geometric quantities;

— study of methods for measuring geometric quantities;

— formation of directions for improvement and development of methods for measuring geometric quantities at industrial enterprises.

Prerequisites for studying the discipline: "Fundamentals of Metrology and Measuring Technology", "Physical Quantities and Measurements".

Competencies that the applicant acquires:

General competencies:

- ability to apply professional knowledge and skills in practical situations;
- ability to search, process and analyze information from various sources;
- the ability to learn and master modern knowledge.

Special (professional) competencies:

— the ability to analyze the components of error according to their essential features, to operate with the components of error/uncertainty in accordance with measurement models;

— ability to apply standard calculation methods in the design of modules, parts and assemblies of measuring instruments and their computing components and modules;

— ability to carry out adjustment and experimental testing of certain types of devices in laboratory conditions and at facilities.

Learning outcomes according to the educational program:

 know and understand the basic concepts of metrology, measurement theory, mathematical and computer modeling, modern methods of processing and evaluating the accuracy of experiment measurements; know and be able to apply modern information technologies to solve problems in the field of metrology and information and measuring equipment.

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		Number of
Topic No.	Name them (LK, LR, PR, SZ, SR)	hours
		Eve
1	2	3
	LC1 Plane-parallel finite measures of length. Measuring dimensions with vernier calipers	2
1	PR1 Comparative analysis of different types of calipers.	2
	CP1 Measurement method with a caliper.	6
	LK2 Micrometric instruments. Application features.	2
2	PR2 Features of the use of micrometric instruments for various practical tasks.	2
	SR2 Methods for taking into account the operator's power actions when using a caliper during high-precision measurements.	6
3	LK3 Metrological characteristics of micrometric instruments.	2
	CP3 Micrometer measurement technique.	6
	LK4 Basic methods and means of controlling the accuracy of the shape and arrangement of surfaces.	2
4	PR3 Analysis of methods for measuring the ellipticity of shafts.	2
	CP4 Methods for measuring cone, barrel and saddle shape	6
	LK5 Calibers. General information. Gauges for controlling lengths, heights, depths, ledges. Complex calibers.	2
5	PR4 Design of a caliber-bracket to control the size of the shaft.	2
	CP5 Design of a gauge-stopper to control the size of the hole.	6
	LK6 Optical-mechanical devices. Design and principle of operation.	2
6	PR5 Analysis of metrological characteristics of an interferometer.	2
	CP6 Interferometer measurement technique.	6
	LK7 Analysis of metrological characteristics of a vertical	2
7	CP7 Measurement technique with a vertical optimeter	6
	LK8 Laser scanners for measuring the volumes of containers.	2
8	PR6 Analysis of the method for determining the accuracy of measuring the volume of the tank with a laser scanner.	2
	CP8 Laser scanner measurement technique.	6
	LK9 Study of the fields of application of laser scanners.	2
9	CP9 Methods for measuring the volumes of containers.	6
10	LC10 Principles of operation of coordinate measuring machines, their composition and functioning.	2

Thematic plan

TOTAL per discipline		
_	WED	80
Together	AVE	16
	LUX	24
	software.	10
	CP12 Analysis of the coordinate measuring machine	10
12	Coordinate Measuring Machine.	2
10	PR8 Environmental Influence on the Accuracy of the	2
	measuring machines.	2
	LK12 Basic metrological characteristics of coordinate	0
	coordinate measuring machines.	10
11	CP11 Study of the fields of application of mobile	10
	LK11 Analysis of mobile coordinate measuring machines.	2
	measuring machine.	6
	SR10 Study of the fields of application of the coordinate	
	of the coordinate measuring machine.	2
	PR7 Justification of the requirements for the components	

Individual educational and research task: not provided.

Teaching methods:

MH1 – verbal method (lecture, educational discussion, explanation, story);

MH2 - practical method (practical classes);

MH3 – visual method (method of illustrations, method of demonstrations);

MH4 – work with literature (educational and methodological; normative literature; search for information on the task);

MH5 – video method in combination with the latest information technologies and computer learning tools (distance);

MH6 - independent work;

Forms and methods of assessment

FMO2 – final control (credit)

FMO4 – written control (individual tasks)

FMO5 – test control (standardized tests, final complex tests)

FMO7 – practical test (defense of practical works)

Grading System and Requirements:

Assessment in the discipline and its transfer into grades on the national scale and the ECTS scale is carried out in accordance with <u>STVNZ 90.1-02:2023 "Assessment of the learning outcomes of higher education applicants".</u>

Current Academic Performance

1 The current performance of applicants for the performance of educational types of work in training classes and for the performance of tasks of independent work is evaluated using a four-point scale of assessments with subsequent recalculation in a 100-point scale. When assessing 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 performance of specified tasks.

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

2 Assessment of the current performance of higher education applicants is carried out at each practical lesson on a four-point scale ("5", "4", "C", "2") and is entered into the journal of academic performance.

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

– "good": the applicant has mastered the theoretical material well, knows the main aspects from primary sources and recommended literature, presents it in a reasoned manner; has practical skills, expresses his thoughts on certain problems, but makes certain inaccuracies and errors in the logic of presenting theoretical content or in the analysis of practical content;

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

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

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

$$K^{curent} = \frac{K1 + K2 + \ldots + Kn}{n},$$

where K^{curent} is the final assessment of success based on the results of current control; K1, K2, ..., Kn – assessment of the success n of the current control measure;

n – the number of current control measures.

Grades are converted into points according to the conversion scale (Table 1).

00010							
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	1.78 to 2.99	35 to 59
						Reasser	nbly
4,55	91	4,00	80	3,45	69	0 to 1.77	0 to 34
4,5	90	3,95	79	3,4	68	Re-stu	dy

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

Final assessment

1 A higher education applicant receives a credit at the last lesson in the discipline according to the results of the current assessment. The average grade for the current activity is converted into points on a 100-point scale, according to the conversion table (Table 1). Applicants for higher education Education who have an average Current Assessment with disciplines lower than "3" (60 points), upon Last classes can increase their current score by

taking tests with Discipline.

Assessment of applicants' knowledge 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 offset is:

- working out all missed Classes;

- average current grade in the discipline not lower "3" (60 points).

3 For the performance 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 applicant for higher education for the current educational activity (for disciplines, the final form of control for which is a test), or to the final grade in the discipline, the final form of control for which is an exam.

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 KhNAHU in the discipline - 5 points;

- performance of individual research (educational and research) tasks of increased complexity - 5 points.

3.3 The number of additional points cannot exceed 20 points.

4 The learning outcome is evaluated (choose the one you need):

– on a 100-point scale (for a differentiated test) according to Table 2.

The final grade, together with additional points, cannot exceed 100 points.

 Table 2 – Scale of assessment of applicants' knowledge based on the results of the final control in the academic discipline

Score	National s	cale score	ECTS score		
points			Score	Criteria	
	Exam	Passed			
90-100	Perfectly	Credited	A	The theoretical content of the course has been mastered completely, without gaps, the necessary practical skills in working with the mastered material have been formed, all the educational tasks provided for by the training program have been completed, the quality of their implementation has been evaluated by the number of points close to the maximum	

Score	National s	cale score		ECTS score
points			Score	Criteria
	Exam	Passed		
80–89	_		В	The theoretical content of the course is mastered completely, without gaps, the necessary practical skills of working with the mastered material are basically formed, all the educational tasks provided for by the training program are completed, the quality of most of them is evaluated by the number of points close to the maximum
75-79	We	edited	С	The theoretical content of the course is mastered completely, without gaps, some practical skills of working with the mastered material are not sufficiently formed, all the educational tasks provided for by the training program have been completed, the quality of performance of any of them has not been evaluated by the minimum number of points, some types of tasks have been completed with errors
67-74	factory	5	D	The theoretical content of the course has been partially mastered, but the gaps are not significant, the necessary practical skills in working with the mastered material have been largely formed, most of the educational tasks provided for by the training program have been completed, some of the completed tasks may contain errors
60–66	Satis		And	The theoretical content of the course has been partially mastered, some practical work skills have not been formed, many of the training tasks provided for by the training program have not been completed, or the quality of some of them has been evaluated by the number of points close to the minimum.
35–59	Disappointing	Credited	FX	The theoretical content of the course has been partially mastered, the necessary practical skills have not been formed, most of the provided training programs for educational tasks have not been completed, or the quality of their implementation has been evaluated 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 educational tasks (with the possibility of re-compiling)
0–34	Unacceptable	Not	F	The theoretical content of the course has not been mastered, the necessary practical skills have not been 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 educational tasks (with the obligatory repeated course)

Recognition of the results of non-formal and informal education

The procedure for recognizing learning outcomes obtained in non-formal and informal education is regulated by <u>STVNZ-83.1-02:2022 "Recognition of the results of non-formal and informal education"</u>.

To recognize such results, it is necessary to apply to the dean of the faculty with a corresponding application and attach certificates, certificates and other documents confirming the received competencies. Based on the results of consideration of the application, a subject commission is created, which considers the submitted documents, conducts an interview with the applicant and makes a decision on the re-enrollment of the learning results or the appointment of certification in the form of a final control (10 working days are given for preparation). Based on the results of the control, the commission gives a final grade. If the applicant received less than 60 points, then the results of training in nonformal or informal education are not counted. When re-enrolling the results of training in the discipline, the applicant is exempt from its study.

Course Policy:

 the course involves teamwork, the environment in the classroom is friendly, creative, open to constructive criticism;

 mastering the discipline involves mandatory attendance at lectures and practical classes, as well as independent work;

 independent work involves the study of individual topics of the academic discipline, which are submitted in accordance with the program for independent study, or were considered briefly;

- all tasks provided for by the program must be completed on time;

 if the applicant for higher education is absent from classes for a good reason, he/she presents the completed tasks during self-preparation and consultation with the teacher;

– during the study of 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 KhNAHU" (https://www.khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz_67_01_dobroch_1.p_df), "Academic integrity. Checking the text of academic, scientific and qualification papers for plagiarism" (https://www.khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz_85.1-02.pdf), "Moral and ethical code of participants in the educational process of KhNAHU (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;

cheating during tests and exams is prohibited (including the use of mobile devices).
 Mobile devices are allowed to be used only during online testing.

Recommended reading:

Basic literature

1. Nabrodov V. Z. Admissions, Landings and Technical Measurements. Textbook. Kyiv: Litera LTD, 2019. 224 p. (in Russian).

2. Metrology, ensuring the unity of measurements and standards of units of physical quantities: textbook / K. O. Chornoivanenko et al. Dnipro: Svidler A.L. Publishing House, 2022. 164 p. (in Russian).

3. Metrology: teaching. Manual. for students. specialty 152 "Metrology and Information and Measuring Technologies" / KPI. Igor Sikorsky; compiled by: N.M. Zashchepkina. Kyiv: KPI. Igor Sikorsky, 2022. 397 p. (in Russian).

Further reading

1. Coordinate measuring machine: description, technical characteristics, application <u>https://1ll.ink/nr3qU/</u>

2. Calibration and calibration of FTAs of geometric and mechanical quantities <u>https://1ll.ink/tJBdO</u>

Additional sources:

1. Дистанційний курс: <u>https://dl2022.khadi-kh.com/course/view.php?id=5181</u>

Developer syllabus of the academic discipline:

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