Syllabus

educational component BK

Instrumental materials

Discipline name:	Instrumental materials
Degree of higher education:	the first (bachelor's)
Course page in Moodle:	https://dl2022.khadi-kh.com/course/view.php?id=1971
The volume of the	3 creditsand (90 hours)
educational component	
Form of final control	Withalik
Consultations:	Witha schedule
Name of the department:	Metal technology and materials science
Language of instruction:	Ukrainian
Course leader:	Moshchenok Vasyl Ivanovych, prof., Ph.D., assoc.
	prof.
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Summary of the educational component:

The goal is to form students' knowledge and skills to solve problems in metal technology and materials science in the field of mechanical engineering at the stage of using modern tool materials in metal cutting and hardness measurement.

Subject: theoretical and methodological foundations of the choice of tool materialsfor various methods of metal cutting, you choose the best method of measuring hardness in order to effectively assess the quality of metal products in modern production.

The main objectives of the study of the discipline are to provide knowledge about instrumental materials and their classification; methods of their production; technological coatings, basic methods for measuring the hardness of metallic materials. To discover the physical essence of the methods of measuring hardness, which with the help of tool materialsare used to assess the quality of metal products.

Prerequisites for studying the educational component:

Technology of structural materials and materials science; Materials Science.

Competences that the applicant acquires:

General competencies:

Ability to apply knowledge in practical situations.

Ability to use information and communication technologies.

Professional competencies:

Knowledge of the basic technologies of manufacturing, processing, testing of materials and products.

The ability to reasonably apply material of a certain chemical composition for a particular product, taking into account the requirements of manufacturability, efficiency, environmental friendliness, reliability and durability.

Program courses of training in accordance with the educational program:

Know and be able to use the knowledge of the fundamental sciences underlying the relevant specialization of materials science at the level necessary to achieve other results of the educational program.

Comply with industry regulations.

Know the engineering disciplines underlying the specialty at the level necessary to achieve other program outcomes, including having some awareness of their latest achievements.

To carry out technological support for the manufacture of materials and products from them.

Possess methods of ensuring and controlling the quality of materials.

Knowledge of technical characteristics, working conditions, the use of production equipment for the processing of materials and instrumentation.

Knowledge of the basic technologies of manufacturing, processing, testing of materials and conditions of their use.

Knowledge of the principles, methods and regulatory framework of state dartization, certification and accreditation of materials and products from them.

Tania	Topic name (LK, LR, WED)				
number					
	LK1. Introduction. Requirements for tool materials for cutting tools. Phenomena that occur in the zone of contact of the tool material with the workpiece	1			
	SRS - Recommendations for choosing tool steels for cutting tools.	6			
	LK2. Carbon and low alloy steels for cutting tools. Composition, labeling, properties, heat treatment, applications.	2			
	LR1. Brinell hardness method. The essence of the method. Indentors. The formula by which hardness is determined. Areas of use of the method.	4			
I	SRS - Recommendations for choosing tool low-alloy steels.	6			
	LK3. High-speed steels for cutting tools. Composition, labeling, properties, heat treatment, applications. High performance high-speed steels. Powder high-speed steels.	2			
	LR2. Rockwell hardness determination method. The essence of the method. Indentora. The formula by which hardness is determined. Areas of use of the method.	4			
	SRS - Manufacturing technology, structure, properties and applications of powder high-speed steels.	6			
	LK4. Heat treatment of tool steels. Equipment, modes. Structures and chemical composition.	1			
	SRS –	—			
2	LK5. Requirements for tool materials for cutting and stamping tools. Composition, labeling, properties, thermal and chemical-heat treatment.	2			
	LR3. Vickers hardness method. The essence of the method. Indentora. The formula by which hardness is determined. Areas of use of the method.	2			
	SRS –	_			
	LK6. Hard alloys: classification, composition, marking, properties, manufacturing technology, applications. Tungsten-free hard alloys.	2			
	LR4. Determination of nanohardness according to Martens HM with continuous identification according to ISO 14577	2			
	SRS - ISO 14577 (part 1)	4			
3	LK7. Mechanical properties of materials according to ISO 14577	1			
	LR5. Hit Nanohardness Determination with Continuous Identification According to ISO 14577	2			
	SRS - ISO 14577 (part 2-3)	4			

Thematic plan

	LK8. The use of hard alloys.					
	SRS - Classification of modern hard alloys according to international standard.					
	LK9. Mineral ceramic materials: classification, composition, labeling, properties, manufacturing technology, applications.					
	SRS - Recommendations for choosing cutting ceramics.					
	LK10. Superhard tool materials based on diamonds: classification, composition, marking, properties, manufacturing technology, applications.	1				
	LR6. Determination of nanohardness according to Martens HMs with continuous identification according to ISO 14577					
1	SRS - Modern superhard materials	4				
4	LK11. Abrasive instrumental materials: classification, composition, marking, properties, manufacturing technology, applications.	1				
	SRS - Determination of the characteristics of abrasive tools.	6				
	LK12. Wear-resistant coatings for cutting tools. Requirements, composition, methods of applying wear-resistant coatings.	1				
	SRS - Justification of the choice of wear-resistant coatings.	4				
Together	LK.	16				
	LR.	16				
	SR.	50				

Individual educational and research task is not provided.

Teaching Methods:

1) verbal: traditional: lectures, explanations, remote;

2) visual: the method of illustrations, the method of demonstrations;

3) laboratory: traditional classes, remote.

System assessment and requirements:

Current performance

1 The current success of applicants for the performance of educational types of work in training sessions and for the performance of independent work tasks is evaluated using a four-point rating scale with subsequent transfer to a 100-point scale. During the evaluation of the current academic performance, all types of work provided for by the educational program are taken into account.

1.1 Lecture classes 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.

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

1.4 Seminar classes are evaluated by the quality of individual assignment/abstract.

2 The current performance of higher education applicants is assessed at each practical session (laboratory or seminar) on a four-point scale ("5", "4", "3", "2") and entered in the journal of academic performance.

- "excellent": the winner mastered the theoretical material flawlessly, demonstrates deep knowledge of the relevant topic or academic discipline, the main provisions;

- "good": the applicant has mastered the theoretical material well, has the main aspects from primary sources and recommended literature, presents it in an argumentative manner; has practical skills, expresses his thoughts on certain problems, but certain

inaccuracies and errors are assumed in the logic of the presentation of theoretical content or in the analysis of practical ones;

- "satisfactory": the applicant has basically mastered the theoretical knowledge of the educational topic or discipline, orients himself in primary sources and recommended literature, but answers unconvincingly, confuses concepts, answers additional questions uncertainly, 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, connect them with the future profession;

- "unsatisfactory": the applicant has not mastered the educational material of the topic (discipline), does not know scientific facts, definitions, hardly orients himself in primary sources and recommended literature, lacks 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, current test works according to the formula:

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

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

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

n – number of ongoing control measures.

O prices are converted into points according to the calculation scale (table 1).

Table 1 – Conversion of the average score for the current activity into a multi-point scale

4-point scale	100 points scale	4-ball scale	100 points scale	4-ball scale	100 points scale	4-ball scale	100 points 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
						reasser	mbly
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	repeated	study

Final assessment

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

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

Assessment of the knowledge of applicants through testing is carried out according to the following scale:

- "Excellent": at least 90% of correct answers;

- "Very good": 82% to 89% correct answers;

- "Good": from 74% to 81% of correct answers;

- "Satisfactory": from 67% to 73% of correct answers;

- "Fair enough": 60% to 66% correct answers;

- "Unsatisfactory": less than 60% of correct answers.

2 The condition for obtaining credit is:

- making up for all missed classes;

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

3 For performing individual independent work and participation in scientific events, additional points are awarded to the winners.

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

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

 prizes in the discipline at the international / all-Ukrainian competition of scientific student works - 20 points;

- prize places 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 the Khnadu in the discipline - 5 points;

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

3.3 The number of additional points cannot exceed 20 points.

4 The learning result is evaluated (select the required one) :

- on a two- point scale (passed/failed) according to table 2;

- for 100 - point scale (for differentiated assessment) according to table 3.

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

Table 2 – Scale for transferring points to the national evaluation system

On a 100-point scale	On a national scale
from 60 points to 100 points	counted
less than 60 points	not counted

Table 3 – The scale for evaluating the knowledge of the students based on the results of the final control of the academic discipline

Score	Evaluati	on on a	Evaluation according to the ECTS scale			
IN points	national scale		Rating	Criteria		
pointo	examina tion	test				
90-100	Perfectly	Enrolled	A	The theoretical content of the course has been mastered in its entirety, without gaps, the necessary practical skills for working with the mastered material have been formed, all educational tasks provided for in the training program have been completed, the quality of their performance has been assessed with a number of points close to the maximum		
80–89 75-79	Okay	nrolled	B C	The theoretical content of the course has been mastered in its entirety, without gaps, the necessary practical skills for working with the mastered material have mainly been formed, all educational tasks provided for by the training program have been completed, the quality of most of them has been assessed with a number of points close to the maximum The theoretical content of the course has been mastered in its entirety, without gaps, some practical skills of working with the mastered material have not been formed enough, all educational tasks provided for by the training program have been completed, the quality of none of them has been assessed with a minimum number of points, some types of tasks have been completed with errors		
67-74 60–66	isfactorily	Satisfactorily	D	The theoretical content of the course is partially mastered, but the gaps are not of a significant nature, the necessary practical skills for working with the mastered material are basically formed, most of the educational tasks provided by the training program have been completed, some of the completed tasks may contain errors The theoretical content of the course has been		
	Satis			partially mastered, some practical work skills have not been formed, many educational tasks provided by the training program have not been completed, or the quality of some of them has been assessed with a number of points close to the minimum.		

Score	Evaluation on a national scale		Evaluation according to the ECTS scale		
in points			Rating Criteria		
	examina tion	test			
35–59	Unsatisfactorily	counted	FX	The theoretical content of the course has been partially mastered, the necessary practical work skills have not been formed, most of the prescribed training programs of educational tasks have not been completed, or the quality of their implementation has been assessed with a number of points close to the minimum; with additional independent work on the course material, it is possible to improve the quality of the performance of educational tasks (with the possibility of retaking)	
0–34	Unacceptable	Not	F	The theoretical content of the course has not been mastered, the necessary practical work skills have not been formed, all completed educational tasks contain gross errors, additional independent work on the course material will not lead to any significant improvement in the quality of the performance of educational tasks (with a mandatory repeat course)	

Course policy:

- the course involves working in a team, the environment in the classroom is friendly, creative, open to constructive criticism;

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

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

- all tasks provided by the program must be completed within the set time;

- if the student of higher education is absent from classes for a good reason, he presents the completed tasks during independent preparation and consultation of the teacher;

- the coursework must be protected no later than a week before the beginning of the examination session *(indicated if available)*;

- while studying the course, students of 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 the Khnadu" (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

(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 the Khnadu (https://www

.khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz_67_01_MEK_1.pdf).

 in case of detection of plagiarism, the applicant receives 0 points for the task and must repeat the tasks provided for in the syllabus; - writing off during tests and exams is prohibited (including using mobile devices). Mobile devices are allowed to be used only during online testing.

Recommended literature:

1. Bazov literature

1.1. Palivoda Y.E. Instrumental materials, cutting modes, technical rationing of machining: educational and methodical manual / Palivoda Yu.E., Dyachun A.E., Leschuk R.Ya. -Ternopil: Ternopil National Technical University named after Ivan Pulyuy, 2019. - 240 p. 1.2. Moshchenko V.I. Methods for determining the hardness of materials: textbook / V.I. Moshchenko, N.O. Lalazarova, V.P. Tarabanov. – Kharkiv: KhNADU publishing house, 2016. - 314 p.

1.3. Moschenok V.I. Modern methods of determining hardness: monograph and I / V.I. Moschenok. - LAP LAMBERT Academic Publishing. - 2019. ISBN-13:978-620-0-25655-3. – 392 p.

1.4. Zaloga V.O., Goncharov V.D., Zaloga O.O. Modern instrumental materials in mechanical engineering: textbook. Manual. - SDU, 2013. - 371 p.

Access mode: http://essuir.sumdu.edu.ua/handle/123456789/30562.

2. Supporting literature

2.1. Kharlamov Y. O., Krol O. S. Improving the operational properties of the cutting tool: textbook. manual / Y. O. Kharlamov, O. S. Krol . - Severodonetsk: publishing house of SNU them. V.Dahl, 2015. - 448 p.

2.2. Kovtun G.P., Verevkin A.A. Nanomaterials: technologies and materials: Obzor / G.P. Kovtun, A.A. Verevkin. - Kharkiv: NSC KIPT, 2010. - 73p.

3. Information resources

3.1. https://www.iso.org/standard/56626.html (14577)

3.2. https://www.iso.org/standard/59671.html (Brinell)

3.3. https://www.iso.org/standard/64068.html (Vickers)

3.4. https://www.iso.org/standard/70460.html (Rockwell)

(addresses of sites with materials)

Developer(s) syllabus of the educational discipline

Bour-H-signature

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Head of the department

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