Syllabus educational component of VK4

(conditional designation OK in the educational program (OPP))

Tribomechanics and basics of contact mechanics

Name of discipline:	Tribomechanics and basics of contact mechanics
Level of higher education:	the first (bachelor's)
Course page in Moodle :	https://dl2022.khadi-
	kh.com/course/index.php?categoryid=840
The scope of the educational	3 credits (90 hours)
component	
Form final control	Test
Consultations:	on schedule
Name of the department:	department of metal technology and materials
	science
Teaching language :	state - Ukrainian
Course leader :	Yuryi Volodymyrovych Ryzhkov , Doctor of
	Technical Sciences , Assoc
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Brief content of the educational component:

The goal is for students to achieve modern constructive, fundamental thinking and a system of knowledge on the theory of mechanisms of friction, lubrication and wear of surfaces, on technological methods of applying wear-resistant coatings on surfaces friction pairs of various parts of machines, types of friction and lubrication, materials of parts surfaces and types of lubricants, thermal processes that accompany surface friction, as well as the basic principles of calculation and construction of reliable friction units.

The main tasks of studying an academic discipline are:

- familiarize with the basic information about the physical and chemical interactions between materials and the surrounding environment, as a result of which the properties of the material change and its functional characteristics deteriorate;

- to consider methods of qualitative and quantitative assessment of the damage effect;

- to learn how to choose optimal methods of increasing the corrosion resistance of materials.

Prerequisites for studying the educational component:

Physics.

Chemistry.

Technology structural materials and materials science. Materials science.

Competencies acquired by the acquirer:

General competences:

Ability to oral and written communication native language ZK3. Ability to act on the basis of legal and ethical judgments.

Ability to find and use information from domestic and foreign sources.

Knowledge and understanding of one's specialty.

Special (professional) competences:

The ability to use modern information and communication technologies in professional activities in the field of materials science and materials technology.

The ability to use in practice modern ideas about the influence of micro-, macro- and nanostructure on the properties of materials, their interaction with the environment.

The ability to perform a literary search of sources, including foreign ones, in the professional sphere and to use them in one's professional activity.

Knowledge of patterns of phase transformations in metals and alloys.

Knowledge of the main groups of materials and the ability to justify their selection for specific operating conditions.

5. Learning outcomes according to the educational program:

Know the basics of elements of theoretical and experimental research in professional activity. To be able to use the achievements of modern information technologies, to make programs.

Know the main groups of materials and reasonably make their selection for specific operating conditions.

Use experimental methods of studying structural, physical-mechanical, electrophysical, magnetic, optical and technological properties of materials.

Thematic plan Distribution disciplines in hours by forms organizations educational process and types of educational activities

		Number of		
Topic No	Name of topics (IK PR SR)			
1	2	3		
	LK. General concepts of friction and wear.	2		
1	PR. Properties of solids, liquids and gases. Effect of processing on			
	superficial properties solid bodies Wetting and capillary phenomena	4		
	Porosity. Contact voltage.			
	LK. Contact interaction of solid bodies during friction	2		
2	PR. Method definition characteristics microgeometry. Actual contact	4		
	area.	-		
3	LK. Mechanisms of friction	2		
	PR. Dynamic processes during friction. Frictional self- oscillations.	4		
Λ	LK. Wear mechanisms	2		
	PR. Friction and wear calculations. Wear contact problem.	4		
5	LK. Electoral transfer.	1		
5	PR. –	_		
	LK. Types and modes of lubrication.	2		
6	PR. Hydrodynamic lubrication Squeezable films Cavitation. Gas	1		
	lubrication.	-		
	LK. Thermal processes during friction and lubrication.	2		
7	PR. Formulation of the problem of thermal conductivity under friction.			
	Thermal dynamics of friction and wear. Numerical modeling using	4		
	method finished elements and method finished volumes			
	LK. Modeling tribomechanical processes. Methods and means of	1		
8	testing.			
	PR. –	_		
9	LK. Modeling tribomechanical processes. Methods and means of	2		
	testing.	_		
	PR. Compatibility and practice of materials. Material selection and	4		
	selection rational load of the friction pair.			
10	LK. Basic principles of calculation and design of friction nodes.	1		

	PR. –	_
	LK. Tribology of seals.	2
11	PR. Calculation of wear, forecasting the life of contact seals. Solution of the wear contact problem for oil seals. Computer modeling contacting surfaces, friction and wear of end seals. Dynamic analysis end seals, taking into account the mechanisms of contact and friction and lubrication.	4
Togothor	LK	16
Together	PR	32

Individual educational and research task (if available): absent

methods :

1) verbal:

- 1.1 traditional: lectures, explanations, stories, etc.;
- 1.2 interactive (non-traditional): problem lectures, discussions, etc.;
- 2) visual: the method of illustrations, the method of demonstrations
- 3) practical:
- 3.1 traditional: practical classes, seminars;

3.2 interactive (non-traditional): business and role players games, trainings, seminars- discussions,

brainstorming method

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:

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

n

where K^{nomou} 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).

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

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

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 Evaluation on a		on on a	Evaluation according to the ECTS scale		
points	national scale		Rating	Criteria	
	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	

Score	Evaluati	on on a		Evaluation according to the ECTS scale	
IN points	nationa	al scale	Rating Criteria		
points	examina tion	test			
80–89		Enrolled	В	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	
75-79	Okaj		C	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	storily		Ш	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
60–66	Satisfac		E	The theoretical content of the course has been 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.	
35–59	Unsatisfactorily	Not 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)	

Score	Evaluation on a national scale		Evaluation according to the ECTS scale		
in points			Rating	Criteria	
	examina tion	test			
0–34	Unacceptable		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 at 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 valid reason, he presents the completed tasks during independent preparation and consultation of the teacher;

- 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 Khnadu" participants in the educational process of the (https://www.khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz_67_01_dobroch_1.pd f), "Academic integrity. Checking the text of completed scientific and works for plagiarism" (https://www.khadi.khar kov.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/filea dmin/P Standart/pologeniya/stvnz 67 01 MEK 1.pdf). - in case detection the fact plagiarism getter receives by task 0 points and must repeat

the tasks provided for in the syllabus;

- writing off lectures or practical works, using other people's educational materials (including using mobile devices) is prohibited. Mobile devices are allowed to be used only during online checking of practical task results, additional testing.

Recommended reading:

 Bearing Tribology : Principles and Applications / Ming Qiu , Long Chen , Yingchun Li , Jiafei Yan ; by Ming Qiu , Long Chen , Yingchun Li , Jiafei Yan . – 1st ed. 2017. - Berlin, Heidelberg: Springer Berlin Heidelberg, 2017. – XII, 333 p. 145 illus ., 9 illus
 Tribology (open courseware) <u>https://ocw.mit.edu/courses/mechanical-engineering/2-800-tribology-fall-2004</u>.

Developer(s) syllabus of the educational discipline

signature

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