Silabus
educational component of the UA
(elective discipline)

Quality of machines

Name of the discipline:	**Quality of machines**
Level of higher education:	**First (bachelor's)**
Course page in Moodle:	https://dl2022.khadi.kharkov.ua/course/view.php?id=719
The volume of the educational component	**4 credits (120 hours)**
Form of final control	**Offset**
Consultations:	**on schedule**
Name of the department:	**Department of construction and road machines**
Language of instruction:	**Ukrainian**
Course leader:	**Pimonov Igor Georgievich, Associate Professor**
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Summary of the educational component:

The aim is to provide students with a comprehensive training of in-depth study of the principles of formation in the design, manufacture and operation of a rational level of quality of lifting and transport, construction, road, land reclamation machines. Of particular importance are the issues of improving the quality of machines in connection with the need to increase the competitiveness of products, the development of the machine-building complex in a market economy.

Subject: quality indicators, their formation, the influence of design and operating conditions of the main groups of lifting and transport, construction, road, land reclamation machines, physics and failure models, the basics of machine reliability, methods of operation and repair of machines, ways to improve the quality of machines at the design, production and operation stages

The main tasks of studying the discipline are:

- mastering the basics of quality theory by students (at the level necessary for them to master the system of interrelated concepts, areas, disciplines that are the basis of quality science.
- studying by students of a set of concepts of quality theory at a level sufficient for practical activity in the specialty.
- familiarization of students with the basics of reliability as a quality deployed in time.

Prerequisites for studying the educational component:

Higher mathematics; Theoretical mechanics; Resistance of materials; Machine parts; General structure of construction, road machines; Design of transmissions of construction, road machines.

Competencies acquired by the applicant:

General competencies:

Ability to gather and interpret information and make judgments on relevant social, scientific or ethical issues.

Special (professional) competencies:

Ability to apply fundamental scientific facts, concepts, theories, principles to solve professional problems and practical problems of industrial engineering.

Ability to assess and ensure the quality of work performed.

Ability to make effective decisions on the choice of structural materials, equipment, processes and combine theory and practice to solve engineering problems.

Ability to take responsibility for managing the professional development of individuals and groups.

Knowledge, skills and abilities to develop and implement scientific projects and programs in the field of lifting and transport, construction, road, land reclamation machinery and equipment.

Learning outcomes in accordance with the educational program:

Search for the necessary scientific and technical information in available sources, in particular in a foreign language, analyze and evaluate it.

Apply means of technical control to assess the parameters of objects and processes in industrial engineering.

Skills and abilities to select the structure of the mechatronic system, algorithms of its functioning for the given parameters of the processes of lifting and transporting, construction, road and land reclamation machines, taking into account advanced scientific achievements in the fields of electronics, mechanics, control systems.

Thematic plan

no. of topics	Name of topics (LC, LR, PR, NW, SR)	Number of hours	
		face-to-face	correspondence
1	LC. Introduction to the discipline "Quality of machines". The purpose and task of studying the discipline. Basic terms, definitions and quality indicators.	2	1
	SR. Formation of quality at the stages of the life cycle of machines.	6	6
2	LC. Quality assessment. Consistency. Basic methods. Qualimetry. Method of expert evaluation of quality indicators and properties of products. Analysis of types, consequences and criticality of failures.	2	1
	PR. Analysis of types, consequences and criticality of failures.	2	1
	SR. The procedure of formalization or normalization.	6	6
3	LC. Quality assessment by a generalized indicator of a group of product properties. Classification of industrial products and indicators of their properties. Assessment of product quality by its most important indicator. Differential method.	2	1
	SR. Technical level (TU) of the assessed engineering products	6	6
4	LC. Method of comprehensive quality assessment. Ways to find the weighting coefficients in the integrated method of quality assessment. Mixed method of assessing the level of product quality.	2	1
	PR. Quantitative assessment of product quality.	2	1
	SR. Ways to find the weighting coefficients in the complex method of quality assessment	6	6
5	LC. Method of integral assessment of quality level. Assessment of product quality by its economic efficiency.	2	1
	SR. The level of quality of the assessed products in terms of economic efficiency	6	6
6	LC. Reliability as the main indicator of quality. Assessment of machine reliability based on the results of full tests.	2	1
	OBJECTIVE. Determination of machine reliability indicators based on the results of full tests.	2	1
	SR. Indicators of reliability	6	6

7	LK. Evaluation of machine reliability indicators based on the results of abbreviated tests. Measurement of wear.	2	
	SR. Determination of machine reliability indicators based on the results of abbreviated tests.	6	6
8	LC Prediction of the resource by the wear criterion. Static prediction of wear parts reliability. Individual prediction of durability based on the results of wear measurement.	2	
	PR. Individual durability prediction based on wear measurement results.	2	1
	SR. Reliability in the period of gradual failures	6	6
9	LC. Prediction of fatigue life in machine design.	2	
	SR. Calculation of the probability of failure-free operation of reinforced and unreinforced axles of the base machine	6	6
10	LC Quality assurance of machines at the design stage. Calculation of reliability.	2	
	PR. Prediction of fatigue life in machine design	2	
	SR. Prediction of fatigue life in the design of machines of products related to non-renewable	6	6
11	LC. Ensuring quality indicators during operation Organizational and technical means to maintain the quality of machines.	2	
	SR. Analysis of the feasibility of further operation of the maschines	2	8
12	LC Reservations. Types. Quality assurance. Calculation of the number of redundant elements.	2	
	PR. Rationalization of the number of reserve elements.	2	
	SR. Reservation permanent (loaded) and by substitution	2	8
13	LC. Ensuring the quality of operation with loaded redundancy. Calculation of parameters	2	
	SR. Determination of the total number of machines in the fleet N, necessary to ensure the trouble-free operation of these machines with a given probability, determined by the availability factor Kg	2	8
14	LC Ensuring the quality of operation by centralized supply of spare parts and preventive replacement with diagnostics.	2	
	OBJECTIVE. Ensuring the quality of operation of loaded redundancy.	2	
	SR. Average consumption of spare parts of one item in the fleet of vehicles for the period T	2	8
15	LC. Ensuring the quality of operation of the repair and technical diagnostics system.	2	
	SR. System of periodic preventive replacements based on technical diagnostics	2	8
16	LC Diagnostic methods, diagnostic error values. Methods of reducing the diagnostic error.	2	
	PR. Determination of the error of diagnosis of units by the statoparametric method and its components	2	
	SR. Reliability of the object as a system consisting of a number of elements	2	10
Together	LC	32	6
	PR (LR, NW)	16	4
	SR	72	110

Individual educational and research task (if available):

Teaching methods:

MH1 - verbal method (lecture, explanation, story);
MH2 - practical method (practical classes);
MH3 - visual method (demonstration method);

MH4 - work with literature (educational and methodical; work with textbooks and manuals; search for information on the task);
MN6 - independent work;

Forms and methods of evaluation

FMO2 - final control (offset, calculation and graphic)
FMO3 - oral control (conversation)
FMO5 - test control (standardized tests, final comprehensive tests)
FMO7 - practical examination (defense of practical works)

Evaluation system and requirements:
Current academic performance

1 The current performance of applicants for the performance of educational types of work in class and for the performance of independent work tasks is assessed using a four-point grading scale with the subsequent conversion to a 100-point scale. When assessing current progress, all types of work provided by the curriculum are taken into account.

1.1 Lecture classes are evaluated by determining the quality of specific tasks.

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

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

1.4 Seminar classes are evaluated by the quality of individual assignments / essays.

2The assessment of the current progress of higher education students is carried out at each practical lesson (laboratory or seminar) on a four-point scale ("5", "4", "C", "2") and recorded in the academic record book.

"excellent": the applicant has perfectly mastered the theoretical material, demonstrates in-depth knowledge of the relevant topic or discipline, the main provisions;

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

- "satisfactory": the applicant has basically mastered the theoretical knowledge of the subject or discipline, is oriented in the primary sources and recommended literature, but unconvincingly answers, confuses concepts, hesitates to answer additional questions, does not have stable knowledge; answering questions of a practical nature, shows inaccuracy in knowledge, is unable to evaluate facts and phenomena, to relate them to the 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.

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

$$K^{поточ} = \frac{K1 + K2 + ... + Kn}{n},$$

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

$K1, K2, ..., Kn$ - assessment of the success of the n current control measure;

n - number of current control measures.

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

Table 1- Conversion of the average score for the current activity 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-examination	

Final evaluation

1 A higher education student receives a credit at the last class of the discipline based on 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).
Higher education applicants who have a current average grade in the discipline below "3" (60 points) in the last class can increase their current score by taking 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 receiving credit is:
- working off all missed classes;
- the average current grade in the discipline is not lower than "3" (60 points).

3 Additional points are awarded for individual independent work and participation in scientific events.
3.1 Additional points are added to the sum of points gained by the applicant for higher education for current educational activities (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;
- prize places in the discipline at the national competitions - 20 points;

- participation in the international / all-Ukrainian competition of scientific student works - 15 points

- participation in international/national scientific conferences of students and young scientists - 12 points;

- participation in national competitions in the discipline - 10 points

- participation in Olympiads and scientific conferences of KhNADU 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 *(select the required)*:

- on a two-point scale (passed/not passed) according to Table 2;
- on a 100-point scale (knowledge assessment scale) according to Table 3.

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

Table 2 - Scale of points conversion to the national evaluation system

On a 100-point scale	**On the national scale**
from 60 points to 100 points	enrolled
less than 60 points	unaccounted for

Table 3 - Scale for assessing the knowledge of students based on the results of the final control of the discipline

Score in points	Assessment on the national scale		Evaluation on the ECTS scale	
	examination	offset	Evaluation	Criteria.
90-100	**That's great.**	**Enrolled**	**A**	The theoretical content of the course is mastered completely, without gaps, the necessary practical skills of working with the mastered material are formed, all the training tasks provided by the training program are completed, the quality of their implementation is estimated by the number of points close to the maximum
80-89	**Okay.**	**Enrolled**	**B**	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 training tasks provided by the training program are completed, the quality of most of them is estimated by the number of points close to the maximum
75-79			**C**	The theoretical content of the course is fully mastered, without gaps, some practical skills of working with the mastered material are insufficiently formed, all the training tasks provided by the curriculum are completed, the quality of any of them is not assessed by the minimum number of points, some types of tasks are performed with errors

Score in points	Assessment on the national scale		Evaluation on the ECTS scale	
	examination	offset	Evaluation	Criteria.
67-74	**Satisfactory**		**D**	The theoretical content of the course is partially mastered, but the gaps are not significant, the necessary practical skills of working with the mastered material are basically formed, most of the training tasks provided by the curriculum are completed, some of the completed tasks may contain errors
60-66			**E**	The theoretical content of the course is partially mastered, some practical skills have not been formed, many of the training tasks provided by the curriculum have not been completed, or the quality of some of them is estimated by the number of points close to the minimum.
35-59	**Unsatisfactory**	**Not enrolled**	**FX**	The theoretical content of the course is partially mastered, the necessary practical skills have not been formed, most of the learning tasks provided by the curriculum 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 learning tasks (with the possibility of repeating)
0-34	**Unacceptable.**		**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 training tasks (with a mandatory repeated course)

Policy of the course:

- the course involves teamwork, 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 discipline, which are submitted in accordance with the program for independent study, or were considered briefly;
- all tasks provided by the program must be completed in due time;

- if the applicant for higher education is absent from classes for a valid reason, he/she presents the completed tasks during independent preparation and consultation of the teacher;
- the term paper must be defended no later than one week before the start of the examination session**;**
- while studying the course, higher education students must adhere to the rules of academic integrity set out in the following documents: "Rules of academic integrity of participants of the educational process of KNADU" (https://www.khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz_67_01_dobroch_1.pdf), "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_01.pdf), "Moral and ethical code of participants of the educational process of KNADU (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 repeat the tasks provided in the silabus;
- cheating during tests and exams is prohibited (including using mobile devices). Mobile devices are allowed to be used only during on-line testing.

Recommended literature:

1. avrunin G.A. Pimonov I.G. Quality of machines: Study guide. - Kharkiv: KhNADU, 2020. 220 p.
2. Machine Reliability and Condition Monitoring: A Comprehensive Guide to Predictive Maintenance Planning Paperback , 2020, -262 pages
3. State standard of Ukraine. Reliability of equipment. Terms and definitions. DSTU 2860-94.
4. Kanarchuk V.E. Reliability of machines: textbook / V.E. Kanarchuk,
S.K. Polyansky, M.M. Dmitriev, V.I. Lesko - K.: Lybid, 2003. - 424 p.

Additional sources:

1. NTB KhNADU (25 Yaroslav Mudryi St., Kharkiv)[electronic resource] .
(http://library.khadi.kharkov.ua/)
2. KhNADU Media Library (25 Yaroslav Mudryi St., Kharkiv)[electronic resource]
(http://files.khadi.kharkov.ua/)
3. File archive of the Department of DBM KhNADU.[electronic resource
](http://files.khadi.kharkov.ua/mekhanichnij-fakultet/budivelnikh-i-dorozhnikh-mashin.html)
4. HNADU training website https://dl2022.khadi.kharkov.ua/course/view.php?id=719

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