Silabus
educational component of the UA
(elective discipline)

Research work of students

Name of the discipline	**Research work of students**
Level of higher education:	**first (bachelor's)**
Course page in Moodle :	https://dl.khadi.kharkov.ua/course/view.php?id=1812
The volume of the educational component	**3 credits (90 hours)**
Form of final control	**Offset**
Consultations:	**on schedule**
Name of the department:	**Department of construction and road machines named after A.M. Kholodov**
Language of instruction	**English**
Course leader:	**Fidrovska Natalia,** doctor of technical sciences, professor
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Summary of the educational component:
The aim is to development of research skills in the field of handling, road, construction and reclamation machines, production of new theoretical knowledge on the methodology of scientific research, solving scientific problems at the theoretical and empirical levels:
Subject*:* theoretical and methodological fundamentals, methodological provisions of scientific directions in the development of handling, road, construction machines and equipment at the present stage

The main tasks of studying the discipline are :
- Mastering the methods of planning and organizing scientific research;
study of methods of scientific research of machines using modern technologies
– formulation of scientific research tasks, development of physical and mathematical models;
-ormation of methodology and plan for conducting experimental studies:–
carrying out mathematical processing of the results of experimental studies.

Prerequisites for studying the educational component:
Chemistry; General structure of construction and road machines; Theory of mechanisms and machines; Machine parts; Hydraulics, hydraulic and pneumatic drives.

Competencies acquired by the applicant:
General competencies **:**
The ability to use knowledge, demonstrating a professional approach in their activities, which allows them to solve problems in the field of lifting and transport, construction, road and reclamation machines.
The ability to generate new ideas (creativity).
Willingness to conduct research at a certain level.
Ability to communicate in a foreign language.
Ability to work in a team.

Special (professional) competencies:

Ability to use typical analytical methods and computer software methods for solving engineering problems in the field of material handling, construction, road and land reclamation engineering.

Ability to use computerized design systems and specialized application software to solve engineering problems in the field of mechanical engineering.

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

The ability to realize creative and innovative potential in design developments in the field of industrial engineering

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

Learning outcomes :

Knowledge and understanding of the basics of technological, fundamental and engineering sciences, which underlie the hoisting and transport, construction, road and reclamation engineering.

Knowledge and understanding of mechanics and material handling, construction, road and land reclamation engineering and the prospects for their development.

To know and understand the systems of automatic control of objects and processes of industrial engineering, to have the skills of their practical use.

Select and use appropriate equipment, tools and methods.

Knowledge and ability to use methods for optimizing the parameters of handling, construction, road and melting machines to achieve the required performance indicators.

Skills and skills to select the structure of the mechatronic system, the algorithms of its functioning, 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	LK (PR, SR)	-	-
	PR. Object, subject, content, task and structure of the course. The concept of science, scientific thinking and research. Types of scientific research	4	-
	SP The main stages of scientific knowledge. Classification of types of research work	4	-
2	LK (PR, SR)	-	-
	PR Stages of scientific and technical research. Information search for the topic of scientific research. Formulation of a working hypothesis. Designing the experimental part of the study	4	-
	SR Research methodology. Assessing the need for research	8	-

3	LK (PR, SR)	-	-
	PR Tasks of theoretical scientific research. Scientific hypotheses, abstractions and generalizations. General characteristics of scientific research methods	4	-
	SR Methods for enhancing the search for new technical ideas. Methods of system analysis in theoretical research.	8	-
4	LK (PR, SR)	-	-
	PR Tasks of analytical methods of scientific research. Stages of theoretical scientific research. Research objectives according to one or more criteria. Assessing the likelihood of research and the limits of their use.	4	-
	SR Limitation and assumptions in scientific research. Mathematical approximation of the studied phenomena	8	-
5	LK (PR, SR)	-	-
	PR. Modeling in scientific research. Principles and theorems on the theory of physical phenomena. Mathematical models of the studied phenomena. Methods for modeling dynamic features.	4	-
	SR Fundamentals of the theory of similarity of physical phenomena. Mathematical models of complex systems. Simulation models of technical systems.	8	-
6	LK (PR, SR)	-	-
	PR.Preparation for conducting scientific experimental research. The choice of the method of conducting the experiment. Basic provisions of the mathematical theory of experiment planning. Planning the optimal experiment .	4	-
	SR The choice of the method of conducting the experiment. Concepts for planning a mathematical experimenta The structure of the plan-program of experimental research	8	-
7	LK (PR, SR)	-	-
	PR Measuring equipment for scientific research. Methods for measuring the parameters of research objects. Mathematical evaluation of the results of experimental studies. Estimation of measurement error	4	-
	SR. Physical quantities and basics of metrology. Characteristics of measurement methods. Measuring converters of speed and acceleration.	6	-
8	LK (PR, SR)	-	-
	PR Methods for presenting and processing the results of experimental studies. Analysis and design of scientific research. Organization of research work of students. Master's work as a qualifying study.	4	-

	SR Determination of the adequacy of theoretical solutions. Analysis of theoretical and experimental research. Formulation of conclusions and proposals .	8	-
Together	LK	-	-
	PR (LK, SR)	32	-
	SR	58	-

Teaching methods:

TM1–verbal method (conversation, educational discussion, explanation, story);

TM4 – work with literature (educational and methodical; scientific literature; normative literature; information search by task);

TM6 – independent work;

TM7 – research work of students

Assessment forms and methods

FMO2 - final control (credit)

FMO4 – written control (individual tasks)

FMO7 – practical examination (presentations of completed tasks and research, student presentations and speeches at scientific events)

FMO8 - methods of self-control and self-assessment

Evaluation system and requirements:

Current academic performance

1 The current performance of applicants for the performance of educational activities in the classroom and for the performance of independent work 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 assessed 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.

2 Evaluation 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 flawlessly mastered the theoretical material, demonstrates deep 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.

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

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

where K^{current} 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 2).

Table 2 - 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 2).

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 amount of points gained by the applicant for higher education for the current educational activity.

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 Learning outcome is assessed :

- on a two-point scale (passed/not passed) according to Table 3;
- on a 100-point scale (for differentiated scoring) according to Table 4.

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

Table 3 - Scale of points conversion to the national evaluation system

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

Table 4 - 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.

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
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 has been mastered partially, some practical skills have not been 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	Assessment on the national scale		Evaluation on the ECTS scale	
	examination	offset	Evaluation	Criteria.
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;
- 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 in 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.

1.Recommended literature :

1.1 Yurinets V.Є. Methodology of scientific research: Navch. posibnik / V.Є Yurinets. - Lviv: LNU named after Ivan Franko, 2011. -178 p.
1.2. Zachosova, N. and Kovalenko, A. (2017), “Methodology of scientific research of problems of ensuring economic security of the state”, Ekonomika ta derzhava, vol. 11, pp. 56–59.
1.3. Kalambet S.V. Methodology of scientific research: Navch. posib. / S.V. Kalambet, S.I. Ivanov, Yu.V. Pivnyak Yu.V. - Day-Sunday: View of Makovetsky, 2015. - 191 p.
1.4. Fundamentals of methodology and organization of scientific research: Navch. posib. For students, cadets, graduate students and adjunct students / edited by A.Є.Konverskogo. - K .: Center for Educational Literature, 2010. - 352 p.
1.5. Methodology of scientific research [Electronic resource]: heading guide / V. S. Antonyuk, L. G. Polonsky, V. I. Averchenkov, Yu. A. Malakhov; NTUU "KPI". – Electronic text data (1 file: 5.83 MB). - Kiev: NTUU "KPI", 2015. − 277 p.
1.6. Methodology and organization of scientific research (in structural and logical schemes and tables): Navch. posib. Sumi: SNAU, 2020. - 220p.
1.7. Methodology of scientific research: Navch. posib. / V.I. Church, I. V. Tishaev, V. K. Demidov. - Nizhin: NDU im. M. Gogol, 2017. - 236 p.
1.8. Birta G.O. Methodology and organization of scientific studies: Navch. posib. / G.O.Birta, Yu.G.Burgu - K .: "Center for Educational Literature", 2014. - 142 p.

2. Supporting literature

2.1Romanchikov V.I. Fundamentals of scientific research. Head helper. - K .: Center for Educational Literature, 2007. - 254 p.
2.2. Fundamentals of scientific research. Organization of independent and scientific work of a student: Navch. Posibnik / Ya. Ya Chornenky and in .. -K .: VD "Professional", 2006. 208 p.
2.3. Primary-methodological handbook of the primary discipline "Organization and methodology of scientific research" for graduate students (finding the level of Doctor of Philosophy) / style: O.G.Danilyan, O.P.Dzoban. – Kharkiv: Law, 2019. -40p.

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3. Information resources

3.1 NTB KhNADU (25 Yaroslav Mudryi St., Kharkiv)[electronic resource] . (http://library.khadi.kharkov.ua/)
3.2. KhNADU Media Library (25 Yaroslav Mudryi St., Kharkiv)[electronic resource] (http://files.khadi.kharkov.ua/)
3.3. File archive of the Department of CRM of KNADU.[electronic resource] (http://files.khadi.kharkov.ua/mekhanichnij-fakultet/budivelnikh-i-dorozhnikh-mashin.html)
3.4 Construction machinery [electronic resource].(http://www.htz.ru)
3.5. www.interscience.wiley.com

Developer
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