Syllabus educational component of the Ministry of Education

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

Subjects:	Machines for laying underground communications
Level of higher education:	second (master's)
Course page in Moodle:	https://dl.khadi.kharkov.ua/
The scope of the educational	4 credits (120 hours)
component	
Final control form	Test
Consultations:	on schedule
Name of the department:	department of construction and road machines
Teaching language:	English
Course leader:	Suponev Volodymyr Mykolayovych, PhD, prof.
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Machines for laying underground communications

Brief content of the educational component:

The goal is training of specialists in the mechanization of the construction of underground engineering communications, getting an idea of machines and mechanisms for carrying out work according to existing technologies of laying networks, familiarization with the construction and the principle of operation of special installations for trenchless laying of underground communications

Subject: Machines and mechanisms that are part of mechanized columns for the construction of underground engineering communications, the construction of installations for the formation of horizontally directed wells during trenchless laying of underground communications

The main tasks of studying an academic discipline are:

- getting an idea of existing technologies laying of underground communications;

- selection and justification of the composition of mechanized columns for the trench method of pipeline construction;

- understanding of engineering communications and conditions for their laying;

- purpose and conditions of use of machines and installations for trenchless laying of engineering communications;

 mastering modern methods of calculation and mathematical modeling of work processes of interaction of work equipment with the soil of machines for trenchless laying of communications;

- getting an idea and mastering engineering methods for calculating the parameters of working equipment and the algorithm for choosing the most effective method of trenchless well development depending on the technological and technical requirements for production.

Prerequisites for studying the educational component:

Machines for earthworks. Modular design of machines. Dynamics of construction and road machines. Design and testing of hydraulic drives.

Competencies acquired by the acquirer:

General competences:

Ability to search, process and analyze information from various sources Ability to generate new ideas (creativity)

Special (professional) competences:

Critical understanding of advanced scientific facts, concepts, theories, principles for industrial mechanical engineering and the ability to apply them to solve complex problems of industrial mechanical engineering and ensure sustainable development.

The ability to create new techniques and technologies in the field of mechanical engineering.

Awareness of promising tasks of modern production, aimed at meeting the needs of consumers, mastering the trends of innovative development of industry technologies.

Learning outcomes:

Knowledge and understanding of the basics of technological, fundamental and engineering sciences, which are the basis of industrial mechanical engineering in the relevant field

Knowledge and understanding of mechanics and mechanical engineering and their development prospects.

Carry out engineering calculations to solve complex problems and practical problems in industrial mechanical engineering.

Торіс	Nome of tension (LK, LD, DD, SZ, SD)	Number of hours	
No	Name of topics (LK, LK, FK, SZ, SK)	ocular	extram ural
	LK Underground engineering communications. Their types, purposes and features.	2	-
1	PR (LR, SZ) Classification of engineering networks according to their purpose	2	
	SR structure of engineering communications, conditions of their laying in open space and compressed urban conditions	12	
	LK Existing technologies for laying engineering networks using the trench method and the composition of mechanized columns for their laying	2	
2	PR (LR, SZ) Selection and justification of the composition of the technician for the development of mechanized columns for trench laying of engineering communications.	2	
	SR Protective cases. Their purpose and principles of protective selection	12	
	LK Laying of pipelines of large diameters by the shield penetration method	2	
3	PR (LR, SZ) Types of pipes, their purpose and their characteristics Mechanical characteristics and properties of steel and polyethylene pipes	2	
	SR Laying of pipelines by the "Wall in the soil" method. Technologies for welding polyethylene pipelines	10	
	LC Selection of trenchless technology and means of their mechanization, Assessment of their technical level	2	-
4	PR (LR, SZ) Construction of machines for forming wells using static methods	2	-
	SR Principles of controlling the trajectory of soil piercing and devices for controlling the position of soil piercing equipment in space	12	-

Thematic plan

5	LK Patterns of processes of static puncture and soil compaction and their mathematical modeling	2	-
	PR (LR, SZ) Determination of soil compaction zones during its static puncture with a symmetrical conical-cylindrical traditional tip	2	-
	SR Features of the operation of machines and installations for trenchless, uncontrolled laying of engineering networks	12	-
	LKBasics of creating minimally energy-intensive working bodies for creating horizontally directed wells in the soil	2	-
6	PR (LR, SZ) Calculations of soil resistance forces using mathematical models of the interaction of working equipment with the symmetrical tip of the working body	2	-
	SR Modern drilling fluids in horizontal directional technologies(managed)boring	12	-
7	LC Establishing the influence of the tips of the working equipment for piercing the soil on the adjacent underground objects. Determination of conditions for non-destructive laying of underground communications.	2	-
	PR (LR, SZ)PR (LR, SZ) Calculations of soil resistance forces using mathematical models of the interaction of work equipment with asymmetric tips of the work body	2	-
	SR Requirements for safe laying of underground communications	8	-
8	LK Occupational safety and environmental safety during the operation of machines and installations for trenchless laying of underground communications	2	-
	PR (LR, SZ) Volumetric hydraulic drive in machines for trenchless laying of engineering networks	2	-
	SR Economic justification of the effectiveness of using trenchless technologies in construction	10	-
Teref	LK	16	-
Toget her	PR (LR, SZ)	16	-
	SR	88	-

Individual educational and research task (in the presence):

Teaching methods:

TM1-verbal method (lecture, explanation, story);

- TM2 practical method (practical classes);
- TM3 visual method (illustration method, demonstration method);
- TM4 work with literature (educational and methodical; work with textbooks and manuals);

Assessment forms and methods

- FME2 final control (semester exam, course project (work));
- FME3 oral control (conversation);
- FME4 written control (individual tasks);
- FME5 test control;
- FME7 practical examination (protection of practical work).

Evaluation system 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 performance in are counted all types of work provided by the curriculum

program

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.

2 Evaluation of the current success rate of higher education applicants is carried out at each practical session (laboratory or seminary) on a four-point scale ("5", "4", "Z", "2") and are entered in accounting journal academic success

- "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 a reasoned 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**Final score by current activity is recognized as an arithmetic average sum points for each lesson, for individual work, current control works according to the formula:

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

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

n - the number of measures of current control.

Assessments 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
						reassen	nbly
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 -Recalculation of the avera	ge grade for the current	activity into a multi-point scale
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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).

Graduates of higher education, who have an average current grade in the discipline lower than "3" (60 points), in the last session can increase their current grade by taking tests in the discipline.

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 participating in scientific events, winners are awarded additional points.

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 result of the study is evaluated (select is required):

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

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

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

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	n on a	E	valuation according to the ECTS scale		
in	national s	scale	Rating	Criteria		
points	examination	test	raung	Uniona		
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	>		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	Oka	Okay		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	ictorily	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	Satisfa 9		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.		

Score	Evaluation	on a	E	valuation according to the ECTS scale	
in	national s	scale	Poting	Criteria	
points	examination	test	Raing		
35–59	Unsatisfactorily	ot 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	SN	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 adhere to 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 National Academy of Sciences

(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 Books:

1. Suponev V.M. Scientific basis and practice of creating minimum energy-intensive working bodies for the formation of communication cavities in the soil / Suponev V.M., Kravets S.V., Posmityukha O.P., Balesny S.P. Monograph. Kharkiv, Khnadu, 2021. 304 p.

2. Suponev V.M. Creation of equipment for the development of horizontal wells by combined methods of static action. Monograph. Kharkiv, Khnadu, 2018. 196 p.

3. Kravets S.V., Kaslin N.D., Rudnev V.K., Suponev V.N. Machines for trenchless laying of underground communications-Kharkiv: Khnadu Publishing House, 2008.

4. Khmara L.A. Machines for earthworks / L.A. Khmara, S.V. Kravets, V.M. Suponev et al. Textbook - Publisher: H. Khnadu. LLC VKF "Favor LTD", 2014 -548 p.

5. Suponev V.M., Vyvchar S.M., Balesny S.P. Trends in the development of technologies and equipment for trenchless laying of underground communications in urban conditions. Scientific news of Daliv University. 2017. No. 12. URL: http://nbuv.gov.ua/UJRN/Nvdu_2017_12_8.

6. Pridmore A., Geisbush J. Developing a Successful Specification for Horizontal Directional Drilling // Pipelines 2017. Pipelines Planning and Design Book set. 2017. R. 553–563. <u>https://doi.org/10.1061/9780784480878</u>

7. Nilo Tsung, Mingming Zheng, Mohammad Najafi, Saleh Mehraban. A Comparative Study of Soil Pressure and Deformation of Pipes Installed by the Open-Cut Method and Trenchless Technology // Pipelines 2016: Out of Sight, Out of Mind, Not Out of Risk. 2016.<u>https://doi.org/10.1061/9780784479957.132</u>

8. Zhao Jun Ling Bian (2014). Trenchless technology underground pipes. Machinery Industry Press, R. 187.

9. Suponyev V. Analytical method of determining the movement resistance of a tip for forming a rectangular technological hole in the lower structure Conf. serirs: Materials Science and Engineering 985 (2020) 012033 Doi: 10.1088/1757-899X/985/1/012033

10. Cuponev V.M. Setting the value of the deviation of the ground-piercing working body with an asymmetric tip when correcting the trajectory of its movement / V.M. Suponev, S.P. Balesny, I.H. Pimonov - Herald of the Khnadu. Collection of scientific articles. Issue No. 92, 2021, vol. 1. - Kharkiv, Khnadu. P. 172-178.

11. Suponyev V. Determination of the regularities of the soil punching process by the working body with the asymmetric tip / S. Kravets, V. Suponyev S. Balesnyi, V. Shevchenko, A. Yefymenko, V. Ragulin - Eastern-European journal of enterprise technologies. 2021. No. 2/1(110). P. 44-51. DOI: 10.15587/1729-4061.2021.230256

Additional sources:

12. Educational site of Khnadu: https://dl.khadi.kharkov.ua/course/view.php?id=72913. File archive of the department of BDM KHNADU:

http://files.khadi.kharkov.ua/mekhanichnij-fakultet/budivelnikh-i-dorozhnikh-mashin.html 14. NTB of Khnadu:<u>http://library.khadi.kharkov.ua/golovna/</u>

Developer(s)

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