Syllabus

educational component

symbol of the EK in the educational program (EP)

Greenhouse Gas Capture Processes

Subjects:	Greenhouse Gas Capture Processes
Level of higher education:	**the second (educational and professional)**
Course page in Moodle:	*https://dl.khadi.kharkov.ua/course/view.php?id=3037*
The scope of the educational component:	3 credits (90 hours)
Final control form:	Test
Consultations:	on schedule
Name of the department:	**Department of Ecology**
Teaching language:	English
Course leader:	**Zipunnikov Mykola**
Contact phone number:	**(057) 7073741**
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Brief content of the educational component:
The goal is to study the main processes of capturing greenhouse gases in the environment. Performance of technological calculations and selection of gas capture equipment in industrial conditions.

Subject: theoretical and methodological foundations, methodological provisions of scientific directions of greenhouse gas capture processes at industrial enterprises.

The main tasks of studying an academic discipline are:
– substantiation of the theoretical foundations of greenhouse gas capture processes;
– study of the main sedimentation devices;
– formation of directions for improvement and development of greenhouse gas capture processes in industrial conditions;
– formation of skills of independent organization of environmental situation determination at industrial facilities and in domestic conditions.

Prerequisites for studying the educational component:
Climate engineering technologies.

Competencies acquired by the acquirer:
Integral competence:
The ability to solve complex tasks and problems in the field of ecology, environmental protection and balanced nature management during professional activities or in the learning process, which involves conducting research and/or implementing innovations, and is characterized by the complexity and uncertainty of conditions and requirements.

General competences:
Ability to use modern methods of environmental protection, principles of comprehensive protection of natural ecosystems and human society from ecologically dangerous natural and technogenic processes (phenomena).

Special (professional) competences:
Skills of working in computer networks, using modern information technologies and software tools; Knowledge of the factors of influence of environmentally dangerous phenomena and processes on biological and physiological indicators of the human condition, the ability to apply them to determine the social consequences of man-made changes in the state of the environment; The ability to organize work related to the assessment of the ecological state, environmental protection and optimization of nature use in conditions of incomplete information and conflicting requirements; The ability to develop and implement a set of works on prevention, adaptation and minimization of the consequences of climate change.

Learning outcomes according to the educational program:
Be able to search for information using relevant sources to make informed decisions. To raise the professional level through continuing education and self-education.

Thematic plan

№ of topic	Name of topics (LC, LW, PW, SC, IW)	Number of hours	
		intramural	intramural
1	LC Classification of greenhouse gases.	2	2
	PW Processes of capturing carbon dioxide.	2	2
	IW Main processes of decarbonization.	12	12
2	LC The main approaches to removing carbon from the atmosphere.	2	2
	PW Capture of carbon dioxide at energy enterprises.	2	-
	IW Basic technologies of carbon storage.	12	12
3	LC Technologies of capture and beneficial use of carbon.	2	-
	PW Useful use of carbon.	2	-
	IW Greenhouse activity of carbon.	12	12
4	LC Ways of disposal of waste nitrous gases.	2	-
	PW Cleaning of gases from nitrogen oxides.	2	2
	IW Greenhouse activity of ozone.	12	12
5	LC Neutralization of nitrogen oxides of exhaust gases of internal combustion engines.	2	2
	PW Methods of liquid neutralization of spent gases of internal combustion engines.	2	-
	IW Beneficial use of nitrogen.	12	12
6	LC Utilization of heat and condensate of steam emissions.	2	-
	PW Schematic complex solutions to the problem of utilization of vapor emissions.	2	-
	IW Fluctuations in the concentration of methane in the environment.	12	12
7	LC Utilization of energetically valuable technological gases (coke, blast furnace, converter and ferroalloy) of the technological process of steel production.	2	-
	PW Methods of utilization of gases of ferroalloy production.	2	-
	IW Use of ferroalloys in alternative energy technologies.	12	12
8	LC Decarbonization of the oil and gas industry.	2	2
	PW Storage of petroleum products.	2	-
	IW Greenhouse activity of petroleum products.	4	24
Разом	LC	16	8
	PW	16	4
	IW	88	108

Individual educational and research task (if available)**:**

Teaching methods:
1) verbal: 1.1 traditional: lectures;
2) visual: method of illustrations, method of demonstrations;
3) practical: 3.1 traditional: practical classes.

Evaluation system and requirements:

Current performance
1 The current performance 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 current 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.

2 Evaluation of the current academic performance of students of higher education is carried out at each practical session on a four-point scale ("5", "4", "3", "2") and is entered in the journal of academic performance.

– "excellent": the winner mastered the theoretical material flawlessly, demonstrates in-depth 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 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:

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

де $K^{current}$ – final assessment of success based on the results of current control;
$K1, K2, \ldots, Kn$ – evaluation of the success of the current control measure;
n - the number of measures of current control.
Estimates are converted into points according to the calculation scale (table 1).

Table 1 – Recalculation of the average grade for the current activity into a multi-point scale

4- points scale	100-points scale	4- points scale	100-points scale	4- points scale	100-points scale	4- points 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
						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	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": 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 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 credit), 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 significance:

- prize places 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 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.

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 students based on the results of the final control of the academic discipline

Score in points	Evaluation on a national scale		Evaluation according to the scale of the European credit transfer-accumulation system	
			estimation	Criteria
	examination	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	**Fine**	**Enrolled**	**B**	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

Score in points	Evaluation on a national scale		Evaluation according to the scale of the European credit transfer-accumulation system	
			estimation	Criteria
	examination	test		
75-79			**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	**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
60–66			**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)
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 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.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 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 books:

1. Rusanov A.V. Thermogas dynamics of physical and energy processes in alternative technologies in 3 volumes. / A.V. Rusanov, V.V. Solovei, M.M. Zipunnikov, A.A. Shevchenko // Technological Center, Kharkiv. 2018 - 365 p.
2. Sokurenko V.V. Life safety and labor protection. / V.V. Sokurenko, O.M. Bandurka, S.M. Bortnyk, O.V. Brusakova, O.P. Hetmanets, E.A. Ananieva, I.V. Vlasenko, N.V. Vnukova, and etc.// Kharkiv: KhNUVS, 2021. – 308 p.

Additional literature:

1. L.L. Tovazhnyanskyi. Machines and devices in the chemical, food and processing industries: Textbook with the handle of MONU: - Kharkiv: Kolegium, 2011. - 606 p.

Additional sources:

1. https://dl.khadi.kharkov.ua/course/view.php?id=3037

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