

## Syllabus

educational component  
(by the choice of higher education students)

### Innovative materials for road construction

Subjects:	<b>Innovative materials for road construction</b>
Level of higher education:	<b>second (master's)</b>
Course page in Moodle:	<a href="https://dl2022.khadi.kharkov.ua/course/view.php?id=2978">https://dl2022.khadi.kharkov.ua/course/view.php?id=2978</a> <a href="https://dl2022.khadi.kharkov.ua/course/view.php?id=2389">https://dl2022.khadi.kharkov.ua/course/view.php?id=2389</a>
The scope of the educational component:	<b>4 credits (120 hours)</b>
Final control form:	<b>Test</b>
Consultations:	<b>on schedule</b>
Name of the department:	<b>Department of Road Construction Materials Technology</b>
Language of teaching:	<b>Ukrainian</b>
Head of the course:	<b>Tolmachov Serhii Mykolayovych, Ph.D., Professor</b> <b>Oksak Serhii Volodymyrovych, Ph.D., associate professor</b>
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#### Brief content of the educational component:

**The goal is** to provide education of specialists on performing future independent professional tasks in production technology using modern innovative materials, methods of evaluating the special properties of construction materials and products that appear during their production, and the possibility of quality control of construction materials based on them.

**Subject:** structure and properties of modern and prospect building materials, scientific base and trends in terms of modifying the composition, structure and properties of building materials, the influence of various agents on the main properties of building materials and their production technologies.

#### The main tasks of studying the academic discipline are:

- study of modern road construction materials for their use in all layers of road and airfield construction;
- principles of developing the optimal composition of cement-concrete, asphalt-concrete and other organo-mineral mixtures for the implementation in road and airfield pavements;
- study of various types of additives and their influence on the structure and properties of building materials;
- study of materials for reconstruction, repairs and operational maintenance of road and airfield pavement.

#### Prerequisites for studying the educational component:

Innovative highway construction technologies; Technology of scientific research

#### Competencies acquired by the acquirer:

##### **General competences:**

Ability to adapt and act in a new situation.

**Special (professional) competences:**

Ability to develop and implement projects in the field of construction and civil engineering

**Learning outcomes according to the educational program:**

Apply specialized conceptual knowledge, including modern scientific achievements, as well as critical understanding of modern problems in the field of construction and civil engineering to solve complex problems of professional activity.

Track the latest achievements in the chosen specialization, apply them to create innovations.

Select modern materials, technologies and methods of performing of the construction production process, taking into account the architectural and planning, constructive part of the project and the resources of the construction organization.

**Thematic plan**

No. topics	Name of topics (LC, LW, PW, SC, IWS)	Number of hours	
		Full-time	external
1	2	3	4
1	LC General concepts on innovative building materials. Technical and economic efficiency of using new materials in road construction	2	
	IWS Study of theoretical materials	4	
2	LC Innovations in the field of regulation of the properties of road bituminous binders and asphalt concrete based on them	2	
	PW Finding of the presence and amount of polymer in asphalt concrete	2	
	IWS Study of theoretical materials	5	
3	LC Ways of targeted regulation of asphalt concrete properties by changing their aggregate composition	2	
	PW Comparison of compositions of different types of asphalt concrete (traditional hot, crushed mastic and cast)	2	
	IWS Study of theoretical materials	4	
4	LC Asphalt concretes with increased water resistance, corrosion resistance and durability.	2	
	PW Calculation of compositions of different types of asphalt concrete (traditional hot, crushed-mastic and cast)	2	
	IWS Study of theoretical materials	5	
5	LC Energy-saving and environmentally safe binders and organo-mineral mixtures for road construction	2	
	PW Calculation of bitumen film thickness and prediction of strength of different types of asphalt concrete of known composition.	2	
	IWS Study of theoretical materials	4	
6	LC Modern materials for horizontal road markings, for filling joints and cracks in the pavement, waterproofing materials	2	
	IWS Study of theoretical materials	5	
7	LC Concretes on composite - organo-hydraulic binders	2	
	IWS Study of theoretical materials	4	
8	LC Geosynthetic materials. Materials for reinforcing asphalt concrete layers	2	
	IWS Study of theoretical materials	5	

1	2	3	4
9	LC Modern polycarboxylate and polyacrylate super-plasticizers for mortars and concretes based on inorganic binders	2	
	PW Calculation of the optimal consumption of superplasticizers	2	
	IWS Study of theoretical materials	4	
10	LC Modern active mineral additives for mortars and concretes based on inorganic binders	2	
	PW Calculation of the optimal consumption of active mineral additives	2	
	IWS Study of theoretical materials	5	
11	LC The use of nanoparticles in the technology of obtaining mortars and concretes based on inorganic binders	2	
	IWS Study of theoretical materials	4	
12	LC Types of fiber for creating modern fiber concrete with special properties	2	
	PW Study of the type of fiber and its amount according to literary sources	2	
	IWS Study of theoretical materials	5	
13	LC Concretes with special properties in transport construction technology	2	
	IWS Study of theoretical materials	4	
14	LC Innovative materials for primary and secondary protection of cement concrete against aggressive environments	2	
	IWS Study of theoretical materials	5	
15	LC Repair warehouses and innovative materials and warehouses for the repair of cement-concrete pavements and transport construction objects	2	
	PW Study of absorption features and compositions of protective additives to ensure secondary protection of cement concrete	2	
	IWS Study of theoretical materials	4	
16	LC Modern methods of testing concretes with special properties from highly mobile concrete mixtures in accordance with EN 206	2	
	IWS Study of theoretical materials	5	
Togeth- er	LC	32	
	PW	16	
	IWS	72	
	In total	120	120

### Teaching 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;

### 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 academic performance, all types of work provided 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** 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 applicant 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, possesses 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;

– «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 control works according to the formula:

$$K^{current} = \frac{K_1 + K_2 + \dots + K_n}{n},$$

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

$K_1, K_2, \dots, K_n$  – assessment of the success of the n-th measure of current control;

$n$  – number of ongoing control measures.

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

Assessment of knowledge of applicants by means of testing is carried out according to 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 obtaining credit is:

- making up for all missed classes;
- average current grade in the discipline 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 KhNAHU 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 result is evaluated on a 100-point scale (for differentiated assessment) according to table 2.

**Table 2** – The scale for evaluating the knowledge of students based on the results of the final control of the academic discipline

Score in points	National scale		Mark in ECTS scale	
	exam	test	Mark	Criteria
<b>90-100</b>	<b>Perfectly</b>	<b>Enrolled</b>	<b>A</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 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 in points	National scale		Mark in ECTS scale	
	exam	test	Mark	Criteria
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
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 evaluated 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 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 good reason, he presents the completed tasks during independent preparation and consultation of the teacher;
- 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 KhNAHU» ([https://www.khadi.kharkov.ua/fileadmin/P\\_Standart/pologeniya/stvnz\\_67\\_01\\_dobroch\\_1.pdf](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 works for plagiarism» ([https://www.khadi.kharkov.ua/fileadmin/P\\_Standart/pologeniya/stvnz\\_85\\_1\\_01.pdf](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 KhNAHU» ([https://www.khadi.kharkov.ua/fileadmin/P\\_Standart/pologeniya/stvnz\\_67\\_01\\_MEK\\_1.pdf](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. Basic Books

1. Іноваційні матеріали і технології для будівництва та ремонту дорожніх одягів автомобільних доріг: навч. посібник / С.Й. Солодкий. – Львів: Вид-во Львівської політехніки, 2013. – 140 с.
2. Кривенко П.В., Пушкарьова К.К., Барановський В.Б., Кочевих М.О., Гасан Ю.Г., Константинівський Б.Я., Ракша В.О. Б 90 Будівельне матеріалознавство: Підручник. — К.: «Видавництво Ліра-К», 2015. — 624 с.
3. Дворкін Л. Й. Будівельне матеріалознавство : підручник / Л. Й. Дворкін, С. Д. Лаповська. – Рівне: НУВГП, 2016. – 448 с.
4. Дворкін Л.Й. Ефективні технології бетонів та розчинів із застосуванням техногенної сировини / Житковський В.В., Марчук В.В., Степасюк Ю.О., Скрипник М.М. – Рівне: НУВГП, 2017. – 424 с.
5. Барановський В.Б. та ін. Сучасні українські будівельні матеріали, вироби та конструкції. – К.: Асоціація «ВСВБМВ», 2012 – 664 с.
6. Дворкін Л.Й. та ін. Високоміцні швидкотверднучі бетони та фібробетони. – Рівне: НУВГП, 2017. – 331 с.
7. Толмачев С.Н., Беличенко Е.А. Применение углеродных коллоидных наночастиц в мелкозернистых цементных бетонах. Х.: ХНАДУ, 2014. – 152 с.
8. Хімічна корозія та захист металів: навчальний посібник / [П.І. Стоєв, С.В. Литовченко, І.О. Гірка, В.Т. Грицина]. – Х. : ХНУ імені В.Н. Каразіна, 2019. – 216 с.

### 2. Supporting Books

9. Гамалий Е.А. Современные органо-минеральные модификаторы для тяжелых бетонов. LAP Lambert Academic Publishing, 2014. – 233 с.
10. Методика визначення наявності та вмісту полімеру в асфальтобетонах М 02071168-709:2012. К.: Укравтодор. - 28 с.

11. Будівельні матеріали. Суміші асфальтобетонні і асфальтобетон дорожній і аеродромний: ДСТУ Б В.2.7-119:2011. [Чинний від 2012-10-01]. – К.: Мінрегіон України, 2012. – 42 с. (Національний стандарт України).

12. Будівельні матеріали. Суміші асфальтобетонні і асфальтобетон щебенево-мастикові. Технічні умови: ДСТУ Б В.2.7-127:2015. [Чинний від 2016-07-01]. – К.: Мінрегіон України, 2015 – 27 с. (Національний стандарт України).

13. Будівельні матеріали. Суміші асфальтобетонні та асфальтобетон литі. Технічні умови: СОУ 42.1-37641918-106:2013. [Чинний від 2013-11-01]. – К.: Укравтодор, 2013 – 18 с. (Стандарт організації України).

14. Задачі для магістрантів та аспірантів з дорожньо-будівельних матеріалів / Золотарьов В.О., Космін О.В., Маляр В.В. – Х.: ХНАДУ, 2012. – 84 с.

### 3. Information resources

distance course: <https://dl2022.khadi.kharkov.ua/course/view.php?id=2978>  
<https://dl2022.khadi.kharkov.ua/course/view.php?id=2389>

<http://files.khadi.kharkov.ua>

<http://www.nbww.gov.ua>

<http://korolenko.kharkov.com>

<http://library.univer.kharkov.ua>

Developer(s)  
the syllabus of the academic discipline



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