Silabus of the educational component (elective discipline)

Construction mechanics (special course)

Name of the discipline:	Construction mechanics (special course)
Level of higher education:	First (bachelor)
Course page in Moodle:	https://dl.khadi.kharkov.ua/course/view.php?id=1247
The volume of the educational	3 credits (90 hours)
component	
Form of final control	Offset
Consultations:	on schedule
	Department of bridges, structures and construction
Name of the department:	mechanics named after V.O. Rosiyskiy
Language of instruction:	Ukrainian, English
Course leader:	Kislov Oleksandr Grigorovich, PhD, Associate
	Professor
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Summary of the educational component:

The aim is to train specialists in the field of construction and civil engineering, to independently solve professional problems at the stage of designing and operating buildings and structures.

Subject: calculation methods of statically determined and statically indetermined engineering structures.

The main tasks of studying the discipline are:

- ability to select of rational basic systems for revealing the static uncertainty of the calculation scheme of a real construction object;
- study of force method and movement method for calculations of load-bearing structures of engineering structures;
- mastering the methods of calculating engineering structures for changes in temperature and displacement of support connections;
- formation of skills in the organization of independent research work and presentation of the results of scientific research.

Prerequisites for studying the educational component:

Higher mathematics; Theoretical mechanics; Physics;. Strength of Materials;. Construction mechanics.

Competencies acquired by the applicant:

General competencies:

Ability to use conceptual scientific and practical knowledge of mathematics, chemistry and physics to solve complex practical problems in construction and civil engineering.

The ability to design building structures, taking into account engineering and technical, geological and hydrological features and resource-saving measures, legal, social, ecological, technical and economic indicators, scientific and ethical aspects, and modern requirements of regulatory documentation in the field of architecture and construction, environmental protection and labor safety.

Learning outcomes in accordance with the educational program:

Have in-depth cognitive and practical skills, mastery and innovation at the level required to solve complex specialized tasks in the field of construction and civil engineering.

Have knowledge of modern design and construction technologies. The ability to rationally organize the technological processes of construction, reconstruction, and equipment of buildings and structures in connection with assembly diagrams, with appropriate construction mechanisms and machines, with the features of the surrounding space.

		Number of hours		
no. of topics	Name of topics (LC, PR, SR)	face- to- face	corres ponde nce	
	LC Movement of elastic rod systems. General concepts. The principle of possible movements. Actual and possible work. Theorems on reciprocity of work and reciprocity of movements. Movement due to external load, due to the effect of temperature and displacement of support connections. Simpson-Kornoukhov formula.	6		
1	PR Construction of diagrams of internal forces in beams and frames Determination of displacements due to external load in beams and frames.	4		
	SR Determination of movements due to temperature changes and displacement of support connections. Determination of movements according to the Simpson-Kornoukhov formula.	6		
0	LC Basic concepts of statically indetermined systems. Basics of calculation of statically indeterminate systems by force method. Basic unknowns, basic and equivalent systems, equivalence condition. Canonical equations of the force method. Determination of coefficients and free terms of equations. Construction of diagrams of internal forces in statically uncertain frames. Application of the method of forces to the calculation of statically indeterminate frames under the influence of temperature and displacement of support connections.	6		
2	PR Calculation of a statically indeterminate frame by the force method. Determination of the number of redundant connections. Selection of the main system. Equivalent system. Compilation of canonical equations. Determination of coefficients and free terms of equations. Construction of calculation charts of internal forces from external load. Checks.	4		
	SR Application of the method of forces to the calculation of a statically indeterminate frame under the influence of temperature and displacement of support connections.	12		
3	LC Fundamentals of calculation of statically indetermined systems by the displacement method. The main unknowns of the movement method. The main system is equivalent, the condition of equivalence. The system of canonical equations of the displacement method. Determination of coefficients and free terms of equations using the static method. Construction of calculation charts of internal forces for a given system from an external load. Application of the method of displacements to	8		

Thematic plan

	statically indeterminate frames on the effect of temperature and displacement of support connections. Comparison of the method of forces and the method of displacements. Mixed and combined methods.		
	PR Calculation of a statically indeterminate frame by the method of displacements on an external load. Determination of the number of main unknowns. The main system. Equivalent system. Canonical equations. Determination of coefficients and free terms of equations. Construction of calculation charts of internal forces from external load. Execution of checks.	6	
	SR Application of the displacements method to the calculation of a statically indetermined frame under the influence of temperature and displacement of support connections. Mastering mixed and combined calculation methods.	14	
4	LC Calculation of continuous beams. Calculation of stationary load using 3-moment equations and the moment focal ratios method. Calculation of changes in temperature and given displacement of supports. Calculation of moving load. Construction of lines of influence of supporting moments and internal forces. Calculation of continuous beams, the supports of which are elastically displaced. Calculation of continuous beams by the displacement method.	12	
	PR Calculation of a continuous beam for a stationary load by the moment focal ratios method. Determination of instantaneous focal ratios and reference moments of the loaded span. Construction of charts of internal forces from a stationary load.	2	
	SR Mastering the calculation of non-cut beams for changes in temperature and given displacement of supports, calculation for moving load.	10	
Toget	LC	32	
her	PR	16	
	SR	42	
All	3 credits	90	

Individual educational and research task (if available):

Teaching methods:

MH1 - verbal method (lecture, explanation, story);

MH2 - practical method (practical classes, exercises);

MH3 - visual method (method of illustrations, method of demonstrations);

MH4 - work with educational and methodical literature;

MH5 - video method in combination with the latest information technologies and computerbased learning tools (distance, multimedia, web-based, etc.).

Forms and methods of evaluation

- FMO2 final control (credit)
- FMO3 oral control (conversation)
- FMO5 test control
- 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 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:

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

where K^{curr} 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).

00010							
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
						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	re-examir	nation

 Table 1 - Conversion of the average score for the current activity into a multi-point scale

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 the current educational activity (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 a 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 <u>final</u>

 control of the discipline

Score in	Score in Assessment on the		Evaluation on the ECTS scale		
points	national	national scale		Criteria.	
	examination	offset	11		
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	Ye	lled		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	Euro Ka		С	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	Assessmen	t on the		Evaluation on the ECTS scale
points	national scale		Evaluation	Criteria.
	examination	offset		
67-74	factory		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	Satisf		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	t 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.	ž	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 (*indicated if available*);

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" (<u>https://www.khadi.kharkov.ua/fileadmin/P Standart/pologeniya/stvnz 67 01 dobroch 1.p df</u>), "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 online testing.

Recommended reading:

1. A.G. Kutsenko Construction mechanics: study guide/ A.G. Kutsenko, M.M. Bondar, V.V. Yaremenko. - K.: Center of Educational Literature, 2020.-644p.

2. Golesko V.O., Kislov O.G. Construction mechanics. General course. Synopsis of lectures. Kharkiv: KhDADTU, 2000. – 128 p.

3. Golesko V.O., Kislov O.G. Methodical instructions for self-dependent work on construction mechanics "Calculation of statically defined spatial rod systems". - Kharkiv: Khnadu 2007. – 31 p.

4. Golesko V.O. Work program, methodological instructions and control tasks in the discipline "Construction Mechanics". Kharkiv: Khnadu, 2003. – 42 p.

Additional sources:

1. Distance course:

https://dl.khadi.kharkov.ua/course/view.php?id=1247

2. V. O. Golesko, O. G. Kislov Statically defined systems of engineering structures on highways of the Khnadu, 2015. - 136 p.

3. Golesko V.O., Krasnov S.M. Determination of forces in elements of non-separated span structures of bridges: Study guide - Kharkiv: Khnadu, 2011. - 156 p.

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