СИЛАБУС
Вибіркового компоненту ВК

Stochastic Methodology in Applied Research

Name of the discipline:	**Stochastic Methodology in Applied Research**
Higher education level:	**third (educational and professional)**
Moodle course page:	https://dl2022.khadi-kh.com/course/view.php?id=3262
Scope of the sample component	4 credits (120 hours)
Final control form	Credit
Consultations:	on schedule
Department name:	Department of higher mathematics
Language of instruction:	English
Course manager:	Yarkho Tetiana Oleksandrivna, Doctor of Pedagogical Sciences, Professor
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Summary of the educational component: the purpose of studying the discipline in the system of continuous mathematical training of bachelors, masters and postgraduates is to form the mathematical competence of future doctors of philosophy, which is the basis of the fundamental component of their professional training.

Subject of the discipline: study of the basics of mathematical theory of the sample Method; theory of point and interval estimation of unknown distribution parameters; theory of testing statistical hypotheses; study of dependencies and detection of solutions between random variables; development of methods for recording, describing and analyzing stochastic experimental data for further obtaining scientifically based conclusions**.**

The main objectives of the discipline are:
- repetition of basic concepts and facts of probability theory;
- restoration of practical skills in solving problems for determining the probabilities of complex random events and numerical characteristics of random variables;
- study of the laws of distribution of random variables common in the practice of stochastic research;
- formation of abilities of practical application of the laws of distribution of content modeling and auxiliary means of stochastic research techniques;
- study of the basics of mathematical theory of the sample Method, The Theory of point and interval estimation of unknown distribution parameters, the theory of testing statistical hypotheses, The Theory of studying dependencies and identifying relationships between random variables and their practical applications;
- formation of the ability to develop methods for recording, describing and analyzing stochastic experimental data for further obtaining scientifically based conclusions**.**

Prerequisites for studying the educational component: the course of the mandatory discipline "Hgher Mathematics"; courses "Probability Theory", "Introduction to Probability and Statistical Analysis", "Mathematical Statistics", special sections of professional disciplines.

Competencies that the applicant acquires:

General competencies:
Ability to think abstractly, analyze and synthesize.
Ability to conduct research at the appropriate level.
Ability to search, process, and analyze information from various sources.
Ability to generate new ideas (creativity).
Ability to identify, pose, and solve problems.
Ability to make informed decisions.

Special (professional) competencies:
The ability to carry out original research, to achieve scientific results that create new knowledge and technologies in the field of Mechanical Engineering and related interdisciplinary areas and can be published in leading scientific publications in the field of Mechanical Engineering and related fields.

Learning outcomes according to the educational program:

Formulate and test hypotheses; use appropriate evidence to substantiate conclusions, in particular, the results of theoretical analysis, experimental research and mathematical and/or computer modeling, and available literature data.

Develop and research conceptual, mathematical and computer models of processes and systems, effectively use them to gain new knowledge and/or create innovative products in the field of Mechanical Engineering and related interdisciplinary areas.

Plan and perform experimental and / or theoretical research using modern tools, critically analyze the results of your own research and the results of other researchers in the context of the entire complex of modern knowledge on the problem under study.

Ability and skills to identify contradictions and not solve problems or parts of them before, formulate working hypotheses, critically perceive and analyze ideas, look for their own ways to solve the problem, based on modern bibliographic and abstract databases, using, in particular, scientometric platforms, carry out critical analysis of their own research.

Thematic plan

№	Topic name (LC, PR, SR)	Number of hours	
		Ochne	Zaochne
1	LC Review of the main aspects of probability theory. Random events. Random variables.	2	2
	PR -	-	-
	SR Solving problems for determining the probabilities of complex random events; numerical characteristics of random variables. Limit theorems of probability theory.	18	18
2	LC Laws of distribution of random variables common in the practice of stochastic research. Distribution laws as an auxiliary tool in the technique of stochastic research	2	2
	PR Solving practical problems for determining and compiling distribution laws for discrete and continuous random variables.	2	2
	SR Lows of distribution of content modelling.	6	6
3	LC Basic concepts of Mathematical Statistics. Tasks. General information about the selective method. Statistical distribution of the sample.	2	2
	PR -	-	-
	SR Solution of practical problems based on experimental studies to determine the empirical distribution function, numerical characteristics of statistical distributions.	12	12
4	LC Fundamentals of mathematical theory of the selective method. Methods for finding point estimates of unknown distribution parameters.	2	2
	PR Solving practical problems based on experimental data to determine point estimates of unknown distribution parameters.	2	2
	SR Theoretical justification of applications of the maximum likelihood method, its practical advantages and disadvantages. Least squares method.	8	8
5	LC Fundamentals of mathematical theory of the selective method. Construction of confidence intervals for estimating the parameters of a normally distributed quantitative feature.	2	2
	PR -	-	-
	SR Theory of interval estimation and its practical applications.	8	8
6	LC Statistical verification of parametric hypotheses. Fundamentals of theory. The level of significance of statistical criteria. General scheme for testing	2	2

	statistical hypotheses.		
	PR Testing hypotheses about the mathematical expectation and variance of normally distributed random variables, the variance of two normal random variables.	2	2
	SR Practical application of statistical verification of parametric hypotheses to solving experimental problems.	16	16
7	LC Statistical testing of nonparametric hypotheses. Method for testing null nonparametric hypotheses using Pearson and Kolmogorov consistency criteria.	2	2
	PR -	-	-
	SR Kolmogorov-Smirnov Criterion and its practical applications.	12	12
8	LC Fundamentals of regression and correlation analysis. Main tasks. Model and empirical regression function. Correlation coefficient.	2	2
	PR Finding empirical regression functions. Solving practical problems based on experimental data.	2	2
	SR Testing hypotheses about the significance of the sample correlation coefficient. Solving practical problems based on experimental data.	16	16
Together	LC	16	16
	PR	8	8
	SR	96	96

Training methods:
* lectures, practical exercises, explanations, etc.;
* standard calculation works;
* standardized tests;
* tasks for in-depth creative training;
* test papers;
* presentations of completed tasks and research;
* student presentations and presentations at scientific events;
* final comprehensive tests.

Evaluation system and requirements
1 Current academic performance:
1.1 the current success of applicants for performing educational types of work in training sessions and for performing tasks of independent work is evaluated using a four-point Assessment Scale, followed by recalculation to a 100-point scale. When evaluating current academic performance, all types of work provided for in the curriculum are taken into account.
1.2 lectures are evaluated by determining the quality of performance of specified tasks.
1.3 practical exercises are evaluated by the quality of performing a control or individual task, performing and completing practical work.
1.4 assessment of the current academic performance of higher education applicants is carried out at each practical lesson (laboratory or seminar) on a four-point scale ("5", "4", "C", "2") and are entered in the academic performance log.
- "excellent": the applicant has perfectly mastered the theoretical material, 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 the original sources and the recommended literature of the RI, presents it in an argumentative manner; has practical skills, expresses his thoughts on certain problems, but admits certain inaccuracies and errors in the logic of presenting the theoretical content or when analyzing the practical one;
- "satisfactory": the applicant has mainly mastered the theoretical knowledge of the educational topic or discipline, is guided in the primary sources and recommended literature of the RI, but does not answer convincingly, confuses concepts, does not answer additional questions uncertainly, does not have stable knowledge; answering questions of a practical nature, shows 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, almost does not navigate in primary sources and recommended literature, there is no scientific thinking, practical skills are not formed.

2 Final assessment:

An applicant for Higher Education receives a credit in the last lesson in the discipline based on the results of the current assessment. The average score for current activities is converted to points on a 100-point scale.

Higher education applicants who have an average current grade in the discipline below "3" (60 points) can improve their current score in the last lesson by passing tests in the discipline.

Assessment of applicants ' Knowledge by testing is carried out on a scale of:

- "Excellent": the theoretical content of the course is fully mastered, without gaps, the necessary practical skills of working with the mastered material are formed, all the training tasks provided for in the training program are completed, the quality of their implementation is estimated by the number of points close to the maximum. (at least 90% of correct answers);
- "Very good": the theoretical content of the course is fully mastered, without gaps, the necessary practical skills of working with the mastered material are mostly formed, all the training tasks provided for in the training program are completed, the quality of most of them is estimated by the number of points close to the maximum. (82% to 89% of correct answers);
- "Good": the theoretical content of the course is fully mastered, without gaps, some practical skills of working with the mastered material are not sufficiently formed, all the training tasks provided for in the training program are completed, the quality of None of them is evaluated with a minimum number of points, some types of tasks are completed with errors (from 74% to 81% of correct answers);
- "Satisfactory": 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 mostly formed, most of the training tasks provided for in the training program are completed, some of the completed tasks may contain errors (from 67% to 73% of correct answers);
- "Satisfactory enough": 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 mostly formed, most of the training tasks provided for in the training program are completed, some of the completed tasks may contain errors (from 60% to 66% of correct answers);
- "Unsatisfactory": the theoretical content of the course is partially mastered, the necessary practical skills of work are not formed, most of the provided training programs for training tasks are not completed, or the quality of their performance is estimated by a number of points close to the minimum; with additional independent work on the course material, it is possible to improve the quality of performing educational tasks(with the possibility of re-passing)(less than 60% of correct answers);
- "Unacceptable" - the theoretical content of the course is not mastered, necessary practical work skills are not formed, all completed training tasks contain gross errors, and additional independent work on the course material will not lead to any significant improvement in the quality of training tasks.(with a mandatory repeat course).

Table1 - scale for transferring points to the National Assessment System

On a 100-point scale **шкалою**	on the national scale
from 60 points to 100 points	are credited
less than 60 points	are not credited

Table 2-correspondence of final rating ratings in points to national scale and ECTS scale ratings

Rating	Rating on the national scale (exam, credit)	Rating on the ECTS scale	
		Grade	Criteria
90-100	Excellent	**A**	"Excellent" - the theoretical content of the course is fully mastered, without gaps, the necessary practical skills of working with the mastered material are formed, all the training tasks provided for in the training program are completed, the quality of their implementation is estimated by the number of points close to the maximum.

82 – 89	Good	**B**	"Good" - the theoretical content of the course is fully mastered, without gaps, the necessary practical skills of working with the mastered material are mostly formed, all the training tasks provided for in the training program are completed, the quality of most of them is estimated by the number of points close to the maximum.
75 – 81		**C**	"Good" - the theoretical content of the course is fully mastered, without gaps, some practical skills of working with the mastered material are not sufficiently formed, all the training tasks provided for in the training program are completed, the quality of performance of any of them is not evaluated with a minimum number of points, some types of tasks are performed with errors
67 – 74	Satisfactory	**D**	"Satisfactory" - 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 mostly formed, most of the training tasks provided for in the training program are completed, some of the completed tasks may contain errors.
60 – 66		**E**	"Enough" - the theoretical content of the course is partially mastered, some practical work skills are not formed, many of the training tasks provided for in the training program are not completed, or the quality of performance of some of them is estimated by a number of points close to the minimum.
35 – 59	Unsatisfactory	**FX**	"Unsatisfactory" - the theoretical content of the course is partially mastered, the necessary practical skills of work are not formed, most of the provided training programs for educational tasks are not completed, or the quality of their performance is estimated by a number of points close to the minimum; with additional independent work on the course material, it is possible to improve the quality of performing educational tasks(with the possibility of re-passing)
1 – 34		**F**	"Unacceptable" -the theoretical content of the course is not mastered, the necessary practical skills are not 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 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 submitted in accordance with the program for independent study, or were considered briefly;
- all tasks provided for in the program must be completed on time;
- when studying the course, applicants for higher education must adhere to the rules of academic integrity set out in the following documents: "Rules of academic integrity of participants in the educational process of KHNADU (https://www.khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz_67_01_dobroch_1.pdf), "Moral and ethical code of participants in the educational process of KHNADU (https://www.khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz_67_01_MEK_1.pdf).
- cheating during test papers and tests is prohibited (including using mobile devices). Mobile devices can only be used during online testing.

Recommended literature:

1.Бідюк П. І. Прикладна статистика: навч. посібник / П. І. Бідюк, О. М. Терентьєв, Т. І. Просянкіна-Жарова. – Вінниця: ПП «ТД» Едельвейс, 2013. – 304 с.
2.Василенко О. А. Математично-статистині методи аналізу у прикладних дослідженнях : навч. посібник / О. А. Василенко, І. А., Сенга. – Одеса : ОНАЗ ім. О. С. Попова, 2011. – 160 с.
3.Герич М. С. Математична статистика: навчальний посібник / М. С. Герич, О. О. Синявська. – Ужгород: ДВНЗ УжНУ, 2021. – 146 с.
4.Горват А. А. Методи обробки експериментальних даних з використанням MS Excel: навчальний посібник / А. А. Горват, О. О. Молнар, В. В. Мінькович. Ужгород: Говерла, 2019. – 182 с

5.Каніовська І. Ю. Математична статистика. Збірник задач : навчальний посібник / І. Ю. Каніовська, О. В. Стусь. – Київ : КРІ ім. Ігоря Сікорського, 2019. – 124 с
6.Лебедєв Є. О. Математична статистика : навчальний посібник / Є. О. Лебедєв, Г. В. Левінська, І. В. Фозора, М. М. Шарапов. – Київ : ВПЦ «Київський університет», 2016. – 159 с.
7. Назаренко Л. А. Планування і обробка результатів експерименту. Конспект лекцій. / Л. А. Назаренко. – Харків: ХНУМГ ім. О. М. Бекетова, 2018. – 163 с.
8. Руденко В. М. Математична статистика / В. М. Руденко. – Київ : Центр учбової літератури, 2012. – 304 с.

Additional sources:

1. distance learning course: : https://dl2022.khadi-kh.com/course/view.php?id=3262

Developer (s)

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