

**Ministry of Education and Science of the Russian Federation
Federal State Autonomous Educational Institution of Higher Education**

National Research University
Lobachevsky State University of Nizhny Novgorod

Institute of Economics and Entrepreneurship

APPROVED
by the decision of the Academic Council of UNN
protocol № 6 dated 31.05.23

Study Program of the Course

STATISTICS

(name of the subject (course))

Level of Higher Education

Bachelor

Area of Study

38.03.01 «Economics»

Program

World Economy

Form of Training

Full - Time

Nizhny Novgorod

2023

1. The Place of the Course in the Structure of the Main Education (Degree) Program

The course is the part of core course Б1.О.21 “Statistics”.

№	The place of the discipline in the curriculum of the educational program	Стандартный текст для автоматического заполнения в конструкторе РПД
1	Block 1. Disciplines (modules). Core part	Academic discipline Б1.О.21 Statistics is the part of core course Area of Study 38.03.01 Economics

2. The planned learning outcomes, correlated with the planned learning outcomes of the educational program (competencies and indicators of competencies achievement)

Competencies	The planned learning outcomes, in accordance with the indicator of achievement of competence		Assessment tools
	Indicator of competence achievement * (код, содержание индикатора)	Learning outcomes **	
UC-1. Is able to search for information, critically analyse and synthesise it, apply systems approach to solving tasks	UC-1.1. Clearly describes the content and structure of the required data and information, and competently implements the processes of data collection, processing and interpretation	<i>To be able</i> to apply the tools of the theory of statistics for the analysis of modern socio - economic phenomena <i>To know</i> the principles of collection, analysis, processing of statistical data, sources of statistical information <i>To have the skills</i> of interpreting statistical data when analyzing an object	Control questions, practical assignments
	UC-1.2. Forms own judgments and evaluations in a competent, logical and well-argued manner	<i>To be able</i> to form personal conclusions based on the data used <i>To know</i> tools for statistical data assessment <i>To have the skills</i> to evaluate statistical data	Control questions, practical assignments
	UC-1.3. Distinguishes facts from opinions, interpretations, assessments, etc., in the reasoning of others involved in the activity	<i>To be able</i> to identify representative sources of statistical information from non-representative <i>To know</i> principles and sources of obtaining representative data <i>To have the skills</i> to identify representative data	Control questions, practical assignments
	UC-1.4. Argues and logically presents his/her point of view through and on the	<i>To be able</i> to make reasonable interpretation of statistical analysis results <i>To know</i> stages of statistical research in order to interpret systematically the	Control questions, practical assignments

	basis of systematic description	results obtained <i>To have the skills</i> to conduct a step-by-step statistical investigation	
GPC-2. Is able to collect, process and statistically analyze data necessary for solving economic problems	GPC 2.1. Is able to perform statistical analysis of data required to solve problems within one's professional field	<i>To be able</i> to collect, process and analyze data <i>To know</i> the methods of collecting, processing and analyzing statistical data <i>To have the skills</i> in collecting, processing and analyzing statistical data	Control questions, practical assignments
	GPC 2.2. Is able to apply mathematical methods to the processing of collected data	<i>To be able</i> to apply the tools of the theory of statistics to process statistical data <i>To know</i> tools of the theory of statistics <i>To have the skills</i> to process statistical data	Control questions, practical assignments
GPC-3. Is able to analyze and explain in a meaningful way the nature of economic processes at the micro and macro level	GPC 3.1. Is able to analyze social and economic processes at micro, macro and global levels	<i>To be able</i> to analyze socio-economic processes using statistical tools <i>To know</i> tools of statistical analysis <i>To have the skills</i> of statistical analysis of socio-economic processes at various levels	Control questions, practical assignments
	GPC 3.2. Knows how to assess trends in socio-economic processes at the micro, macro and global levels	<i>To be able</i> to use statistical tools to assess socio-economic trends at micro, macro and global levels <i>To know</i> methods, stages, algorithms of statistical research for assessing trends in socio-economic processes at various levels <i>To have the skills</i> of statistical analysis of trends in socio-economic processes occurring at various level	Control questions, practical assignments
PC-3. Is able to analyze and interpret data from domestic and foreign financial, accounting and other information, identify trends in economic and socio-economic indicators and use the information to make managerial decisions	PC 3.1. Generates, analyses and interprets financial and economic information	<i>To be able</i> to analyze and interpret data obtained from different sources <i>To know</i> tools for analyzing and interpreting data <i>To have the skills</i> to analyze and interpret data	Control questions, practical assignments
	PC 3.2. Identifies trends and uses the results of information analysis to make managerial decisions	<i>To be able</i> to identify trends in the development of phenomena based on statistical tools <i>To know</i> tools for identifying trends in the development of phenomena over time <i>To have the skills</i> to identify trends in the development of phenomena over time	Control questions, practical assignments

3. The Structure and Content of the Course

3.1 Workload of the Course

	Full - Time
Total number of credits	4 3ET
Hours according to the curriculum	144
including	
Contact work with the teacher:	
- Lectures	32
- Seminars (practical classes / laboratory work)	32
Student's independent work	42
Control	2
Midterm Assessment - Exam	36

3.2. Content of the Course

Modules or topics	Workload (hours)	Including				
		Contact Work				Independent work
		Lectures	Seminars	Lab classes	Total	
Unit 1. Theory of statistics	26	6	6		12	14
Unit 2. Economic statistics	152	26	26		52	100
Control	2	-	-		2	-
Midterm assessment - Exam	36	-	-		36	-
Total	216	32	32		102	114

Unit 1. Theory of statistics

Statistics definition. Tools and stages of statistical investigation. Grouping and summary of statistical data. Mean values. Structural average. Absolute and relative variables. Variation variables. Dynamics variables. Extrapolation and interpolation. Methods for identifying trends. Indices. Nonparametric methods of analysis.

Unit 2. Economic statistics

Statistics of national wealth. The system of national accounts. Statistics of enterprises' finance. Statistics of people's income.

Practical classes (seminars) are organized with elements of practical training, that provides the implementation of certain activities related to future profession.

Practical training includes practical tasks on Unit 1 – Methods for identifying trends.

4 hours are allocated for practical training (seminars) in the form of practical training.

Practical training is aimed at the formation and development of:

- practical skills in accordance with the profile of the program: organizational and managerial; analytical.

- competencies:

PC-3. Is able to analyze and interpret data from domestic and foreign financial, accounting and other information, identify trends in economic and socio-economic indicators and use the information to make managerial decisions.

UC-1. Is able to search for information, critically analyse and synthesise it, apply systems approach to solving tasks.

GPC-2. Is able to collect, process and statistically analyze data necessary for solving economic problems.

GPC-3. Is able to analyze and explain in a meaningful way the nature of economic processes at the micro and macro level.

Ongoing monitoring of academic performance is carried out within the framework of seminar-type classes.

4. Methodological support for students' independent work

Assessment tools	Form of assessment
Test	Assessment of tests' results
Practical assignments	Checking practical assignments

Questions for final control, tasks for current control and Midterm Assessment based on the learning outcomes of the discipline are given in 5.2.

An online course created in the UNN e-learning system is used to ensure the independent work of students (Statistics, <https://e-learning.unn.ru/course/view.php?id=5251>), - <https://e-learning.unn.ru/>

The course consists of lectures, seminars, independent work of students and the comprehensive final test.

A significant role in the study of the discipline is given to independent work of students; its scope is defined by the curriculum. Independent work is a form of out-of-classroom activities mandatory for each student.

In the course of their independent work, students familiarize themselves with theoretical material from textbooks and monographs given in the list of recommended literature, solve practical problems, prepare for seminars, write papers, essays, take electronic tests in the learning mode, answer self-test questions. Independent work can be done in the reading halls of the library or at

home. Self-checks in the course of independent work may be in the form of electronic tests or credit tasks. At the end of studies, there is a regular test.

Independent work is intended to familiarize the student with certain sections of the course and additional materials, it gives the opportunity to study the main topics in-depth, to acquire new knowledge, skills, abilities. Independent work is based on the use of recommended materials and envisages tasks of various types.

Students' independent work includes:

- the collection and study of materials necessary for participation in interactive games, and other forms of interactive work;

- preparation of the tasks most relevant to discipline topics;

- preparation for current assignments and testing;

- preparation for the final test.

The main organizational principle of students' independent work is an integrated approach aimed at developing critical thinking of students and promoting diversified activities.

Control of students' knowledge includes:

- Monitoring the work on practical tasks, taking into consideration the degree of activity of each student and timely performance of assignments.

- Preparation of detailed answers on topical issues.

- Monitoring the progress of testing based on the study of selected topics and modules of the discipline.

- The final assessment in the form of the final written test or oral answer.

- The final grade is based on the results of the student's work within practical classes, reports, results of ongoing work and final testing.

Independent work is an out-of-class type of activities designed to familiarize the student with certain parts or topics of the course with the recommended materials and to prepare individual assignments for the course.

The main principle of organization of students' independent work is an integrated approach aimed at developing critical thinking of students and promoting diverse activities.

Monitoring students' current progress is envisaged after studying each module. The students will be evaluated by conducting tests, writing essays and tests on the subjects they have studied. Oral answers during seminars and practical classes will also be assessed. The results of current work and tests will be taken into account to determine the final grade.

INSTRUCTIONS FOR STUDENTS

The study of the theoretical material is determined by the curriculum of the discipline which is included into the plan of study and the list of recommended literature. It is necessary to recapitulate the material of previous topics, as well as the material of the preceding academic disciplines that serves as the base of the topic being studied. When preparing for the practical lesson, you must study the lecture materials and read the recommended literature. The material studied should be analyzed in accordance with the lesson plan, and then the degree of assimilation of the material should be verified.

Practical classes are inseparably connected with homework as the main part of independent work. They are part of a systematic study in combination with the theoretical material. The knowledge and skills acquired are assessed within the framework of interim and final attestation (tests and exams) .

Independent work is carried out with the purpose of deepening of knowledge and includes:

- recapitulation of the material studied in class, reading the recommended literature;

- preparation for practical classes;
- implementation of group and individual assignments;
- work with electronic sources;
- preparation for the final test.

Students' independent work consists of the study of literature complementing the material presented in the lectures.

It is assumed that, having listened to the lecture, students should refer to the literature from the main bibliographical lists of books, then search for the necessary additional information and critically evaluate the material from the Internet sites.

Students should master the skills of bibliographic search, including search in the Internet resources, they should learn how to compare different points of view and determine research methods.

It is important to plan time for independent work for the entire semester and it is necessary to set aside some time for recapitulation of the material.

In their preparation for the final exams, students should be guided by the list of questions for the final control on the course. They must understand the basic concepts of the discipline.

5. Evaluation tools for Midterm Assessment based on the learning of the course material, includes:

5.1. Criteria for assessing learning outcomes

Learning outcomes	Assessment criteria						
	«Poor»	«Unsatisfactory»	«Satisfactory»	«Good»	«Very good»	«Excellent»	«Perfect»
	FAIL		PASS				
<u>Knowledge</u>	Lack of theoretical knowledge. Inability to assess the completeness of knowledge due to the student's refusal to answer	The level of knowledge is below minimum requirements. There has been serious errors.	Minimum acceptable level of knowledge. A lot of errors were made.	The level of knowledge corresponds to the program. A few errors were made	The level of knowledge corresponds to the program. A few minor flaws were made	The level of knowledge corresponds to the program. There are no flaws.	The level of knowledge exceeds the level required in the training program.
<u>Abilities</u>	Lack of minimal abilities and skills. Inability to assess the completeness of knowledge due to the	Basic abilities and skills in solving standard tasks are not demonstrated. There has been serious errors.	Basic abilities and skills are demonstrated. Typical tasks with non-serious errors were solved. All tasks are completed,	All basic abilities and skills are demonstrated. All the main tasks with non-serious errors have been solved. All the tasks	All basic abilities and skills are demonstrated. All the main tasks have been solved. All tasks are completed, in full, but some	All the basic abilities and skills are demonstrated. All the main tasks are solved with some minor shortcomings,	All the basic abilities and skills are demonstrated. All the main tasks have been solved. All tasks are completed, in

	student's refusal to answer		but not in full.	were completed, in full, but some of them were incomplete.	with shortcomings.	all the tasks are completed in full	full, without any shortcomings
<u>Skills</u>	Lack of skills of the material. Inability to assess the completeness of knowledge due to the student's refusal to answer	Basic skills in solving standard tasks are not demonstrated There has been serious errors.	There is a minimal set of skills in solving standard tasks with some shortcomings	Basic skills in solving standard tasks are demonstrated with some shortcomings	Basic skills in solving standard tasks are demonstrated without errors and shortcomings	Skills in solving non-standard tasks are demonstrated without errors and shortcomings.	A creative approach to solving non-standard tasks is demonstrated

Scale for the assessment of the learning outcomes:

Assessment		Training level
	Perfect	All competencies (parts of competencies) are formed at a level not lower than "Perfect". Knowledge, skills, and proficiency in the relevant competencies are demonstrated at a level higher than the program provides
PASS	Excellent	All the competencies (parts of competencies) are formed at a level not lower than "excellent", at least one competence is formed at the "Excellent" level.
	Very good	All the competencies (parts of competencies) are formed at a level not lower than "Very good", at least one competence is formed at the "Very good" level.
	Good	All the competencies (parts of competencies) are formed at a level not lower than "Good", at least one competence is formed at the level of "Good".
	Satisfactory	All the competencies (parts of competencies) are formed at a level not lower than " Satisfactory ", at least one competence is formed at the level of " Satisfactory ".
FAIL	Unsatisfactory	All the competencies (parts of competencies) are formed at a level not lower than " Unsatisfactory ", no one competence is formed at the level of " Poor ".
	Poor	At least one competence is formed at the " Poor " level

Typical assignments or other materials necessary for the assessment of learning outcomes.

5.2.1 QUESTIONS FOR EXAM

<i>Questions</i>	<i>Code of competence</i>
Definition and types of statistical observation	UC-1

Types of statistical data	UC-1
Statistical grouping and summary	GPC-2
Distribution series	GPC-2
Statistical tables and graphs	GPC-2
Absolute and relative statistical variables	GPC-2, GPC-3
Mean values. Principles of mean values' choosing	GPC-2, GPC-3
Variables of central tendency (structural average)	GPC-2, GPC-3
Absolute variation variables	GPC-2, GPC-3
Relative variation variables	GPC-2, GPC-3
Nonparametric methods	GPC-2, GPC-3
Dynamic variables	PC-3
Methods for identifying tendencies	PC-3
Indices	GPC-2
Indices correlation. Factors analysis with using index system	PC-3
Index method in defining average level of a qualitative variable	PC-3
Macroeconomics variables: types and ways of calculation	GPC-3
The system of national account: structure and definition	GPC-3
Principles of constructing national accounts	GPC-3
Variables of people's income	GPC-3
Variables of fixed and current assets	GPC-3
Finance statistics variables	PC-3

5.2.2. Standard tests for assessing the competence formation UC-1, GPC-2, GPC-3, PC-3

«UC-1»:

1. Countable data refers to

- 1) Discrete data
- 2) Continous data

2. If a set of data has only whole numbers, it relates to:

- 1) Discrete data
- 2) Continous data

3. A company as one of the objects refers to
 - 1) Statistical unit
 - 2) Statistical aggregate
4. Generalizing characteristic of the analyzing object refers to
 - 1) Statistical unit
 - 2) Statistical aggregate
 - 3) Statistical variable

«GPC-2»:

1. If variation coefficient is 5%, it means that
 - 1) Statistical units differ significantly and statistical aggregate is heterogenous
 - 2) Statistical units differ insignificantly and statistical aggregate is homogenous
2. If variation coefficient is 42%, it means that
 - 1) Data are representative and can be used in analysis
 - 2) Data are unrepresentative and can not be used in analysis
3. If variation coefficient is 21%, it means that
 - 1) Data are representative and can be used in analysis
 - 2) Data are unrepresentative and can not be used in analysis
4. If data are grouped, _____ is used
 - 1) Simple average formula
 - 2) Weighted average formula
5. Define median meaning in the following data set: 10, 11, 12, 13, 14, 15
 - 1) 12
 - 2) 12,5
 - 3) 13

«GPC-3»:

1. What formula is used in case of average value calculation, if both dominator and nominator in the formula are known?
 - 1) Arithmetic simple average formula
 - 2) Arithmetic weighted average formula
 - 3) Simple harmonic average formula
 - 4) Weighted harmonic average formula
2. What formula is used in case of average value calculation, if denominator in the formula is known, but nominator is unknown?
 - 1) Arithmetic simple average formula
 - 2) Arithmetic weighted average formula
 - 3) Simple harmonic average formula
 - 4) Weighted harmonic average formula
3. What formula is used in case of average value calculation, if nominator in the formula is known, but denominator is unknown?
 - 1) Arithmetic average formula
 - 2) Harmonic average formula
 - 3) Geometric average formula

4. Dispersion is

- 1) Deviation of individual meanings from mean value
- 2) Square deviation of individual meanings from mean value

5. Weighted formula for dispersion calculation is used, when data are

- 1) Grouped
- 2) Ungrouped

«PC-3»:

1. If interval range is irregular, mode interval is defined on the highest

- 1) Frequency
- 2) Density

2. Median value interval is defined on the basis of

- 1) Frequency
- 2) Density
- 3) Cumulative frequency

3. Decil interval is defined on the basis of

- 1) Frequency
- 2) Density
- 3) Cumulative frequency

5.2.3. Standard tasks for assessing the competence formation

1. Calculate average workers' production experience (GPC-2). Conclude on the results (PC-3)

n	Production experience
1	8
2	2
3	6
4	1
5	4
6	2
7	10
8	5
9	4
10	3
11	6

2. Calculate average output per month (GPC-2). Conclude on the results (PC-3)

The number of workers (fi)	Average output per month (Xi)
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5	10
4	6
9	7
8	6
4	9
2	8
1	12
1	10
10	8
12	7
15	9
Total:	-

3. Calculate average price using the following data (GPC-2). Conclude on the results (PC-3)

Type of Products	Price per one unit of products, thousand rubles	Turnover, thousand rubles
1	20	200
2	30	300
3	15	225
4	35	175

4. In the table the following data are presented

Product type	Products' sales, units		Price per one unit of a product, thousand rubles	
	q0	q1	p0	p1
A	500	500	15	14
B	200	240	10	11
C	600	420	25	30

- 1) Calculate individual indices of price, quantity and turnover (GPC-2)
- 2) Carry out factor analysis of turnover changes because of influence of different factors (GPC). Show index model and find turnover changes in relative and absolute meanings (PC-3).

6. There are data on the number of workers and their salary

Workers' specialization	Number of workers, people		Salary, rubles	
	Basic period	Current period	Basic period	Current period
Technical	610	600	30000	35600
Economic	840	820	28000	32000

1. Calculate individual indices of the number of workers, their salary and salary fund (GPC-2).
2. Define in relative and absolute meanings Salary Fund changes due to influence of different factors (PC-3).

7. There are data on workers' distribution on average level of productivity

Groups of workers on average level of productivity per month, X_i , units	The number of workers, f_i (frequency)
30-40	25
40-60	20
60-65	40
65-70	35
70-80	50
80-100	30
100-110	15
Total	215

1. Mode level of productivity (GPC-2)
2. Median level of productivity (GPC-2)
3. D_1 (GPC-2)
4. D_9 (GPC-2)
5. K_d (GPC-2)

Carry out analysis on the presented data (GPC-3) and conclude on the results (PC-3).

8. There are data on enterprises' distribution on average productivity

Groups of enterprises on average productivity per month, units (X_i)	The number of enterprises, f_i	i
30-35	25	5

35-40	20	5
40-45	40	5
45-50	35	5
50-55	50	5
55-60	30	5
60-65	15	5
65-70	11	5
Total	226	-

Calculate:

1. Average level of productivity
2. Mode level of productivity (GPC-2)
3. Median level of productivity (GPC-2)
4. D1 (GPC-2)
5. D9 (GPC-2)
6. Kd (GPC-2)

Carry out analysis on the presented data (GPC-3) and conclude on the results (PC-3).

6. Methodological and information support for the course

a) Main literature:

1. Carmen Batanero, Manfred Borovcnik Statistics and Probability in High School (2016)
<https://link.springer.com/book/10.1007/978-94-6300-624-8>
2. Electronic course «Статистика» (<https://e-learning.unn.ru/course/view.php?id=5251>) - <https://e-learning.unn.ru/>

б) Additional literature:

1. Andreas Eichler, Lucía Zapata-Cardona Empirical Research in Statistics Education (2016)
<https://link.springer.com/book/10.1007/978-3-319-38968-4>
2. Eichler, Lucía Zapata-Cardona Empirical Research in Statistics Education Andreas (2016)
<https://link.springer.com/book/10.1007/978-3-319-38968-4>
3. Jun Shao Mathematical Statistics: Exercises and Solutions (2005)
<https://link.springer.com/book/10.1007/0-387-28276-9>
4. Festschrift A Advances in Directional and Linear Statistics (2011)
<https://link.springer.com/book/10.1007/978-3-7908-2628-9>
5. Mittelhammer Ron C Mathematical Statistics for Economics and Business (2013)

в) Internet Resources and Software

1. <https://trendeconomy.com>
2. <https://www.wto.org>
3. <https://unstats.un.org>
4. <https://www.gks.ru>
5. <https://unctad.org/statistics>
6. <https://www.statista.com>
7. <https://theglobaleconomy.com>
8. Operating system Microsoft Windows
9. Application software Microsoft Office

7. Logistical support for the course

Special classrooms are used for conducting lectures and seminars, group and individual consultations, ongoing monitoring and intermediate certification, as well as for students' independent work. These rooms are equipped with specialized furniture and technical teaching aids for presenting educational information to a large audience: a computer, a projector or LCD TV, a speaker and microphone (if necessary), and a whiteboard.

For lecture-type classes, sets of demonstration equipment and educational visual aids are offered to provide thematic illustrations that correspond to the program of a given subject.

Premises for students' independent work are equipped with computers that provide connection to the Internet and access to Lobachevsky University's electronic information and educational environment.

The program was compiled in accordance with the requirements of the UNN's own educational standard and the Educational Program in the field of "Economics", the profile is "World Economy".

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The program was approved at a meeting of the Methodological Commission of the Institute of Economics and Entrepreneurship 31.05.23, № 6.