



APPROVED

Vice-rector for educational activities

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2023.

***Теория вероятностей и математическая статистика /
Probability theory and mathematical statistics***

Syllabus of the course

Specialty	38.03.02 Management
Specialization	Business management and digital innovations
Level of higher education	Bachelor
Form of training	Full-time
Year of enrolment	2023
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Total number of hours	144	Form of final attestation: Exam: semester 2
incl:		
contact work	48	
self-study	60	
practical training	0	
control hours	36	

Hours distribution:

Semester:	2
Type of classes	Hours
Contact hours	20
Practical training	28
Laboratory work	
Total contact hours	48
Self-study	60
Control hours	36
Total academic hours	144
Total credits	4

CONTENTS

1. LEARNING OBJECTIVES	3
2. COURSE PLACE IN THE PROGRAMME STRUCTURE.....	3
3. EXPECTED LEARNING OUTCOMES	3
4. COURSE STRUCTURE AND CONTENT	3
5. TEACHING AND LEARNING TOOLS OF THE COURSE.....	4
5.1 Recommended literature	4
5.2 List of software (including national production).....	5
5.3 List of reference systems and modern professional databases	5
6. TECHNICAL FACILITIES.....	5
7. METHODOLOGICAL GUIDELINES FOR STUDENTS	7
8. SPECIFICATIONS FOR TEACHING DISABLED PERSONS	8
ASSESSMENT RESOURCES.....	9
Control tasks and assignments for interim attestation	9
1.2 Topics for written task	9
1.3 Interim checkpoints.....	9
1.4 Other assessment objects	9
1.5 Self-study.....	9
1.6 Grading scale	10

1. LEARNING OBJECTIVES

Objective:	To give students the necessary stock of information on a number of sections of probability theory and mathematical statistics (basic definitions, theorems, rules) that are most relevant to their future professional activities, as well as a mathematical apparatus that helps them to put in mathematical form and solve professional problems.
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2. COURSE PLACE IN THE PROGRAMME STRUCTURE

The discipline B1.O Probability theory and mathematical statistics is a part of Block 1.

3. EXPECTED LEARNING OUTCOMES

Code and name of graduate competence	Code and name of the competence achievement indicator	Expected learning outcomes
GPC-1 – Able to solve professional problems based on knowledge (at an intermediate level) of economic, organizational and management theory	GPC-1.3 – Uses tools of economic and mathematical modeling for setting and solving typical problems of identifying cause-and-effect relationships and optimizing the activity of the control object	<p>To know: basic concepts of probability theory and mathematical statistics.</p> <p>To be able to: use the methods and models of probability theory and mathematical statistics to solve applied problems.</p> <p>To possess: the skills of modeling and solving applied problems related to the concepts of probability theory and mathematical statistics.</p>

4. COURSE STRUCTURE AND CONTENT

Code and name of the topics	Course content	Academic hours			
		Contact work			Self-study
		Lectures	Practices	Workshops	
Topic 1. Random events. Definition of probability.	Random experiment. Random events, actions on them. The classic definition of probability. Statistical definition of probability. The concept of the axiomatic definition of probability.	1	4		6
Topic 2. Theorems of addition and multiplication of probabilities. Conditional Probability.	The theorem of addition of probabilities. Probability multiplication theorems. Conditional Probability. Independent random events	2	4		6

Topic 3. Total probability formula. Bayes formula.	Total Probability Formula. Bayes formula.	2	2		6
Topic 4. Bernoulli scheme.	Bernoulli scheme. Bernoulli formula.	1	2		4
Topic 5. Discrete random variables, their numerical characteristics.	Discrete random variables, distribution laws. Expected value and variance of a discrete random variable. Cumulative function of a discrete random variable, its properties.	2	2	6	
Topic 6. Binomial distribution law.	Binomial distribution law. Basic formulae.	1	1	4	
Topic 7. Continuous random variables, their numerical characteristics	Continuous random variables. Cumulation function of a continuous random variable, distribution density.	2	2	6	
Topic 8. Uniform distribution law. Normal distribution law.	Uniform distribution law. Normal distribution law. Basic formulae.	3	3	8	
Topic 9. Fundamentals of mathematical statistics.	General and sample populations, their numerical characteristics.	2	2	4	
Topic 10. Overview of the main problems of mathematical statistics.	Point and interval estimation of parameters of the general population. Problems of testing statistical hypotheses. Dependency research.	4	6	10	
Control hours:					36
Total hours:		20	28	0	60

5. TEACHING AND LEARNING TOOLS OF THE COURSE

5.1 Recommended literature

Bibliographic description of the publication (author, title, type, place and year of publication, number of pages)	Digital resources
Gmurman, V. E. Probability theory and mathematical statistics : textbook for universities / V. E. Gmurman. — 12th ed. — Moscow : Yurayt Publishing House, 2021. — 479 p.	https://urait.ru/viewer/teoriy ... maticheskaya-statistika-468331
Kremer, N. S. Probability theory and mathematical statistics in 2 hours Part 1. Probability theory : textbook and workshop for undergraduate and specialty / N. S. Kremer. — 4th ed., reprint. and add. — Moscow : Yurayt Publishing House, 2018. — 264 p.	https://urait.ru/viewer/teoriy ... -teoriya-veroyatnostey-421

Kremer, N. S. Probability theory and mathematical statistics in 2 h. Part 2. Mathematical statistics: textbook and workshop for undergraduate and specialty / N. S. Kremer. — 4th ed., reprint. and add. — Moscow : Yurayt Publishing House, 2018. — 254 p.	https://urait.ru/viewer/teoriy ... maticheskaya-statistika-421233
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5.2 List of software (including national production)

- 7-Zip
- LibreOffice
- ОС АЛТ образование 10

5.3 List of reference systems and modern professional databases

№	Name of reference systems and professional databases
1.	Digital library Grebennikon.ru – www.grebennikon.ru
2.	Science Digital Library eLIBRARY – www.elibrary.ru
3.	Science Digital Library КиберЛеника – www.cyberleninka.ru
4.	Database ПОЛПРЕД Справочники – www.polpred.com
5.	Database OECD Books, Papers & Statistics on the platform OECD iLibrary www.oecd-ilibrary.org
6.	Legal reference system КонсультантПлюс (installed resource UNECON or www.consultant.ru)
7.	Legal reference system «ГАРАНТ» (installed resource UNECON or www.garant.ru)
8.	Information and referral system «Кодекс» (installed resource UNECON or www.kodeks.ru)
9.	Digital library system BOOK.ru - www.book.ru
10.	Digital library system ЭБС ЮРАЙТ – www.urait.ru
11.	Digital library system ЗНАНИУМ (ZNANIUM) – www.znanium.com
12.	Digital library UNECON – opac.unecon.ru

6. TECHNICAL FACILITIES

There are special rooms for lectures, seminars, coursework, group and individual consultations, current and interim assessments, as well as rooms for self-study.

The premises are equipped with equipment and teaching aids.

The rooms for students' independent work are equipped with computers with Internet connection and access to the university's electronic learning environment.

Name of classroom	Classroom location
Classroom 2009 Training classroom (for lecture- and seminar-type classes, coursework, group and individual consultations, current control and intermediate attestation), equipped with a multimedia system. Special furniture and equipment: Educational furniture for 122 seats (study table 61 pcs., chairs 122 pcs.), the teacher's workplace, desk m/m, drawer 1 pc, chalk board 1 pc (3 sections), chair 1 pc, drawer 1 pc, chair 1 pc, Chair 2 pcs., Intel i3-2100 2.4 Ghz /4Gb/500Gb/Acer V193 19" - 1 pc, Sound projector Yamaha YSP-3000 - 1 pc, Projector stand with	191023, St. Petersburg, Griboedova canal, 30-32, lit. A, Б, Р

camera decks - 1 pc, Projection screen draper - 1 pc, Multimedia projector Type 2 Panasonic PT-VX610E - 1 pc, Screen Media D1 ceiling bracket - 1 pc. Sets of display equipment and visual aids: multimedia applications for lecture courses and practical sessions, interactive teaching and visual aids.	
Classroom 2011 Training classroom (for lecture- and seminar-type classes, coursework, group and individual consultations, current control and intermediate attestation), equipped with a multimedia system. Specialized furniture and equipment: Educational furniture for 118 seats, teacher's workplace, desk - 1 pc, chalk board (3 sections) - 1 pc, marker board - 1 pc, desk - 1 pc, desk - 1 pc, drawer - 1 pc, chair - 3 pcs., Computer Intel i3-2100 2.4 Ghz /4Gb/500Gb/Acer V193 19" - 1 pc, ScreenMedia Champion 244x183cm SCM-4304 - 1 pc, Panasonic PT-VX610E multimedia projector - 1 pc. Sets of display equipment and visual aids: multimedia applications for lecture courses and practical sessions, interactive teaching and visual aids.	191023, St. Petersburg, Griboedova canal, 30-32, lit. A, B, P
Classroom 2028 Training classroom (for lecture- and seminar-type classes, coursework, group and individual consultations, current control and intermediate attestation), equipped with a multimedia system. Specialized furniture and equipment: Educational furniture for 44 seats, teacher's workplace, chalk board (one section) - 1 pc, chair - 1 pc, table - 1 pc, chair - 3 pcs. Portable multimedia set: HP 250 G6 1WY58EA laptop, LG PF1500G multimedia projector. Sets of display equipment and visual aids: multimedia applications for lecture courses and practical sessions, interactive teaching and visual aids.	191023, St. Petersburg, Griboedova canal, 30-32, lit. A, B, P
Classroom 2045 Training classroom (for lecture- and seminar-type classes, coursework, group and individual consultations, current control and intermediate attestation), equipped with a multimedia system. Specialized furniture and equipment: Educational furniture for 78 seats, teacher's workplace, chalk board (3 sections) - 1 pc, chair - 1 pc, chairs - 2 pcs. Portable multimedia set: HP 250 G6 1WY58EA laptop, LG PF1500G multimedia projector. Sets of display equipment and visual aids: multimedia applications for lecture courses and practical sessions, interactive teaching and visual aids.	191023, St. Petersburg, Griboedova canal, 30-32, lit. A, B, P
Classroom 2052 Training classroom (for lecture- and seminar-type classes, coursework, group and individual consultations, current control and intermediate attestation), equipped with a multimedia system. Specialized furniture and equipment: Educational furniture for 88 seats, teacher's workplace, chalk board (3 sections) - 1 pc, desk - 1 pc, table - 2 pcs, chair - 2 pcs, Computer Intel i3-2100 2.4 Ghz/500/4/Acer V193 19" - 1 pc, Multimedia projector Type 2 Panasonic PT-VX610E - 1 pc, ScreenMedia Champion 244x183cm SCM-4304 motorized screen - 1 pc, MW Cinerollo 200*200cm manual spring loaded screen - 1 pc, Multimedia projector Type 2 Panasonic PT-VX610E - 1 pc. Sets of display equipment and visual aids: multimedia applications for lecture courses and practical sessions, interactive teaching and visual aids.	191023, St. Petersburg, Griboedova canal, 30-32, lit. A, B, P
Classroom 2060 Training classroom (for lecture- and seminar-type classes, coursework, group and individual consultations, current control and intermediate attestation), equipped with a multimedia system. Specialized furniture and equipment: Educational furniture for 82 seats, a teacher's workplace, chalk board (3 sections) - 1 pc., chair - 1 pc., table - 1 pc., chair - 2 pcs., Computer Intel i3-2100 2.4 Ghz/500/4/Acer V193 19" - 1 pc., Multimedia projector Panasonic PT-VX610E - 1 pc., Screen with electric drive ScreenMedia Champion 203x153cm (SCM-4303) - 1 pc. Sets of display equipment and visual aids: multimedia applications for lecture courses and practical sessions, interactive teaching and visual aids.	191023, St. Petersburg, Griboedova canal, 30-32, lit. A, B, P
Classroom 2061 Training classroom (for lecture- and seminar-type classes, coursework, group and individual consultations, current control and intermediate attestation), equipped with a multimedia system. Specialized furniture and equipment: Educational furniture for 80 seats, teacher's workplace, table - 1 pc, chalk board (3 sections) - 1 pc, pulpit - 1 pc, chairs - 2 pcs. Portable multimedia set: HP 250 G6 1WY58EA laptop, LG PF1500G multimedia projector. Sets of display equipment and visual aids: multimedia applications for lecture courses and practical sessions, interactive teaching and visual aids.	191023, St. Petersburg, Griboedova canal, 30-32, lit. A, B, P
Classroom 2023 Computer room (for practical classes, course design (coursework))	191023, St.

using computer technology), equipped with a multimedia system. Specialized furniture and equipment: Educational furniture for 48 seats, teacher's workplace (computer desk - 1 pc.), wheeled marker board - 1 pc, 3 sectional marker board - 1 pc, desk - 1 pc, iso chair - 7 pcs, chair -1 pc, blinds - 3 pcs., Computer i5-8400/8GB/500GB_SSD/Viewsonic VA2410-mh -34 pcs, Switchboard Cisco Catalyst 2960-48PST-L (including SmartNet Service Contract CON-SNT-2964STL) - 1 pc, Wi-Fi Access Point Type1 UBIQUITI UAP-AC-PRO - 1 pc, NEC M350 X projector - 1 pc, Local Area Network Switch (48 ports) Cisco WS-C2960+48PST-L - 1 pc, ProCurve Switch 2626 - 1 pc, Intel pentium x2 g3250 computer /500gb / philips 21.5' monitor - 1 pc, Ubiquiti IP video camera - 1 pc, Wireless access point/UNI FI AP PRO/Ubiquiti - 1 pc. Sets of display equipment and visual aids: multimedia applications for lecture courses and practical sessions, interactive teaching and visual aids.	Petersburg, Griboedova canal, 30-32, lit. A, B, P
Classroom 2034 Computer room (for practical classes, course design (coursework) using computer technology), equipped with a multimedia system. Specialized furniture and equipment: Educational furniture for 25 seats, teacher's workplace (table 1pc., chair 1pc.), marker board 1pc, Rack hanger 2pcs, chairs 3pcs.Computer I5-7400/8Gb/1Tb/DELL S2218H - 21pcs, Network switch Cisco WS-C2960-48TT-L (Catalyst2960) 48-ports 10/100Mbps+2p - 1 pc, Switchboard Cisco Catalyst 2960 24 WS-C2960-24PC-L - 1 pc. Sets of display equipment and visual aids: multimedia applications for lecture courses and practical sessions, interactive teaching and visual aids.	191023, St. Petersburg, Griboedova canal, 30-32, lit. A, B, P

7. METHODOLOGICAL GUIDELINES FOR STUDENTS

The following documents should be made available to the trainee before the start of the course:

- training and methodological documentation;
- local normative acts regulating the main issues of the organisation and implementation of educational activities, including those regulating the procedure for current monitoring and interim assessment of students;
- the schedule of consultations of the teaching staff.

The level and depth of mastering the discipline is determined by the active and systematic work of students in lectures, seminars, independent work, including in terms of identifying the most significant and relevant problems for further study. A special condition for qualitative mastering of the discipline is an effective organisation of work, which allows distributing the academic workload evenly in accordance with the schedule of the educational process.

When preparing for classes, students have the opportunity to attend consultations with the staff of UNECON according to the timetable set out in the schedule of consultations.

The students' in- and out-of-classroom work should aim to form:

- the fundamentals of the learner's world view and scientific understanding;
- basic knowledge relevant to the training area and the declared professional field, forming the target and professional basis for training;
- professional competences oriented towards the needs of the labour market;
- an individual trajectory by mastering a unique set of professional competences that complement the learner's competence model, through a

focus on specific professional specialised areas of knowledge defined by labour market representatives;

- meta-skills for learners, such as teamwork and leadership, data analysis, digital skills, project design and implementation, intercultural interaction.

8. SPECIFICATIONS FOR TEACHING DISABLED PERSONS

Students with disabilities, if necessary, are taught on the basis of an adapted work programme using special teaching methods and didactic materials that take into account the particularities of their psychophysical development, individual capacities and health status.

In order for disabled persons and persons with disabilities to master the curriculum, the University shall ensure that:

- for the visually impaired and visually impaired: availability of information on the timetable in accessible places and adapted forms for learners who are blind or visually impaired; presence of an assistant to assist the learner as needed; production of alternative formats of teaching materials (large print or audio files);
- for the hearing-impaired and hearing-impaired: adequate sound reproduction of information;
- for persons with disabilities and persons with mobility impairments: the possibility of unimpeded access for students to classrooms, restrooms and other areas of the department, as well as their stay in these areas.

Learners with disabilities and persons with disabilities are provided with printed and/or electronic educational resources in forms adapted to their disabilities. The education of students with disabilities may be organised with other students or in separate groups or organisations.

ASSESSMENT RESOURCES

Control tasks and assignments for interim attestation

1. Random events
2. Determining the probability of a random event
3. Conditional probability. Independent events
4. Theorems of addition and multiplication of probabilities.
5. Total probability formula
6. Bayes formula
7. Bernoulli scheme
8. Discrete random variables, their numerical characteristics
9. Binomial distribution law
10. Continuous random variables, their numerical characteristics
11. Uniform distribution law
12. Normal distribution
13. General and sample populations, their numerical characteristics
14. Point and interval estimation of population parameters
15. Testing statistical hypotheses
16. Dependency research

1.2 Topics for written task

Is not provided by the work programme of the discipline.

1.3 Interim checkpoints

Number	Type	Method of conduct	Topic number
1	Test paper	In written form	1-4
2	Test paper	In written form	5-8
3	Monitoring	with the help of technical means and information systems	1-10

1.4 Other assessment objects

Is not provided by the work programme of the discipline.

1.5 Self-study

Name of self-study	Topic number
Doing homework	1-10
Preparation for lectures and practical classes	1-10
Exam Preparation	1-10

1.6 Grading scale

Scales of assessment and procedures for assessing learning outcomes of the discipline are regulated by the Regulations on the current control of progress and interim attestation of students in higher education programmes and the Regulations on the scoring and rating system.

A grading and rating system is used to assess the learning outcomes of the discipline:

The final control of the discipline is an examination (or a differentiated test), the final grade being formed in accordance with the scale given in the table below:

Points	Grade
≤ 54	fail
55-69	satisfactory
70-84	good
≥ 85	excellent

Grading scale

2 (points to 54)	Demonstrates a lack of understanding of the problem. Many of the requirements of the assignment are not met. An initial perception of the material is demonstrated. The work is incomplete and/or plagiarised.
3 (points 55-69)	Demonstrates a partial understanding of the problem. Most of the requirements of the task have been met. Mastery of the elements of the assigned material. The material is mostly clear and coherent.
4 (points 70-84)	Demonstrates considerable understanding of the issue by the discipline. All requirements of the assignment are fulfilled. The content of the completed tasks is disclosed and examined from different perspectives.
5 (points 85-100)	Demonstrates full understanding of the problem. All requirements of the assignment are fulfilled. Demonstrates proficiency in the discipline. The completed assignments are holistic, complete, structured, present different points of view and demonstrate creativity.