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**Federal State Autonomous Educational Institution of Higher Education**  
**PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA**  
**RUDN University**

*Faculty of Physics, Mathematics and Natural Sciences*

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educational division (faculty/institute/academy) as higher education programme developer

**COURSE SYLLABUS**

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**Non-Euclidean geometries and its applications**

course title

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**Recommended by the Didactic Council for the Education Field of:**

**01.04.01 Mathematics**

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field of studies / speciality code and title

**The course instruction is implemented within the professional education programme of higher education:**

«Functional methods in differential equations and interdisciplinary research»

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higher education programme profile/specialisation title

## 1. COURSE GOAL(s)

The purpose of mastering the discipline "Non-Euclidean geometries and their applications" is to master the learning concepts, axioms and methods of classical non-Euclidean geometries

## 2. REQUIREMENTS FOR LEARNING OUTCOMES

Mastering the discipline "Non-Euclidean geometries and their applications" is aimed at developing the following competencies (parts of competencies):

*Table 2.1. List of competences that students acquire through the course study*

Code	Competence	Competence achievement indicators (within this discipline)
PC-1	Able to conduct scientific research and obtain new scientific and applied results independently and as part of a scientific team	PC-1.1. Draws up a general research plan and detailed plans for individual stages
		PC-1.2. Selects experimental and computational-theoretical methods for solving the problem based on the available material and time resources

## 3. COURSE IN HIGHER EDUCATION PROGRAMME STRUCTURE

The discipline "Non-Euclidean geometries and their applications" refers to the part formed by the participants in the educational relations of block B1 of the EP HE.

As part of the EP HE, students also master other disciplines and / or practices that contribute to the achievement of the planned results of mastering the discipline "Non-Euclidean geometries and their applications".

*Table 3.1. The list of the higher education programme components/disciplines that contribute to the achievement of the expected learning outcomes as the course study results*

Code	Competence	Previous disciplines/modules, practices	Subsequent disciplines/modules, practices*
PC-1	Able to conduct scientific research and obtain new scientific and applied results independently and as part of a scientific team	-	Research work, Undergraduate practice, State examination

## 4. COURSE WORKLOAD AND ACADEMIC ACTIVITIES

The total labor intensity of the discipline "Non-Euclidean geometries and their applications" is 2 credits.

*Table 4.1. Types of academic activities during the periods of higher education programme mastering (full-time training)\**

Type of study work	TOTAL, a.h.	Semester			
		1	2	3	4
<i>Contact work, academic hours</i>	36		36		
Lectures (LC)	18		18		
Lab work (LW)					
Seminars (workshops/tutorials) (S)	18		18		
<i>Self-studies</i>	36		36		
<i>Evaluation and assessment (exam/passing/failing grade)</i>					
<b>Course workload</b>	a.h.	<b>72</b>	<b>72</b>		
	credits	<b>2</b>	<b>2</b>		

## 5. COURSE CONTENTS

*Table 5.1. Course contents and academic activities types*

Course Module Title	Brief Description of the Module Content	Type of study work
Section 1. Non-Euclidean geometry of Lobachevsky	Topic 1.1. Discovery of the non-Euclidean geometry of Lobachevsky. Lobachevsky space models. Basic of Lobachevsky planimetry. Volumes of figure in Lobachevsky space	Lecture, seminar
Section 2. Spherical geometry	Topic 2.1. Basic concepts of spherical geometry. Basic formulas of spherical trigonometry  Topic 2.2. Volumes of figure in spherical spaces	Lecture, seminar
Section 3. Non-Euclidean geometry of Galileo	Topic 3.1. Basic definitions and concepts of Galilean geometry. The simplest examples of theorems for the Galilean plane	Lecture, seminar

## 6. CLASSROOM EQUIPMENT AND TECHNOLOGY SUPPORT REQUIREMENTS

*Table 6.1. Classroom equipment and technology support requirements*

Classroom type	Classroom equipment	Specialized educational/laboratory equipment, software and materials for mastering the discipline
Lecture	An auditorium for lecture-type classes, equipped with a set of specialized furniture; board (screen) and technical means of	-

Classroom type	Classroom equipment	Specialized educational/laboratory equipment, software and materials for mastering the discipline
	multimedia presentations.	
Seminar	An auditorium for conducting seminar-type classes, group and individual consultations, current control and intermediate certification, equipped with a set of specialized furniture and technical means for multimedia presentations.	-
For independent work of students	An auditorium for conducting seminar-type classes, group and individual consultations, current control and intermediate certification, equipped with a set of specialized furniture and technical means for multimedia presentations.	-

## 7. RESOURCES RECOMMENDED FOR COURSE STUDY

### Main literature:

1. Rosenfeld B.A. Non-Euclidean spaces, any edition
2. Rosenfeld B.A., Zamakhovsky M.P. Geometry of Lie groups - M.: MTsNMO, 2004. - 787 p.
3. Rosenfeld B.A., Yaglom I.M. Encyclopedia of elementary mathematics, v.5 (article "Non-Euclidean geometries") - M.: Nauka, 1966 - 625 p.
4. D. V. Alekseevskii, E. B. Vinberg, and A. S. Solodovnikov, Geometry of spaces of constant curvature, Itogi Nauki i Tekhniki. Series "Modern Problems of Mathematics. Fundamental Directions". 1988. T. 29. - S. 5–146.

### Additional literature:

1. Berger M. Geometry. In 2 volumes / Per. from French — M.: Mir, 1984. — 928 p. Volume II, Part V: Internal geometry of the sphere, hyperbolic geometry.
2. Klein F. Non-Euclidean geometry. - M.: ed. NKTP USSR, 1936. - 355 p.
3. Laptev B. L. N. I. Lobachevsky and his geometry. - M.: Education, 1976.
4. V. V. Prasolov, Geometry of Lobachevsky. - Ed. 3rd. — M.: MTsNMO, 2004. — ISBN 5-94057-166-2.

### Resources of the information and telecommunications network "Internet":

1. RUDN ELS and third-party ELS, to which university students have access on the basis of concluded agreements:
  - RUDN Electronic Library System - RUDN EBS <http://lib.rudn.ru/MegaPro/Web>
  - ELS "University Library Online" <http://www.biblioclub.ru>
  - EBS Yurayt <http://www.biblio-online.ru>
  - ELS "Student Consultant" [www.studentlibrary.ru](http://www.studentlibrary.ru)
  - EBS "Lan" <http://e.lanbook.com/>
  - EBS "Trinity Bridge"

## **2. Databases and search engines:**

- electronic fund of legal and normative-technical documentation <http://docs.cntd.ru/>
- Yandex search engine <https://www.yandex.ru/>
- Google search engine <https://www.google.ru/>
- abstract database SCOPUS <http://www.elsevierscience.ru/products/scopus/>

## **8. ASSESSMENT TOOLKIT AND GRADING SYSTEM\* FOR EVALUATION OF STUDENTS' COMPETENCES LEVEL UPON COURSE COMPLETION**

Evaluation materials and a point-rating system\* for evaluating the level of formation of competencies (parts of competencies) based on the results of mastering the discipline "Non-Euclidean geometries and their applications" are presented in the Appendix to this Work Program of the discipline

**Developer:**



**V.A. Krasnov**

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signature

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name and surname

**HEAD  
OF HIGHER EDUCATION PROGRAMME:**



**V.I. Burenkov**

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signature

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name and surname

**HEAD  
OF EDUCATIONAL DEPARTMENT**



**A.B. Muravnik**

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signature

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name and surname