Federal State Autonomous Educational Institution of Higher Education

PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA
RUDN University

Faculty of Physics, Mathematics and Natural Sciences

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

COURSE SYLLABUS

«Operators in function spaces»
course title

Recommended by the Didactic Council for the Education Field of:

01.04.01 Mathematics
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»

higher education programme profile/specialisation title

1. COURSE GOAL(s)

The purpose of mastering the discipline "Operators in function spaces" is to master the basics of the modern theory of function spaces and its applications to the problems of modern mathematical and functional analysis

2. REQUIREMENTS FOR LEARNING OUTCOMES

Mastering the discipline "Operators in function spaces" 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)
GPC-1	Able to formulate and solve relevant and significant problems of mathematics	GPC-1.1 Uses existing and receives new methods for solving mathematical problems
		GPC-1.2 Uses modern equipment, software and professional databases to solve problems in a chosen area of mathematics or related sciences
		GPC-1.3 Uses modern calculation-theoretical mathematical methods to solve professional problems
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 " Operators in function spaces " 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 "Operators in function spaces".

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*
GPC-1	Able to formulate and solve relevant and significant problems of mathematics	Topological methods in elliptic theory	Additional chapters of partial differential equations, Nonlinear evolution equations, State exam
PC-1	Able to conduct scientific research and obtain new scientific and applied results independently and as	-	Research work, Undergraduate practice, State exam

Code	Competence	Previous disciplines/modules, practices	Subsequent disciplines/modules, practices*
GPC-1	Able to formulate and solve relevant and significant problems of mathematics	Topological methods in elliptic theory	Additional chapters of partial differential equations, Nonlinear evolution equations, State exam
	part of a scientific team		

4. COURSE WORKLOAD AND ACADEMIC ACTIVITIES

The total labor intensity of the discipline " Operators in function spaces " is 3 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
Contact work, academic hours		*36*		*36*		
Lectures (LC)		36		36		
Lab work (LW)						
Seminars (workshops/tutorials) (S)						
Self-studies		*45*		*45*		
Evaluation and assessment (exam/passing/failing grade)		*27*		*27*		
Course workload	a.h.	**108**		**108**		
	credits	**3**		**3**		

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. Morrey spaces	Topic 1.1. Definition and basic properties of Morrey spaces. Examples of functions from Morrey spaces. Completeness. Comparison with Nikolsky spaces Topic 1.2. Definition and basic properties of local Morrey spaces. Examples of functions from Morrey spaces Topic 1.3. Definition and basic properties of general local and global spaces of Morrey type. Conditions for non-triviality	Lecture

Section 2. Maximum operator	Topic 2.1. Definition and basic properties of the maximum Hardy-Littlewood operator Topic 2.2. Necessary and sufficient conditions for a maximal operator to be bounded in general local spaces of Morrey type	Lecture
Section 3. Fractional maximum operator	Topic 3.1. Definition and basic properties of the fractional maximal operator. Necessary and sufficient conditions for boundedness of a fractional maximal operator in general local spaces of Morrey type	Lecture

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 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. S. L. Sobolev. Some applications of functional analysis in mathematical physics. Any edition.
2. O. V. Besov, V. P. Ilyin, and S. M. Nikol'skii. Integral representations of functions and embedding theorems. Any edition.
3. V. I. Burenkov. Sobolev spaces on domains, B.G. Teubner, Stuttgart-Leipzig, 1998.

Additional literature:

1. V. I. Burenkov. functional spaces. Basic integral inequalities related to spaces. M.: RUDN, 1989.
2. V. I. Burenkov Function spaces. Sobolev spaces. Part 1. M.: RUDN, 1991.
3. V. I. Burenkov Function spaces. Sobolev spaces. Part 2. M.: RUDN, 1994.

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
- 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 "Operators in function spaces" are presented in the Appendix to this Work Program of the discipline

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