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 program developer

COURSE SYLLABUS

Additional Chapters of Mathematical Modeling
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

2025

1. COURSE GOAL(s)

The course is aimed to be a bridge between the study of mathematics and the applications of mathematics to various fields. The course affords the students the opportunity to see how the pieces of an applied problem fit together. The students investigate meaningful and practical problems chosen from common experiences encompassing many academic disciplines, including the mathematical sciences, physics, economics, ecology, biology, medicine, and sociology.

2. REQUIREMENTS FOR LEARNING OUTCOMES

Mastering the discipline "Additional Chapters of Mathematical Modeling" 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-3	Able to use knowledge in the field of mathematics when returning to teaching	GPC-3.1. Presents the results of the work in the form of a scientific publication (abstract, article, review) in Russian and English
		GPC-3.2. Presents the results of his work orally in Russian and English
PC-9	Able to teach mathematical disciplines and informatics in general educational organizations, professional educational organizations and educational institutions of higher education	PC-9.1. Formation of pedagogical skills and abilities
		PC-9.2. Ability to work and interact with a team

3.COURSE IN HIGHER EDUCATION PROGRAMME STRUCTURE

The discipline " Additional Chapters of Mathematical Modeling " 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 "Additional Chapters of Mathematical Modeling".

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-3	Able to use knowledge in the field of mathematics when returning to teaching	-	State Examination
PC-9	Able to teach mathematical disciplines and informatics in general educational organizations, professional educational organizations and educational institutions of higher education	-	Function spaces, Interdisciplinary term paper, Pedagogical training, State Examination

4. COURSE WORKLOAD AND ACADEMIC ACTIVITIES

The total labor intensity of the discipline "Additional Chapters of Mathematical Modeling" is 4 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)		18	18			
Lab work (LW)						
Seminars (workshops/tutorials) (S)		18	18			
Self-studies		*72*	*72*			
Evaluation and assessment (exam/ passing/failing grade)		36	36			
Course workload	a.h.	**144**	**144**			
	credits	**4**	**4**			

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. Methods for contruction of mathematical models	Topic 1.1. Mathematical models and their properties (correctness, cost-effectiveness, flexibility). The main stages of constructing a model. Dimensional analysis. Model fitting. Selection of the most appropriate model. Construction of empirical models. Optimization of discrete models. Optimization of continuous models.	Lecture, seminar
Section 2. Examples of mathematical models	Topic 2.1. Modeling with difference equations (spread of a contagious disease, decay of Digoxin in the bloodstream, prescription for Digoxin) and with a systems of difference equations (a car rental company). Modeling with differential equations and systems. Simulation modeling. Probabilistic modeling with discrete systems. Model construction based on decision-making theory. Modeling using graph theory.	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 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 readings:

1. Samarskii A.A., Mikhailov A.P. “Principles of Mathematical Modeling. Ideas, Methods, Examples”. Translated from the 1997 Russian original. Numerical insights. 3. London: Taylor & Francis. x, 349 p. (2002).

Additional readings:

1. Giordano F.R., Fox W.P., Horton S.B. “A First Course in Mathematical Modeling”, 5th Edition, Brooks/Cole, 2014.

Internet sources

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 "Additional Chapters of Mathematical Modeling" are presented in the Appendix to this Work Program of the discipline

Developer:

	D.E. Apushkinskaya
signature	name and surname

HEAD
OF HIGHER EDUCATION PROGRAMME:

	V.I. Burenkov
signature	name and surname

HEAD
OF EDUCATIONAL DEPARTMENT

	A.B. Muravnik
signature	name and surname