Federal State Autonomous Educational Institution of Higher Education
"Peoples' Friendship University of Russia"
(RUDN University)

Academy of Engineering

(Name of the main educational unit (MEU)- of the developer of the EP of HE)

COURSE SYLLABUS

Mathematical Support and Software for Computer Systems, Complexes and Computer Networks / Математическое и программное обеспечение вычислительных систем, комплексов и компьютерных сетей

(Name of the discipline/module)

Scientific specialty:

2.3.5 Mathematical Support and Software for Computer Systems, Complexes and Computer Networks / Математическое и программное обеспечение вычислительных систем, комплексов и компьютерных сетей

(code and name of the direction of training / specialization)

The development of the discipline is carried out as part of the implementation of the postgraduate program:

Mathematical Support and Software for Computer Systems, Complexes and Computer Networks / Математическое и программное обеспечение вычислительных систем, комплексов и компьютерных сетей

(name (profile/specialization) EP HE)

2022 г.

1. GOAL OF MASTERING THE DISCIPLINE

The purpose of mastering the discipline "Mathematical and software support for computing systems, complexes and computer networks" is to form a system of scientific knowledge and professional competencies in the field of mathematical and software computing systems for graduate students, as well as updating the knowledge of key concepts from previous disciplines, especially important for mathematical modeling . Students get acquainted with the main modern problems of mathematical modeling that arise in various fields and learn to choose the most appropriate method for solving the problems assigned to them.

2.REQUIREMENTS FOR THE RESULTS OF MASTERING THE DISCIPLINE

As a result of mastering the discipline "Mathematical and software support for computing systems, complexes and computer networks", a graduate student must:

Know: Fundamentals of the methodology of mathematical modeling, elements of probabilistic modeling, elements of operational modeling, main classes of numerical methods, their features, theoretical approaches to the creation of software packages, principles of software engineering, the latest trends in software engineering

Be able to: Effectively use in practice the theoretical components of science: concepts, judgments, conclusions, laws; present a panorama of software engineering methods, use modern tools for creating software complexes, abstract from the irrelevant in mathematical modeling, plan the optimal conduct of a numerical experiment; choose numerical methods suitable for solving a particular problem.

Own: the concepts of measure and Lebesgue integral; methodology for planning, setting and processing the results of a numerical experiment; mathematical modeling of scientific problems and engineering design problems, concepts of convex analysis; concepts of mathematical statistics; basic terminology of decision theory; basic terminology of the theory of operations research; basic numerical methods; methodology for setting up computational experiments; one of the widespread systems of mathematical modeling.

3. COURSE WORKLOAD AND ACADEMIC/TRAINING/LEARNUNG ACTIVITIES

The total labor intensity of the discipline "Mathematical and software support for computer systems, complexes and computer networks" is 3 credits.

Table 3.1. Types of educational work by periods of mastering the postgraduate program

Table 3.1. Types of educational work for full-time education

Type of educational activity		**Total number of hours**	**Semester(s)**			
			1	**2**	**3**	**4**
Contact academic hours		*60*		*60*		
Lectures (L)		30		30		
Lab work (LW)						
Seminars (workshops/tutorials) (S)		30		30		
Self-study(ies)		*48*		*48*		
Evaluation and assessment (exam/pass/fail grading)						
Total labor intensity	**hour**	**108**		**108**		
	CU	**3**		**3**		

4. COURSE MODULES AND CONTENTS

Table 5.1. Content of the discipline (module) by types of educational work

Name of discipline section	**Content of the section (topics)**	**Types of educational work ***
Introduction	System approach and mathematical modeling as a scientific methodology for solving problems. Conceptual design of mathematical models. Designing a model for assessing the reliability of an information-computing system.	L, S
Mathematical modeling in engineering	The current state of the problem of systems modeling. Mathematical modeling as the main method of research. Mathematical modeling as a method of cognition of the real world. The study of mathematical modeling using computer technology. The use of mathematical modeling in various fields of human activity. The main stages of mathematical modeling.	L, S
Mathematical models in engineering disciplines	The concept of a mathematical model. Structure of mathematical models. Fundamental principles for constructing mathematical models. Classification of mathematical models. Classification of mathematical models, features, hierarchy.	L, S
Methods for studying mathematical models	Analytical models. simulation models. Empirical-statistical models. Artificial intelligence. Stages of building a mathematical model.	L, S
Mathematical nodels in cientific esearch	Models of dynamic systems. special points. Bifurcations. dynamic chaos. Ergodicity and mixing. The concept of self-organization. dissipative structures. Aggravated regimes. Computer techologies. Numerical methods. Interpolation and approximation of functional dependencies. Numerical differentiation and integration. Information Technology. Operations research and artificial intelligence tasks. Pattern recognition.	L, S

6.CLASSROOM EQUIPMENT AND TECHNOLOGY SUPPORT REQUIREMENTS

Table 6.1. Technical equipment for the discipline

Audience type	**Audience equipment**	**Specialized educational / laboratory equipment, software and materials for mastering the discipline** (if needed)
Lection	An auditorium for lecture-type classes, equipped with a set of specialized furniture; board (screen) and technical means of multimedia presentations.	Computer classroom equipped with 25 workstations with a personal computer, specialized software for laboratory work and practical lessons
Labor	An auditorium for laboratory work,	Classroom equipped with 30 workstations for lectures and group lessons

	individual consultations, current control and intermediate certification, equipped with a set of specialized furniture and equipment.	
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.	Computer classroom equipped with 25 workstations with a personal computer, specialized software for laboratory work and practical lessons
Computer class	Computer class for conducting classes, group and individual consultations, current control and intermediate certification, equipped with personal computers (in the amount of ____ pcs.), Board (screen) and multimedia equipment презентаций.	
Individual work	An auditorium for independent work of students (can be used for seminars and consultations), equipped with a set of specialized furniture and computers with access to the EIES.	

7. RECOMMENDED SOURCES FOR COURSE STUDIES

a) software:

– space mission general analysis software GMAT;
– low level space dynamics library Orekit;
– flight simulator and information support program (MIOP);
– software development tools Python, C++, etc.

b) databases, reference and information, and search systems:

– electronic fund of legal, and normative and technical documentation http://docs.cntd.ru/;

– search system Yandex https://www.yandex.ru/;
– search system Google https://www.google.ru/;
– abstract database SCOPUS http://www.elsevierscience.ru/products/scopus/.

a) Main reading(sources)

1) I-Liang Chern MATHEMATICAL MODELING AND ORDINARY DIFFERENTIAL EQUATION Additional (optional) reading (sources), ode2015.pdf (ntu.edu.tw)

2) An Introduction to Mathematical Modelling Glenn Marion, Bioinformatics and Statistics Scotland Given 2008 by Daniel Lawson and Glenn Marion 2008, course_text.dvi (bris.ac.uk)

Internet-(based) 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 ELS
   http://lib.rudn.ru/MegaPro/Web
   - ELS "University Library Online" http://www.biblioclub.ru
   - ELS Uright http://www.biblio-online.ru
   - ELS "Student Advisor" www.studentlibrary.ru
   - ELS "Lan" http://e.lanbook.com/
   - ELS "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/
   - ……..
   Educational and methodological materials for independent work of students in the course of mastering the discipline/module:*

7. EVALUATION MATERIALS AND SCORE-RATING SYSTEM FOR ASSESSING THE LEVEL OF FORMATION OF COMPETENCES IN THE DISCIPLINE

In accordance with the requirements of the EP HE RUDN University, for attestation of students for compliance of their personal achievements with the planned discipline learning outcomes, assessment tools funds have been created (VF is presented in Annex 1).

The teacher has the right to change the number and content of assignments given to students (student), based on the contingent (their level of preparedness).

DEVELOPERS:

PhD		**Saltykova O.A.**
Position, department	Signature	Name, surname

SUPERVISOR of DMCP:

Prof.		**Razoumny Yu.N**
Department	Signature	Name, surname