Federal State Autonomous Educational Institution
higher education
Peoples' Friendship University of Russia

Engineering Academy

Recommended by ISSC

THE WORKING PROGRAM OF THE DISCIPLINE

Discipline name: Fundamentals of teaching methods for the development of engineering applications based on mathematical modeling using computer science and computer technology in higher education

Direction of training: 01 .06.01 " Mathematics and Mechanics "

Directivity (profile): " Dynamics, ballistics, movement control of aircraft "

Moscow,
20 21

1. The purpose and objectives of the discipline

The aim of the development of the discipline " Fundamentals of teaching on the basis of mathematical modeling of engineering application development techniques with the use of computer science in high school ," I S THE formation of Aspira ntov system of scientific knowledge about the perspective 's method ah investigating and solving professional problems based on the global trends in the development of aviation and rocket and space technology .

The main **objectives of the** discipline are:

- Readiness for teaching activities in the main educational programs of higher education;
- Ability to select and transform mathematical models of phenomena, processes and systems in the field of rocket and space technology in order to study them;
- Ability to develop mathematical models, methods, computer technology and decision support systems in scientific research, design and engineering activities .

2. Place of discipline in the structure of the educational program

The discipline " Fundamentals of teaching methods for the development of engineering applications based on mathematical modeling using computer science and computer technology in higher education " refers to the variable part of Block 1 of the curriculum. Table 1 shows the previous and subsequent disciplines aimed at the formation of discipline competencies in accordance with the competence matrix of EP HE.

Table 1 - List of previous and subsequent disciplines

P / p №	Code and name of competence	Preceding disciplines	Subsequent disciplines (groups of disciplines)
Universal competences			
	Ability to plan and solve problems of one's own professional and personal development (UK-5)		History and philosophy of science , Priority areas for the development of mathematics and mechanics , Aircraft dynamics, ballistics and motion control Scientific research (research activities) Scientific research (preparation of scientific and qualifying work (dissertation) for the degree of candidate

			of sciences)
General professional competencies			
	Readiness for teaching activities in the basic educational programs of higher education (OPK-2);		Aircraft dynamics, ballistics and motion control Teaching practice
Professional competencies (type of professional activity _____)			
	The ability to select and transform mathematical models of phenomena, processes and systems in the field of rocket and space technology in order to study them (PC-4);		Aircraft dynamics, ballistics and motion control
	Ability to develop mathematical models, methods, computer technologies and decision support systems in scientific research, design and engineering activities (PC-5);		Aircraft dynamics, ballistics and motion control
	Ability to develop new mathematical models of objects of aviation and rocket and space technology, to develop analytical and approximate research methods (PC-6);		Priority areas of development of mathematics and mechanics Aircraft dynamics, ballistics and motion control
	Readiness to teach training courses, disciplines (modules), conduct certain types of training		Teaching practice

	sessions in Russian and foreign languages in higher education programs (PC-7);		
	Ability to organize educational, research and project activities of students in higher education programs (PC-8)		Teaching practice
Vocational and specialized competencies of specialization _____			

3. Requirements for the results of mastering the discipline:

The process of studying the discipline is aimed at the formation of the following competencies:

UK- 5 , OPK- 2 , PC- 4 , PC- 5 , PC-6 , PC-7, PC-8

(indicated in accordance with the OS VO RUDN University)

As a result of studying the discipline, the student must:

Know : To know new methods of selection and transformation of mathematical models of phenomena, processes and systems in the field of rocket and space technology in order to study them .

Know new methods of developing mathematical models, methods, computer technologies and decision support systems in scientific research .

Know new methods of developing mathematical models of objects of aviation and rocket-space technology .

Know the specialized theoretical and practical knowledge that serves as the basis for developing new ideas .

Know the regulatory framework for teaching in the higher education system .

Be able to: Be able to use new methods of selection and transformation of mathematical models of phenomena, processes and systems in the field of rocket and space technology in order to study them .

To be able to use new methods of developing mathematical models, methods, computer technologies and decision support systems in scientific research .

To be able to use new methods for the development of mathematical models of objects of aviation and rocket-space technology .

Be able to analyze, prioritize, plan, monitor and provide feedback .

Be able to select and implement the best teaching methods .

Possess : Possess new methods of selection and transformation of mathematical models of phenomena, processes and systems in the field of rocket and space technology in order to study them

Possess new methods of developing mathematical models, methods, computer technologies and decision support systems in scientific research

Own new methods for the development of mathematical models of objects of aviation and rocket-space technology

Possess the technology for developing an action plan for conducting research, determine the necessary resources and conduct certain types of training sessions in Russian and foreign languages for higher education programs

Possess the technology of designing the educational process at the level of higher education .

4. Scope of discipline and types of educational work

Table 3 - Scope of discipline and types of educational work
for full-time education

Type of educational work		Total, ac . hours	Semester
			3
Auditory lessons		20	20
including:		-	-
Lectures (L)		-	-
Practical / Seminar Lessons (PL)		20	20
Laboratory work (LW)		-	-
Course project / course work		-	-
Independent work (IWS), including control		52	52
Type of certification test			Exam
Total labor intensity	academic hours	72	72
	credit units	2	2

5. Content of the discipline

5 . 1 . Contents of discipline sections

P/p №	The name of the discipline section	Section content (topics)
1	1. Fundamentals of teaching methods of developing engineering applications	1.1. Basic concepts of pedagogy and didactics. The main subjects and tasks of educational psychology. Pedagogical. process. Forms of educational organization. activities . 1.2. Features of higher education pedagogy. Strategies for the formation of new knowledge and abilities . 1.3. Psychological factors affecting the learning process . 1.4. The main tasks of engineering pedagogy. Setting educational goals. Taxonomies of learning objectives . 1.5. Programmed training, problem training, etc. Control. Validity, reliability and reliability of control. Assessment and grade 1.6. Styles of pedagogical communication. Charismatic traits of the teacher 1.7. Human representative systems. Fundamentals of teaching excellence in higher education

5 . 2 . Sections of disciplines and types of classes

№ P/p	The name of the discipline section / topic of the lesson	Pract./Seminars	SRS	Total hrs.

№ P/p	The name of the discipline section / topic of the lesson	Pract./Seminars	SRS	Total hrs.
1	**Section # 1. Fundamentals of Teaching Engineering Application Development Methods**	20	**52**	**72**
	Topic 1.1. Basic concepts of pedagogy and didactics. The main subjects and tasks of educational psychology. Pedagogical. process. For ms of educational organization. activities	2	7	9
	Topic 1.2. Features of higher education pedagogy . Strategies for the formation of new knowledge and abilities	3	7	10
	Topic 1.3. Psychological factors affecting the learning process	3	7	10
	Topic 1.4. The main tasks of engineering pedagogy. Setting educational goals. Taxonomies of learning objectives	3	7	10
	Topic 1.5. Programmed training, problem training, etc. Control. Validity, reliability and reliability of control. Assessment and grade	3	7	10
	Topic 1.6. Styles of pedagogical communication. Charismatic traits of the teacher	3	8	11
	Topic 1.7. Human representative systems. Fundamentals of teaching excellence in higher education	3	9	12
	Exam	**3**	**52**	72

6 . Laboratory workshop *(if available) - not provided*

7. Practical lessons (seminars) *(if any)*

№ P/p.	№ of discipline section	Practical lessons (seminars)	Labor intensity (hour.)
1	1	Topic 1.1. Basic concepts of pedagogy and didactics. The main subjects and tasks of educational psychology. Pedagogical. process. Forms of educational organization. activities	2
2	1	Topic 1.2. Features of higher education pedagogy. Strategies for the formation of new knowledge and abilities	3
3	1	Topic 1.3. Psychological factors affecting the learning process	3
4	1	Topic 1.4. The main tasks of engineering pedagogy. Setting educational goals. Taxonomies of learning objectives	3
5	1	Topic 1.5. Programmed training, problem training, etc. Control. Validity, reliability and reliability of control. Assessment and grade	3
6	1	Topic 1.6. Styles of pedagogical communication. Charismatic traits of the teacher	3

7	1	Topic 1.7. Human representative systems. Fundamentals of teaching excellence in higher education	3

8. Logistics of the discipline

Table 5 - Material and technical support of the discipline

Auditorium with a list of logistics	Location
Educational laboratory "Laboratory of computing systems and methods of processing big data": № 345 Equipment and furniture: - Personal graphic workstations based on the AVK -1 system unit + monitor (13 pcs.); –□Interactive whiteboard Polyvision TSL 610; –□Projector Epson EB - X 02; –□Switch Cisco Catalyst 2960 24; –□Line filter. There is Internet access. –□List of licensed software. Details of the supporting document: 1. Windows 7 (Microsoft Subscription) Enrollment for Education Solutions № 86626883 of 04.01.2018 g).; 2. Microsoft Office 2007 (Microsoft Subscription) Enrollment for Education Solutions № 86626883 from 01.04.2018 g).; 3. Borland Developer Studio 2006 (License Certificate Number: 33080, 33081, 33082); 4. MATLAB R 2008 b (361405 2008); **5. Notepad ++ (free application).** **6. Acrobat Reader DC (free application)**	Moscow, st. Ordzhonikidze, 3

9. Information support of the discipline

Resources of the information and telecommunications network "Internet":

1. EBS of RUDN University and third-party EBS to which university students have access on the basis of concluded agreements:

- Electronic library system RUDN - EBS RUDN http://lib.rudn.ru/MegaPro/Web
- EBS "University Library Online" http://www.biblioclub.ru
- EBS Yurayt http://www.biblio-online.ru
- EBS "Student Consultant" www.studentlibrary.ru
- EBS "Doe" http://e.lanbook.com/

2. Websites of ministries, departments, services, manufacturing enterprises and companies whose activities are core to this discipline:

3. 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/
- SCOPUS abstract database http: // www .elsevierscience.ru / products / scopus /

Methodological materials for independent work of students and studying the discipline (also posted in the TUIS RUDN University in the corresponding section of the discipline):

1. A course of lectures on the discipline " Fundamentals of teaching methods for the development of engineering applications based on mathematical modeling using computer science and computer technology in higher education " (*Appendix 2*).
2. Methodical instructions for independent work of students in the discipline " Fundamentals of teaching methods for the development of engineering applications based on mathematical modeling using computer science and computer technology in higher education " (*Appendix 3*).

10 . Educational and methodological support of the discipline

Main literature:

1. Mushroom E.V., Ponomareva D.I., Stulnik T.D. Psychology and pedagogy ucheb.-method. manual for students of tech . fac. (study-method. work). Military. un-t, 2011 .-- 70 p.
2. Vulfov B.Z., Ivanov V.D., Kukanova E.V., Pidkasisty P.I. Psychology and Pedagogy Textbook for universities. Yurayt: Higher education, 2010 .-- 714 p.
3. Izyumova I.V. Psychology and pedagogy textbook. guide to guide . 080200 "Management" (profile " Production management"). Kind word, 2013 .-- 303 p.
4. Smirnov S.D. Psychology and Pedagogy for Higher School Teachers Textbook. manual for students of training and professional development of teachers . Bauman Moscow State Technical University , 2014 .-- 423 p.
5. Modern problems of computational mathematics and mathematical modeling: in 2 volumes / [otv. ed. NS Bakhvalov, VV Voevodin] Inst . Vychisl . mathematics. - M .: Nauka, 2005.
6. Samarskiy A.A., Mikhailov A.P. Mathematical modeling: Ideas, methods, examples. - M .: Fizmatlit , 2008.
7. Councils B. Ya., Yakovlev SA Modeling of systems: Textbook. for universities - 3rd ed., rev . and add. - M .: Higher . shk ., 2001.
8. Tikhonov N.A., Tokmachev M.G. Fundamentals of Mathematical Modeling / Tutorial. M .: Physics Department Mga 2013

Additional literature:

1. Gultyaev A.K. MatLab 5.2 Simulation modeling in the Windows environment . SP .: Crown-print, 1999.
2. Computer networks. Comprehensive manual for construction, operation and planning. User encyclopedia. Per. from English Kiev: Diasoft , 1998.
3. Samarskiy A.A., Mikhailov A.P. Math modeling. Moscow: Nauka, 1997.320c.
4. Korobeynikov V.P. Principles of mathematical modeling. Vladivostok: Dalnauka , 1997, 240 p.
5. Samarskiy A.A., Vablitsevich P.N., Samarskaya E.A. Problems and exercises on numerical methods. Moscow: Editorial URSS, 2000.208 p.

11. Methodical instructions for students on mastering the discipline (module)

The organization of classes in the discipline " Fundamentals of teaching methods of developing engineering applications based on mathematical modeling using

computer science and computer technology in higher education " is carried out in the following types of educational work: interactive practical classes (seminars), preparation of independent work and their subsequent defense.

The implementation of the competence-based approach in the framework of the training area 0 1 .06.01 " Mathematics and Mechanics " provides for a combination in the educational process of contact work with a teacher and extracurricular independent work of students for a more complete formation and development of his professional skills, independent study of some topics of the course and confirmation of their knowledge in the course of control activities.

Graduate student is obliged to master all the topics provided for by the curriculum of the discipline. Certain topics and issues of training are submitted for independent study. Graduate student studies the recommended literature and briefly outlines the material, and clarifies the most difficult issues requiring clarification during consultations. The same should be done with sections of the course that were skipped due to various circumstances.

The aim of practical training and seminars is to provide graduate students knowledge and develop practical skills in the field of ballistics and navigation rockets. To achieve this purpose both traditional forms of work - the tasks, work with the process equipment / specialized software under execution and laboratory work and the like, and interactive methods - group work, case studies, etc.

Using the method of analyzing a specific situation, students develop such qualifications as the ability to clearly formulate and express their position, the ability to communicate, discuss, perceive and evaluate information received in verbal form. Practical classes and seminars are held in special classrooms equipped with the necessary visual aids.

Independent work covers the study of individual questions of the theoretical course by students.

Independent work is carried out on an individual basis based on teaching and learning materials discipline (*application 2 -4*). The level of mastering the material on independently studied issues of the course is checked during current control and certification tests (exam and / or test) in the discipline.

12. Fund of assessment tools for intermediate certification of students in the discipline (module)

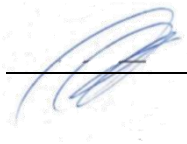
The fund of assessment tools, formed for the current monitoring of progress and intermediate certification of students in the discipline " Fundamentals of teaching methods for the development of engineering applications based on mathematical modeling using computer science and computer technology in higher education " is presented in *Appendix 1* to the work program of the discipline and includes:

- a list of competencies with an indication of the stages of their formation in the process of mastering the educational program;
- description of indicators and criteria for assessing competencies at various stages of their formation, description of assessment scales;
- typical control tasks or other materials necessary to assess knowledge, skills, skills and (or) experience of activity, characterizing the stages of the formation of competencies in the process of mastering the educational program;

- methodological materials that determine the procedures for assessing knowledge, skills, skills and (or) experience of activities, characterizing the stages of the formation of competencies.

The program has been drawn up in accordance with the requirements of the OS of VO RUDN

Developers:

Associate Professor of the Department of Mechanics and Mechatronics		O. E. Samusenko
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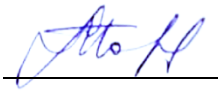
Senior Lecturer of the Department of Mechanics and Mechatronics		T. A. Morozova
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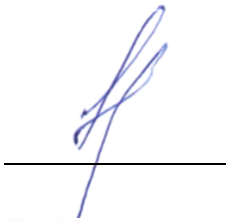

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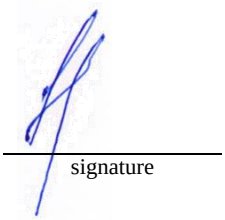

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signature | initials, surname