

*Federal State Autonomous Educational Institution of Higher Education
«RUDN University»
Engineering Academy*

THE WORKING PROGRAMME OF THE DISCIPLINE

Name of discipline: Fundamentals of teaching methods for the development of engineering applications based on mathematical modeling using informatics and computer technology in higher education

Direction: 01.06.01 Mathematics and Mechanics

Scientific specialty: Dynamics and strength of machines, devices and equipment (technical sciences)

1. Purpose and objectives of the discipline:

The purpose of mastering the discipline Fundamentals of teaching methods for the development of engineering applications based on mathematical modeling using informatics and computer technology in higher education is to form the postgraduate students universal and professional competences, based on the understanding of the fundamental problems of computer science and computer technology in order to apply the methods of teaching computer and information science in higher education. Integrated psychological and pedagogical training of postgraduate students for scientific and pedagogical activity in higher education; formation of general cultural and professional competencies of future specialists required for professional activity. Achievement of the goal is provided through the solution of theoretical, practical and educational tasks.

Course objectives: the postgraduate student should know about modern methods of teaching informatics and computer science in higher school, have an idea about the formation of knowledge of the main achievements, problems and trends of development of higher school pedagogy in Russia and abroad; modern approaches to modelling of pedagogical activity; basics of formation of psychological and pedagogical culture of higher school teacher; psychological and pedagogical basics of teaching and education process in higher school; specific features of professional activity in higher school conditions formation of ability to use in the educational process the knowledge of fundamentals, modern achievements, problems and tendencies of development of psychology and pedagogy of higher school; to activate cognitive activity of postgraduate students in the learning process; to use methods of research and organisation of collective research work and formation of postgraduate students' skills of independent work, professional thinking and development of their creative abilities to use the skills of organizing productive activities of the teacher and postgraduate students; formation of skills and abilities of organization and implementation of pedagogical activities in higher education; possession of methods of identification, generalization and implementation of best teaching practices; innovative technologies of organization of research activities; psychological methods of communication.

2. The place of the discipline in the structure of the educational programme

The discipline Fundamentals of teaching methods for the development of engineering applications based on mathematical modeling using informatics and computer technology in higher education refers to the disciplines of the variative component of the compulsory part of Block 1 of the curriculum. The study is based on the material of the previous disciplines of the curriculum, the list of which is presented in Table 1.

Table № 1

Prior and subsequent disciplines aimed at the formation of competencies

№	Code and name of competence	Preceding disciplines	Subsequent disciplines (groups of disciplines)
Universal competences			
1	the ability to plan and solve problems of their own professional and personal development (UC-5)		History and philosophy of science Research methodology Priority areas for the development of mathematics and mechanics
General professional competencies			

2	willingness to teach in the basic educational programs of higher education (OPC-2)		Research methodology Priority areas for the development of mathematics and mechanics
Professional competence			
3	the ability to create new generations of machines, devices, equipment, technologies and materials with qualitatively new functional properties, as well as to improve existing machines, devices, equipment and technologies with improved performance characteristics, less material and energy consumption (PC-4);		Dynamics, strength of machines, devices and equipment Technology and engineering of nanodevices and systems System analysis, management and information processing Modern problems of control theory
4	the ability to develop methods of mechanics and computational mathematics, computer technology and decision support systems in scientific research, design and engineering activities (PC-5).		Dynamics, strength of machines, devices and equipment Technology and engineering of nanodevices and systems System analysis, management and information processing Modern problems of control theory
5	the ability to study patterns and relationships, dynamic processes, stress states and strength of machines, devices and equipment (PC-6).		Priority areas for the development of mathematics and mechanics Dynamics, strength of machines, devices and equipment Technology and engineering of nanodevices and systems System analysis, management and information processing Modern problems of control theory
6	willingness to teach courses, disciplines (modules), conduct certain types of training sessions in Russian and foreign languages for higher education programs (PC-7).		
7	the ability to organize educational, research and project activities of students in higher education programs (PC-8)		

3. List of planned learning outcomes of the discipline, correlated with the planned learning outcomes of the educational programme

The discipline Fundamentals of teaching methods for the development of engineering applications based on mathematical modeling using informatics and computer technology in higher education aims to develop the following competencies:

- 1.the ability to plan and solve problems of their own professional and personal development (UC-5);
2. willingness to teach in the basic educational programs of higher education (OPC-2);

3. the ability to create new generations of machines, devices, equipment, technologies and materials with qualitatively new functional properties, as well as to improve existing machines, devices, equipment and technologies with improved performance characteristics, less material and energy consumption (PC-4);
4. the ability to develop methods of mechanics and computational mathematics, computer technology and decision support systems in scientific research, design and engineering activities (PC-5).
5. the ability to study patterns and relationships, dynamic processes, stress states and strength of machines, devices and equipment (PC-6).
6. willingness to teach courses, disciplines (modules), conduct certain types of training sessions in Russian and foreign languages for higher education programs (PC-7).
7. the ability to organize educational, research and project activities of students in higher education programs (PC-8)

The learning outcomes of the discipline are the knowledge, skills and (or) experience that characterise the stages of competence formation and ensure the achievement of the planned learning outcomes of the educational programme.

4 Scope of the discipline and types of study

Table 3 - Scope of the discipline and types of study for full-time education

Type of study	Total, ac. Hours	Semester	
		1	
Classroom activities	20	20	
including:		-	
Lectures (L)			
Practical/seminar sessions (SP)	20	20	
Laboratory work (LW)			
Course project/coursework			
Independent work (IWW), including preparation of an abstract	52	52	
Type of certification test - differential credit			
Total workload	72	72	108
	2	2	3

5. Content of the discipline

Table 4 - Content of the discipline and types of classes for full-time education

No. n/a	Title of discipline section/subject of the lesson	Lectz.	Prakt. / seminar.	Lab.	SRS	Total hour.
<i>1 term</i>						
1.	Basic concepts of pedagogy and didactics. The main subjects and tasks of educational psychology. The pedagogical process. Forms of organisation of learning. activity.		3		7	10

No. n/a	Title of discipline section/subject of the lesson	Lectz.	Prakt. / seminar.	Lab.	SRS	Total hour.
2	Peculiarities of higher education pedagogy. Strategies for shaping new knowledge and abilities.		3		7	10
3	Psychological factors affecting the learning process.		3		7	10
4	The main objectives of engineering pedagogy. Setting learning objectives. Taxonomies of learning objectives.		3		7	10
5	Programmed learning, problem-based learning, etc. Controls. Validity, reliability and validity of controls. Assessment and marking		3		7	10
6	Styles of pedagogical communication. Charismatic traits of a teacher		3		7	10
7	The representational systems of the individual. Fundamentals of pedagogical excellence in higher education.		2		10	12
	Summary					
	Differentiated credit					
	Total (hours)		20		52	72

6. Educational technology

The organisation of classes in the discipline *Fundamentals of teaching methods for the development of engineering applications based on mathematical modeling using informatics and computer technology in higher education* is carried out by the following types of academic work: practical work.

Implementation of the competence-based approach in the framework of the training area 01.06.01 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.

Group work in case studies and laboratory work in a subgroup develops the ability to analyse and diagnose problems. The case study method develops skills such as the ability to clearly articulate and express one's position, the ability to communicate, to discuss, to perceive and evaluate information in verbal form. Laboratory work takes place in special classrooms equipped with the necessary visual materials.

Independent work includes working on selected questions from the theoretical course and completing an abstract.

The level of mastery of the material in the self-study course is checked during the current control and certification tests in the discipline.

7. Training, methodological and information support for the discipline

(a) Basic literature

1. Satybaldinova K. M. *Filosofiya i metodologiya nauki: Uchebno-metodicheskoye posobiye.* - M.: Izd-vo RUDN, 2014. - 14 s.
2. Moskvichev YU. N. *Metodologiya nauchnogo issledovaniya: Uchebno-metodicheskoye posobiye dlya aspirantov i soiskateley [Elektronnyy resurs].* - Elektronnyye tekstovyye dannyye. - Volgograd: VGAFK, 2013. - 54 s.
3. Ruzavin G. I. *Metodologiya nauchnogo poznaniya: Uchebnoye posobiye dlya vuzov.* - M.: YUNITI-DANA, 2013. - 287 s.

b) further literature

1. Burgin M. S., Kuznetsov V. I. *Vvedeniye v sovremennuyu tochnuyu metodologiyu nauki: struktury sistem znaniya: Posobiye dlya studentov vuzov.* – M.: AO «Aspekt Press», 1994. – 304 s.
2. Kuzin F. A. *Kandidatskaya dissertatsiya: metodika napisaniya, pravila oformleniya i poryadok zashchity: Prakticheskoye posobiye dlya aspirantov i soiskateley uchenoy stepe-ni.* 2-ye izd. – M.: «Os'-89», 1998. – 208 s.
3. Ruzavin G. I. *Metodologiya nauchnogo issledovaniya: Ucheb. posobiye dlya vuzov.* – M.: YUNIT-DANA, 1999. – 317 s.
4. Volkov YU. G. *Dissertatsiya: podgotovka, zashchita, oformleniye: Prakticheskoye posobiye / Pod red. N. I. Zaguzova.* – M.: Gardariki, 2001. – 160 s.

Periodicals:

1. <http://yspu.org/> Pedagogy: Electronic versions of magazines and newspapers

Main internet resources:

1. <http://www.bytic.ru/conf.html> International Annual Conference and Exhibition "Applying New Technologies in Education"
2. <http://www.moscow-education-online.com/> International Conference on E-learning MOSCOW Education Online
3. <http://tm.ifmo.ru/> All-Russian annual scientific-methodological conference "Telematics"

Resources of the information and telecommunication network "Internet":

1. PFUR Libraries and third-party Libraries to which university students have access on the basis of contracts:

- RUDN Electronic Library System - RUDN EBS <http://lib.rudn.ru/MegaPro/Web>
- University Library Online EBS <http://www.biblioclub.ru>
- EBS Yurite <http://www.biblio-online.ru>
- Student's Consultant Libraries www.studentlibrary.ru
- Lan' EBS <http://e.lanbook.com/>

2. Websites of ministries, agencies, services, manufacturing enterprises and companies whose activities are relevant to the discipline:

<http://www.ipu.ru>

3. databases and search engines:

- Electronic collection of legal, regulatory and 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/>

Software:

1. Specialised software for lectures, laboratory and practical classes, coursework/projects and students' independent work:

1. Matlab 6.5 SP1/7 + Simulink 5/6.

2. Demo version of the Gensym G2.

Methodological materials for students' independent work and study of the discipline (also available at the TUIS PFUR in the relevant section of the discipline):

1. A textbook with a course of lectures on Modern Tools for Intelligent Systems. (*Annex 2*).

2. QMK Intelligent Systems and Technologies. (*Appendix 3*).

3. methodological guidelines for students' independent work in the discipline Toolkit for Intelligent Systems (*annex 4*).

4. Guidelines for an abstract on Intelligent Systems Toolkit (*Appendix 4*).

5. Laboratory Workshop on Intelligent Systems Instrumentation (*Appendix 5*).

8. Logistical support for the discipline

Table 5 - Logistical support for the discipline

Auditorium with a list of logistics	Location
Laboratory for laboratory work ("Automated Control Systems Laboratory"), auditorium No. 416 Equipment and furniture: - BT/Core2-Duo3000/4x1024Mb/1000GbR/V512Mb/S/DVD+-RW + monitor, keyboard, mouse (13 pcs.) - Contar software and hardware training and research stand (12 pcs.) - Polyvision TSL 610 interactive whiteboard; - Toshiba TLP-XC3000 projector; - Cisco Catalyst 2960 switch 24; - mains filter 13 pcs.); - Internet access: LAN and Wi-Fi, - tables, chairs, - a mobile marker board.	Moscow, Ordzhonikidze st. 3

9. Assessment tools fund

The assessment tools, formed for the current control of progress and interim certification of students in the discipline Fundamentals of teaching methods for the development

of engineering applications based on mathematical modeling using informatics and computer technology in higher education is presented in *Appendix 1* to the work programme of the discipline and includes:

- A list of competences and the stages of their formation during the study programme;
- Description of indicators and criteria for assessing competences at different stages of their formation, description of assessment scales;
- The model checklists or other materials necessary to assess the knowledge, skills and (or) work experience that characterise the stages of competence development in the course of the educational programme.

Developer

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