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

Academy of Engineering

PROGRAM
STATE FINAL CERTIFICATION

Program of training: 09.06.01 Informatics and computer technology

Scientific specialty : System analysis, management and information systems (technical sciences)

1. Goals and objectives of the state final examination

State final attestation (hereinafter - SFA) held the State Examination Commission (hereinafter - SEC) for the purpose of determining compliance with the results of studying the development of the basic educational program " <u>System analysis, management and in-formation systems</u> " (Technical Science) requirements of the educational standard of People's Friendship University

The main tasks of the SFA are :
- completion of the formation and determination of the student's level of competence formation, provided for by the educational standard of the RUDN *University* in the direction *09.06.01 Informatics and computer technology* (universal , general professional and professional);
- determination of the level of theoretical and practical readiness of a graduate to solve scientific and professional problems in the areas of professional activity defined by the educational standard of the RUDN University;
- making a decision by the State Electoral Commission on assigning to a student who has fully mastered the educational program, the qualification *" Researcher. Research teacher "* .

2. Forms and place of SFA in the structure of the educational program

State final attestation refers to the basic part of Block 4 of the curriculum.

State final certification for the educational program Mathematical modeling, numerical methods and program complexes (technical sciences) in the direction 09.06.01 Informatics and computer technology is carried out in the form of preparation for passing and passing the state exam, as well as submitting a scientific report on the main results of the prepared scientific qualification work (dissertation) .

3. List of planned results of mastering the educational program

As a result, the development of educational programs <u>System analysis, management</u> <u>and information systems</u> (technical science) at the direction of 09.06.01 Computer Science and Engineering graduate should have the following universal, general professional and professional competences:
− the ability to critically analyze and evaluate modern scientific achievements, generate new ideas in solving research and practical problems, including in interdisciplinary areas (UK-1);
− the ability to design and carry out complex research, including interdisciplinary, based on a holistic systemic scientific worldview using knowledge in the field of history and philosophy of science (UK-2);
− willingness to participate in the work of Russian and international research teams to solve scientific and scientific and educational problems (UK-3);
− readiness to use modern methods and technologies of scientific communication in the state and foreign languages, including the readiness to communicate in oral and written

forms in Russian and foreign languages to solve problems of professional activity, possession of foreign language communicative competence in official business, educational and professional, scientific, socio-cultural, everyday spheres of foreign language communication (UK-4);

− the ability to follow ethical standards in professional activity (UK-5);

− the ability to plan and solve problems of one's own professional and personal development (UK-6).

− own the methodology of theoretical and experimental research in the field of professional activity (OPK-1);

− own the culture of scientific research, including the use of modern information and communication technologies (OPK-2);

− the ability to develop new research methods and their application in independent research activities in the field of professional activity (OPK-3);

− willingness to organize the work of the research team in the field of professional activity (OPK-4);

− the ability to objectively evaluate the results of research and development carried out by other specialists and in other scientific institutions (GPC-5);

− the ability to present the results of research activities at a high level and taking into account the observance of copyright (OPK-6);

− master the methods of conducting patent research, licensing and copyright protection when creating innovative products in the field of professional activity (GPC-7);

− willingness to teach in the basic educational programs of higher education (GPC-8).

− possession of th methodology, theoretical and experimental research in the field of computer science and computer engineering, ownership culture of scientific research in the field of computer science and computer technology, including the use of new information and communication technologies (PC-1);

− the ability to develop new research methods and their application in independent research activities in the field of informatics and computer technology, taking into account the copyright rules (PC-2);

− the ability for independent (including leading) research activities, requiring broad fundamental training in modern areas of industry science, deep specialized training in the chosen direction, possession of the skills of modern research methods (PC-3);

− possession of fundamental knowledge in the main sections of mathematical modeling, numerical methods and software complexes (PC-4);

− readiness to teach training courses, disciplines (modules), conduct certain types of training sessions in Russian and foreign languages in higher education programs (PC-5).

4. Volume of SFA and the kinds of educational work

State final certification is carried out in the form of contact work and in the form of independent work of students (Table 1).

Table 1 - Scope of SFA and types of educational work

Type of educational work	Total, ac. hours	Semester

			8
Preparation for passing and passing the state exam			
Contact work of a student with a teacher		4	4
Independent work of the student, including passing the exam		104	104
Type of certification test		Exam	
The total labor intensity of the certification test	academic hours	*108*	*108*
	credit units	*3*	*3*
Preparation and presentation of a scientific report on the main results of the prepared scientific and qualification work			
Contact work of a student with a teacher		8	8
Independent work of the student, including passing the exam		208	208
Type of certification test		public presentation	
The total labor intensity of the certification test	academic hours	*216*	*216*
	credit units	*6*	*6*
The total labor intensity of the SFA	academic hours	**324**	**324**
	credit units	**9**	**9**

5. State examination program

Program g osudarstvenn th exam and the educational program " Mathematical modeling, numerical methods and program complexes " (technical science) toward 09.06.01 Computer Science and Engineering corresponds to the program of the candidate minimum on scientific specialty 05.13. 18 Mathematical modeling, numerical methods and program complexes (in technical sciences) , approved by the order of the Ministry of Education and Science of Russia dated 08.10. 2007 No. 274.

State examination shall be written using the examination tickets. Each exam ticket contains three questions .

The questions included in the examination card are interdisciplinary in nature and are aimed at determining the level of theoretical and practical preparedness of the graduate to solve scientific and professional problems in the areas of professional activity defined by the educational standard of RUDN University .

The total number of exam tickets is determined by the number of graduate students admitted to the state exam. The student is given 120 minutes to prepare and defend a written answer to the ticket .

At the state exam, the members of the State Electoral Commission may ask the graduate additional questions in the field of his future professional activity , as stipulated by the educational standard.

The list of questions for preparing for the state exam, as well as the criteria for assessing the results of this stage of the state final certification are given in the fund of evaluation tools of the State Inspection Agency.

6. Requirements for a scientific report and the procedure for its presentation

A scientific report on the main results of the prepared scientific and qualification work (dissertation) is a work performed by the student, demonstrating the level of his preparedness for independent scientific and professional activities.

The volume, structure and order of registration of the final qualifying work for postgraduate programs (scientific report) is regulated by the National standard GOST R 7.0.11-2011 "Dissertation and thesis abstract. Structure and design rules " , as well as the Regulations for the preparation and execution of scientific and qualification work (dissertation) on training programs for highly qualified personnel at the Peoples' Friendship University of Russia, approved by the Rector's Order No. 40 dated January 20, 2017.

7 . Normative and educational-methodological support of the State Institute

1. Federal Law "On Education in the Russian Federation" dated December 29, 2012 No. 273-FZ.

2. The order of organization and implementation of educational activities in educational programs of higher education - programs for the training of scientific and pedagogical personnel in postgraduate studies (postgraduate studies), approved by the Order of the Ministry of Education and Science of Russia dated November 19, 2013 No. 1259.

3. The procedure for conducting state final certification for educational programs of higher education - programs for the training of scientific and pedagogical personnel in postgraduate studies (postgraduate studies), residency programs, programs of assistive training, internships, approved by the Order of the Ministry of Education and Science of the Russian Federation of 03/18/2016 city number 227.

4. Regulations on the state final certification of students under higher education programs - programs for the training of scientific and pedagogical personnel in graduate school, approved by the Rector's Order No. 41 dated January 20, 2017.

5. Regulations for the use of the "Antiplagiat" system for checking written educational work at RUDN University, approved by the Rector's Order No. 228 dated March 30, 2018.

6. National standard GOST R 7.0.11-2011 "Dissertation and abstract of dissertation. Structure and design rules ".

7. Program of the minimum candidate for a scientific specialty 05.13.18 Mathematical modeling, numerical methods and program complexes (in technical sciences), approved by order of the Ministry of Education and Science of Russia dated 08.10.2007, No. 274

8. Basic literature indicated in the work programs of disciplines / modules of the educational program (in preparation for the state exam).

Resources of the information and telecommunication 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/Mega-Pro/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 . Databases and Search Engines:

- electronic fund of legal and normative-technical documentation http://docs.cntd.ru/

- Yandex search system https: // www .yandex.ru /

- search engine Google https://www.google.ru/

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

Program software:

1. Specialized software for preparing a scientific report and independent work of students :

- Windows 7 (Microsoft Subscription Enrollment for Education Solutions № 86626883 of 01.04.2018 r .);

- Microsoft Office 2007 (Microsoft Subscription Enrollment for Education Solutions № 86626883 from 01.04.2018 g .);

- Windows XP (Microsoft Subscription Enrollment for Education Solutions № 86626883 from 01.04.2018 g .);

- Microsoft Office 2003 (Microsoft Subscription Enrollment for Education Solutions № 86626883 from 01.04.2018 g .);

- MATLAB R2008b (361405 2008);

- Mathcad 14 (7A1354555) ;

- Borland Developer Studio 2006 (License Certificate Number: 33080, 33081, 33082) ;

- Notepad ++ (free application) ;

- Acrobat Reader DC (free application);

Methodological materials for independent work of students in the process of preparing a scientific report :

1. The regulations for the preparation and execution of scientific qualification work (dissertation) on training programs for highly qualified personnel at the Peoples' Friendship University of Russia, approved by the Rector's Order No. 40 dated January 20, 2017 .

2. Numerical Models for Differential Problems [Electronic resource]: Undergraduate textbook . - Electronic text data. -: Springer Milan , 2009. - (; 2). - System requirements: Windows XP or higher. - ISBN 978-88-470-1071-0. http://lib.rudn.ru/MegaPro/UserEntry?Action= Rudn_FindDoc & id = 328049 & idb = 0 .

3. Evolutionary Design of Intelligent Systems in Modeling, Simulation and Control [Electronic resource]: Monograph. - Electronic text data . -: Springer Berlin Heidelberg, 2009. - (Studies in Computational Intelligence ; 257). - System requirements : Windows XP or higher . - ISBN 978-3-642-04514-1. http://lib.rudn.ru/MegaPro/UserEntry?Action=Rudn_FindDoc&id=327239&idb=0 .

4. Differential equations in applications [Text]: Transl. from the Russ. / VV Amel'kin . - book on the English language . - M . : Mir, 1990 .-- 279 p. : i l . - ISBN 5-03-000521-8 : 0.80. 22.16 - A498.

5. Mathematical modeling and digital simulation for engineers and scientists / JM Smith. - book on the English language . - New York: Wiley, 1977 .-- 332 p .: il . - (A Wiley- Interscience publication). - 30.00. 3 BT - S652 .

6. Analysis, Partial Differential Equations and Applications [Electronic resource] : Proceedings. - Electronic text data . -: Birkhauser Basel, 2009 .-- (Operator Theory: Advances and Applications; 193). - System requirements : Windows XP or higher . - ISBN 978-3-7643-9898-9. http : // lib . rudn . ru / MegaPro / UserEntry ? Action = Rudn _ FindDoc & id = 327847 & idb = 0 .

7. Elementary differential equations with applications / WR Derrick, SI Grossman. - book on the English language . - Reading: Addison-Wesley, 1976 .-- 597 p. : il . - (Addison-Wesley series in mathematicos ; 1470). - 13.30.3BM - D438 .

8. Optimal Control of Coupled Systems of Partial Differential Equations [Electronic resource]: Proceedings. - Electronic text data . -: Birkhauser Basel, 2009 .-- (International Series of Numerical Mathematics; 158). - System requirements : Windows XP or higher . - ISBN 978-3-7643-8923-9. http : // lib . rudn . ru / MegaPro / UserEntry ? Action = Rudn _ FindDoc & id = 327783 & idb = 0 .

9. Fuzzy Information and Engineering Volume 2 [Electronic resource]: Proceedings . - Electronic text data. -: Springer Berlin Heidelberg , 2009 .-- (Advances in Soft Computing ; 62). - System requirements: Windows XP or higher. - ISBN 978-3-642-03664-4. http : // lib . rudn . ru / MegaPro / UserEntry ? Action = Rudn _ FindDoc & id = 326966 & idb = 0 .

10. Intelligent Distributed Computing 3 [Electronic resource]: Monograph . - Electronic text data. -: Springer Berlin Heidelberg , 2009 .-- (Studies in Computational Intelligence ; 237). - System requirements: Windows XP or higher. - ISBN 978-3-642-03214-1. http : // lib . rudn . ru / MegaPro / UserEntry ? Action = Rudn _ FindDoc & id = 327251 & idb = 0.

11. A.A. Amosov, Yu.A. Dubinsky, N.V. Kopchenova Computational methods for engineers. - M .: Higher . shk ., 1994 .-- 544 p.

12. H Bahvalov . With . , Ji -ranked NP . Numerical methods : A textbook for students of physical and mathematical specialties of higher educational institutions . - M .: BINOM. Laboratory of knowledge, 2015 .-- 636 p.

13. Wentzel E.S. Probability theory. M .: Higher school, 2002 .-- 575 p.

14. Knut D . E. The art of programming in 3 volumes - M .: Izd. house Williams, 2008. - T.1 - 720, T.2 - 832 p., T.3 - 824 p.

15. Ortega J., Poole W. Introduction to numerical methods for solving differential equations. - M .: Nauka, 1986 .-- 288 p.

16. Samarskiy A.A. Numerical Methods : Tutorial . - M .: Nauka, 1989 .-- 430 p.

17. Samara AA . , Vabishchevich P.N. Numerical Methods for Solving Inverse Problems of Mathematical Physics: Textbook. - M .: Publishing house of LKI, 2014 .-- 480 p.

18. A Sukharev . G. , Timokhov A.V., Fedorov V.V. Optimization Methods Course . - Moscow: Nauka, 1986 .-- 326 p.

19. Moses H . N. Numerical Methods in the Theory of Optimal Systems . - Moscow: Nauka, 1971. - 424 p.

8. Logistics support of the SFA

To prepare for the state exam and submit a scientific report, students use the premises for independent work.

To conduct a state exam and / or present a scientific report , a room with a capacity of 12 or more people is used, in which workplaces are equipped for all members of the SEC, with the ability to listen to reports, view public presentations of speakers, keep records and minutes, there are places for listeners, those wishing to attend the procedure for submitting a scientific report . The necessary equipment of the premises includes:

- equipment for public presentations, including a multimedia screen, a projector, audio equipment.

- a board for illustrating answers to questions ;

- Tablets / stands format not less than A1 (if necessary), to be placed on them graphically of the material within the scientific report .

About wishes to additional material and technical mu equipment (if necessary) the audience , appointed to conduct the DPA , the student may notify the issuing department a written application no later than one week before the security procedures.

9 . Appraisal Fund

The fund of assessment tools, formed for the state final certification of students in the educational program Mathematical modeling, numerical methods and program complexes (technical sciences) in the direction *09.06.01 Informatics and computing* , includes:

- a list of competencies that students must master as a result of mastering the educational program;

- description of indicators and criteria for assessing competencies, as well as assessment scales;

- typical control tasks or other materials necessary to assess the results of mastering the educational program;

- methodological materials that determine the procedures for assessing the results of mastering the educational program.

9.1 The list of competencies that students must master as a result of mastering the educational program

As a result of the development of the educational program " Mathematical modeling, numerical methods and program complexes " (technical science) at the direction of 06.09.01 Computer Science and Engineering graduate is entitled to all the universal , general and professional competences listed in Section 3 of this Program.

9.2 Indicators, criteria and scales for assessing competencies in the process of conducting SFA

According to the results of the state exam a grade in accordance with the Peoples' Friendship University of score -rating systems (score / ECTS / Assessment of the Russian Federation, a maximum of 100 points) .

The price based on the results of the state exam is determined by the results of checking the student's written answer to the exam ticket and (if necessary) by the quality of the student's answers to additional questions from the SEC members.

The scale and criteria for assessing the state exam are presented in Table 2.

Table 2 - Scale and criteria for assessing the state exam

Grading scale	86-100 points	69-85 points	51-68 points	0-50 points
Criteria	- the content of the examination card material is fully disclosed; - the material is presented correctly, in a certain logical sequence; - terminology is used accurately; - shown the ability to illustrate theoretical provisions with specific examples, to apply them in a new situation; - the answer sounded independently, without leading questions; - demonstrated the ability to creatively apply knowledge of theory to solving professional problems; - demonstrated a high level of competence formation	- the questions of the examination material are presented systematically and consistently; - demonstrated the ability to analyze the material, however, not all conclusions are well-grounded and evidence-based; - the assimilation of the main literature is demonstrated. - the answer contains one of the following disadvantages: - small gaps are allowed in the presentation, which did not distort the content of the answer; - a mistake or more than two omissions was made when covering minor issues, which are easily corrected as noted by the examiner.	- the content of the material is incompletely or inconsistently disclosed, but a general understanding of the issue is shown and skills are demonstrated that are sufficient for further assimilation of the material; - mastered the main categories on the considered and additional questions; - there were difficulties or mistakes in the definition of concepts, the use of terminology, corrected after several leading questions; - with incomplete knowledge of the theoretical material, insufficient formation of competencies, abilities and skills is revealed, the student cannot apply the theory in a new situation; - the assimilation of the main literature was demonstrated.	- the main content of the educational material has not been disclosed; - found ignorance or misunderstanding of the most or the most important part of the educational material; - mistakes were made in the definition of concepts, when using terminology, which were not corrected after a few leading questions. - competencies, skills and abilities are not formed.

The scientific report is assessed in accordance with the point-rating system adopted by the RUDN University (score / ECTS / RF score, maximum 100 points) according to the following indicators, which make it possible to assess the level of competence formation provided for by the educational program:

Indicators for evaluating a scientific report	Maximum score
- correspondence of the content of the scientific report to the approved SCW topic and the assigned task, clarity of the formulation of the goals and objectives of the research	20
- reliability, originality and novelty of the results obtained in the SCW	10
- the practical value of the completed SCW - the practical value of the completed SCW	10
- style of presentation of a scientific report	5
- compliance with the approved requirements for registration of the SCW	10
- quality of presentation and report	10
- the quality of answers to questions from members of the SEC	10
- assessment of the scientific work of the graduate student by the supervisor (review)	10
- assessment of the SCW by a reviewer (review)	10
- availability of publications on the topic of work, certificates, awards, etc.	5

The scale and criteria for evaluating a scientific report based on the results of SCW are presented in Table 3.

Table 3 - Scale and criteria for evaluating a scientific report

Compliance of the content of the scientific report with the approved SCW topic and the assigned task, clarity of the formulation of the goals and objectives of the research				
Scale	**15-20 points**	**5-14 points**	**1-4 points**	**0 points**
Criteria	The SCW is carried out on a topical topic, the goals and objectives of the research are clearly formulated.	The SCW was carried out on a topical topic, there are minor remarks on the formulation of the goals and objectives of the study.	The relevance of the SCW topic raises doubts. The goals and objectives of the SCW are formulated with significant remarks, not clearly enough . There is no link between the essence of the topic and the most significant directions for solving the problem under consideration .	The goals and objectives of the SCW do not correspond to the approved topic of work and do not reveal the essence of the research being carried out
The accuracy, originality and novelty of the in SCW results				
Scale	**7-10 points**	**4-6 points**	**1-3 points**	**0 points**
Criteria	An in- depth analysis of the research object has been carried out. The reliability, originality and novelty of the conclusions on the research topic are noted .	The analysis of the object of research has not been carried out deeply enough . The reliability, originality and novelty of the conclusions have a number of minor remarks.	The reliability, originality and novelty of the conclusions based on the results obtained cause serious remarks.	The accuracy of the results is put under doubt the originality and novelty of the results is not
Practical value of the completed SCW				Practical value of the completed SCW
Scale	**7-10 points**	**4-6 points**	**1-3 points**	**0 points**	

Criteria	The work is given a new solution to the theoretical or practical problem, which has a significant importance for the professional field.	The work provides a partial solution to a theoretical or practical problem that is important for the professional field .	In the work , only the directions of solving the problem are considered, the results obtained are of a general nature or insufficiently reasoned.	The results do not represent the practical value

Scientific presentation style

Scale	4-5 points	2-3 points	1 points	0 points
Criteria	The scientific style of presenting the results of work with correct references to literary sources is noted	There are insignificant remarks to scientific style of presentation of the results and / or to the correctness of the links to sources	There are serious remarks about the scientific style of presenting the results of the work and / or about the correctness of references to sources	The style of presentation does not correspond to scientific, references to sources are incorrect

Compliance with the approved requirements for registration of the SCW

Scale	7-10 points	4-6 points	1-3 points	0 points
Criteria	SCW fully complies with the requirements for registration	SCW with minor remarks respectively exists requirements for registration	SCW has significant comments on compliance with the requirements for registration	SCW does not meet the requirements for registration

Quality of presentation and report

Scale	7-10 points	4-6 points	1-3 points	0 points
Criteria	Presentation and report in full extent reflect the content of SCW, demonstrated good possession pictures work sure, consistent and logical presentation of the results of the study	There are insignificant nye comments to Prez tation and / or report on the subject SCW. They were admitted slight inaccuracies when izlo zhenii results H KR not distort the main content of work.	There are significant comments on the quality of the presentation and / or report on the topic of SCW. They were allowed considerable malfunctioning when presentation material influencing on essence pony mania main content SCW, broken logic presentation.	The presentation and / or report does not reflect the essence of the SCW. No demonstrated proficiency in the material of the work..

Quality of answers to questions from members of the SEC

Scale	7-10 points	4-6 points	1-3 points	0 points
Criteria	Answers to the questions are given in the full volume	Answers are not completely and / or with minor errors	The answers to the questions are incomplete, with serious errors	Answers to the questions are not given

Assessment of the scientific work of a graduate student by the head

Scale	7-10 points	4-6 points	1-3 points	0 points
Criteria	Excellent	Good	Satisfactorily	Unsatisfactory

Assessment of the SCW by the reviewer

Scale	7-10 points	4-6 points	1-3 points	0 points
Criteria	Excellent	Good	Satisfactorily	Unsatisfactory

Availability of publications on the topic of work, certificates, awards, etc.

Scale	4-5 points	2-3 points	1 points	0 points

Criteria	The results of the study were tested in speeches at conferences, seminars, there PUB of replication of in print, re results of validated certificate of introduction and etc	The research results are declared for a report at conferences, seminars, or accepted for publication in the press, for implementation.	The research results are prepared for discussion at conferences, seminars, or prepared for publication in print, for implementation.	Research results are not planned for publication, presentation at conferences, seminars, for implementation

9.3 Typical control tasks or other materials necessary to assess the results of mastering the educational program

List of questions to prepare for the state :

Mathematical Foundations

1. Elements of function theory and functional analysis

The concept of Lebesgue measure and integral. Metric and normed spaces. Spaces of integrable functions. Sobolev spaces. Linear continuous functionals. Hahn- Banach theorem . Linear operators. Elements of spectral theory. Differential and integral operators.

2. Extreme tasks. Convex Analysis

Extreme problems in Euclidean spaces. Convex minimum problems. Mathematical programming, linear programming, convex programming. Minimax tasks. Foundations of the calculus of variations. Optimal control problems. Maximum principle. The principle of dynamic programming.

3. Probability theory. Math statistics

Axiomatics of probability theory. Probability, conditional probability. Independence. Random variables and vectors. Elements of the correlation theory of random vectors. Elements of the theory of random processes. Point and interval estimation of distribution parameters. Elements of the theory of testing statistical hypotheses. Elements of multivariate statistical analysis. Basic concepts of the theory of statistical decisions. Foundations of information theory.

Information Technology

4. Making decisions

General problem solution. Loss function. Bayesian and minimax approaches. Method of sequential decision making.

5. Operations Research and Artificial Intelligence Challenges

Expertise and informal procedures. Design automation. Artificial Intelligence. Pattern recognition.

Computer techologies

6. Numerical Methods

Interpolation and approximation of functional dependencies. Numerical differentiation and integration. Numerical methods for finding an extremum. Computational methods

of linear algebra. Numerical methods for solving systems of differential equations. Spline approximation, interpolation, finite element method. Fourier transforms, Laplace, Haar, etc. Numerical methods of wavelet analysis.

7. Computational experiment

The principles of the computational experiment. Model, algorithm, program.

8. Algorithmic languages

Introduction to high-level programming languages. Application packages.

Mathematical modeling methods

9. Basic principles of mathematical modeling

Elementary mathematical models in mechanics, hydrodynamics, electrodynamics. The versatility of mathematical models. Methods for constructing mathematical models based on the fundamental laws of nature. Variational principles of constructing mathematical models

10. Research methods of mathematical models

Stability. Checking the adequacy of mathematical models.

11. Mathematical models in scientific research

Mathematical models in statistical mechanics, economics, biology. Methods for mathematical modeling of measuring and computing systems.

Reduction problems to an ideal device. Synthesis of the output signal of an ideal device. Checking the adequacy of the measurement model and the adequacy of the reduction results.

Models of dynamic systems. Special points. Bifurcations. Dynamic chaos. Ergodic and agitated. The concept of self-organization. Dissipative structures. Exacerbation modes.

Approximate topics of scientific research carried out in the department :

1. Ensuring the reliability of thermoelectric semiconductor devices during ultra-long operation using methods of physical and technological diagnostics .

2. Theoretical and numerical study of increasing the throughput of the system using the ME - SOA multi-electrode semiconductor optical amplifier in optical access networks .

9.4 Methodological materials defining the procedures for evaluating the results of mastering the educational program

Methodology for assessing the results of the state exam

Based on the results of the state exam, a score is given in accordance with the score - rating system adopted at the RUDN University (score / ECTS / RF score).

According to the results of the state exam, a graduate student can receive a maximum of 100 points. The score is determined based on the results of checking the student's written answer to the exam ticket and (if necessary) the quality of the postgraduate student's answers to additional questions from the SEC members. The mark received by the graduate by a nickname based on the results of the state exam is put on

the list of the state examination (by the chairman of the SEC) , in the minutes of the meeting of the SEC (by the secretary of the commission) and communicated to the student .

Methodology for evaluating the results of submitting a scientific report

For the efficiency and convenience of the work of the SEC members, it is recommended to provide them with a supporting document *"Worksheet for assessing the formation of competencies during the SEC"* , the form of which is given in Appendix 1.

In the process of hearing a scientific report, the members of the SEC give points for each of the above indicators. At the end of the presentation of the report, each of the members of the GEC summarizes all the assigned points.

The final assessment of the formation of competencies is an assessment given following the results of hearing a scientific report by all members of the SEC who attended the hearing . To determine the final grade, it is necessary to calculate and round off the arithmetic average of the grades given by all members of the state commission. In the event of any controversial issues, the chairman of the SEC has a casting vote.

The total score received by the graduate student based on the results of the presentation of the scientific report is put down in the examination sheet (by the chairman of the SEC) and in the minutes of the meeting of the SEC (by the secretary of the commission).

Attachment 1

<table>
<tr>
<td colspan="4" align="center">WORK SHEET
assessing the formation of competencies during the SFA</td>
</tr>
<tr>
<td colspan="2">Program of training:</td>
<td colspan="2" align="center">09.06.01. «Informatics and computer technology»</td>
</tr>
<tr>
<td colspan="2">Educational program (scientific specialty):</td>
<td colspan="2" align="center">05.13.18</td>
</tr>
<tr>
<td colspan="4" align="center"><u>System analysis, management and information processing</u> (technical sciences) (<u>Researcher . Teacher-researcher)</u></td>
</tr>
<tr>
<td>Full name of the member of the SEC:</td>
<td colspan="3"></td>
</tr>
<tr>
<td>Date:</td>
<td colspan="3"></td>
</tr>
<tr>
<td>Qualification test:</td>
<td colspan="3" align="center"><i>Scientific presentation</i></td>
</tr>
<tr>
<td>Full name of the graduate:</td>
<td colspan="3"></td>
</tr>
<tr>
<td colspan="2" align="center">Indicators for assessing the protection of GCW</td>
<td align="center">Maximum score</td>
<td align="center">Actual score</td>
</tr>
</table>

- compliance of the content of the scientific report with the approved SCW topic and the assigned task, clarity of the formulation of the goals and objectives of the research	20	
- the accuracy, originality and novelty of the in SCW results	10	
- the practical value of the completed SCW	10	
- style of presentation of a scientific report	5	
- compliance with the approved requirements for registration of the SCW	10	
- quality of presentation and report	10	
- the quality of answers to questions from members of the SEC	10	
- assessment of the scientific work of the graduate student by the supervisor (review))	10	
- assessment of the SCW by a reviewer (review)	10	
- availability of publications on the topic of work, certificates, awards, etc.	5	
Points total:	100	
SEC member's signature		