

MINISTRY OF SCIENCE AND HIGHER EDUCATION OF THE RUSSIAN FEDERATION
FEDERATIONS
Federal State Autonomous Educational Institution
higher education
NORTH CAUCASIAN FEDERAL UNIVERSITY

I APPROVE

Dean of the Faculty of Mathematics
and computer science named after
Professor N.I. Chervyakov, candidate
physical and mathematical sciences, associate professor
Grobova T.A.

**ASSESSMENT TOOLS FUND
for educational practice**

Scientific Research Work (obtaining basic research skills) / Научно-исследовательская работа
(получение первичных навыков научно-исследовательской работы)

Direction of training	02.04.01 Mathematics and Computer Science
Directionality (profile)	Training Program for Electronic Information
Year of commencement of studies	2026
Form of study	full-time
Implemented in a semester	3

Introduction

1. Purpose: The assessment toolkit is designed to provide a methodological basis for organizing and conducting ongoing assessments of the academic practice of Scientific Research Work (obtaining basic research skills) / Научно-исследовательская работа (получение первичных навыков научно-исследовательской работы). Ongoing assessment in this discipline is a systematic method of assessing students' knowledge, skills, and abilities. The objectives of ongoing assessment are to obtain initial information on the progress and quality of competencies acquired, as well as to encourage regular, targeted student work. This assessment is used to develop a certain level of competencies.

2. The FOS is an appendix to the educational practice program "Research work (obtaining primary skills in research work)

3. Developer: Maria Anatolyevna Lapina, Associate Professor of the Department of Computational Mathematics and Cybernetics.

4. An examination of the FOS was carried out.

Members of the expert group:

Chairman

Babenko M. G., Head of the Department of Computational Mathematics and Cybernetics

Members of the commission:

Peleshenko V.S., Associate Professor of the Department of Computational Mathematics and Cybernetics

Peleshenko T. A., Associate Professor of the Department of Computational Mathematics and Cybernetics

Representative of the employer organization Kornienko S. A., head of the branch department FSUE "Main Radio Frequency Center" in the Southern and North Caucasian Federal Districts districts

Expert opinion: the assessment tool fund complies with the educational program for the specialty 02.04.01 Mathematics and Computer Science, profile "Training Program for Electronic Information" and is recommended for ongoing monitoring of academic performance and midterm assessment of students.

5. The validity period of the FOS is determined by the period of implementation of the educational program.

1. Description of the criteria for assessing competence at various stages of its development, description of assessment scales

Competence(s), indicator(s)	Levels of development of competencies,			
	The minimum level has not been reached (Unsatisfactory) 2 points	Minimum level (satisfactorily) 3 points	Intermediate level (Fine) 4 points	High level (excellent) 5 points
<i>Competence: UK-2 is capable of managing a project at all stages of its life cycle.</i>				
ID-1 UK-2 As part of the project activities, it models the technological processes of creation and processing of materials taking into account economic factors and in accordance with the requirements of environmental and industrial safety ID-2 UK-2 Implements a new project into production and manages it at all stages of its life cycle	The technological process is modeled with gross errors or is absent. There is no cost-benefit analysis or it is performed incorrectly. Environmental and industrial safety requirements are ignored. The project does not contain new solutions and uses outdated technologies. The work does not correspond to the assignment, contains critical errors, and lacks a structured format. The project plan is missing or presented in an unsystematic manner. The project implementation is not carried out or is carried out with serious problems. There is no system for monitoring and analyzing performance indicators. The economic feasibility has not been worked out; there may be high	A simplified technological process has been developed; inaccuracies or the absence of some stages are possible. The cost-effectiveness analysis is presented superficially or partially. Only basic safety aspects are taken into account, and measures to reduce environmental impact are not presented. Standard technologies are used without any attempts to optimize or introduce new solutions. The project is partially completed; there are logical inconsistencies or calculation errors. The project implementation plan has been presented, but contains significant gaps. The project is	The technological process is designed correctly, but may contain minor flaws or insufficient detail. An analysis of economic efficiency is presented, but the calculations are not detailed in all aspects. Basic safety requirements are met, but minor omissions are possible. Modern technologies are used, but without significant innovations or optimizations. The project meets the basic requirements of the assignment, but may contain minor design or	The technological process has been developed with a high degree of detail, taking into account all key stages and factors. A detailed analysis of the economic efficiency of the process is presented, and cost and profitability calculations are carried out. The project meets the modern environmental and industrial safety

	risks of loss. There are no provisions for further development and scaling of the project. The project does not comply with regulatory requirements; there are critical errors in calculations, management and design.	undergoing implementation with difficulties and management problems are being observed. Benchmarks are not monitored sufficiently and data analysis is fragmented. A general cost-benefit analysis is presented, but a detailed economic justification is missing. Issues of further development of the project have not been worked out or are proposed in general terms. The project is partially completed; there may be errors in calculations, management or design.	calculation errors. The project is thoroughly planned, but with minor omissions in detail. The project is being implemented successfully, but management could be optimized to increase efficiency. Key indicators are monitored, but there may be shortcomings in the control system. The economic feasibility of the project is presented, but may require more detailed calculations. Development paths for the project are being considered, but without in-depth consideration of scalability. The project complies with the main regulatory requirements, but there may be minor design flaws.	requirements and takes into account measures to minimize the negative impact on the environment. Modern technologies and approaches to material processing are used, and process optimization elements have been introduced. The project fully complies with the assignment and is designed in accordance with established standards. A detailed project implementation plan is presented, taking into account
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				all key aspects (goals, objectives , resources, risks, deadlines) . The project was successfully implemented at all stages of the life cycle using modern management methods. A performance evaluation system has been implemented, ensuring timely monitoring of key performance indicators. Reasonable calculations of costs, profitability and potential profit are presented. Possibilities for further
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				development and improvement of the project were taken into account, and scaling strategies were proposed. The project fully complies with technical, economic and legal norms and is designed in accordance with established standards.
<i>Competence: UK-3 Able to organize and manage the work of a team, developing a team strategy to achieve the set goal</i>				
ID-1 UK-3 Manages the production activities of employees ID-2 UK-3 Prepares and presents presentations of plans and results of personal and team activities	There is no clear distribution of responsibilities and there is chaos in the work. Planning is absent or is carried out formally, and control over implementation is minimal. The management is ineffective, there is a lack of motivation and control over employees. Emerging problems are ignored or not resolved in a timely manner.	There are gaps in the distribution of responsibilities and coordination of employees. Planning is underway, but there are significant deviations from deadlines and insufficient control. management is at a basic level and employee motivation is weak. Problems are resolved with delays or not in	Responsibilities are distributed, but minor shortcomings in work coordination are possible. The work plan has been drawn up and is being implemented, however, minor deviations from the schedule are possible.	Employee responsibilities are clearly distributed, and effective coordination of work is ensured. A detailed work plan was developed and implemented, including

	Production processes are not optimized, which can lead to significant losses of time and resources. Production activities are carried out with serious violations of regulatory requirements. The presentation does not have a clear structure, and the sequence of information delivery is chaotic. The main aspects of the topic are poorly covered or absent, and the materials are poorly prepared. The slides are overloaded with text, unreadable, or poorly formatted. The speaker reads the text without expression, does not use intonation, and makes many hesitations. There is no interaction with the audience and the material is presented formally. There is a lack of coordination within the team; speakers do not coordinate information with each other. Either he doesn't answer questions, or he does so uncertainly, with mistakes and deviations from the topic.	full. There is no systematic approach to improving efficiency and reducing costs. Production activities are carried out with violations; there are organizational and regulatory shortcomings. The presentation has a weak structure, and the logic of presentation is broken in places. Only the main aspects are presented, important details or evidence base are missing. The slide design contains too much text, poor color combinations, or sloppy elements. The report is read monotonously, there may be frequent hesitation and a lack of expressiveness. Interaction with the audience is minimal, the performance is more like a monologue. During a team presentation, there is a lack of coordination among the speakers and an uneven distribution of roles. Answers to	Management is good, but there may be minor problems with staff motivation. Problems are resolved in a timely manner, but minor delays or shortcomings in the process are possible. Basic efficiency improvement methods are applied, but the optimization potential is not fully realized. Production activities comply with basic standards, but minor omissions may occur. The presentation is logically structured, but there may be some minor flaws in the logic of presentation. The basic information is presented, but some aspects may be covered superficially. The presentation design is generally high	deadlines, resources, and milestones. Modern methods of personnel management are successfully applied, and employee motivation is ensured. Problems arising in the production process are quickly and effectively resolved. Strategies to improve labor efficiency and minimize costs are applied. Production activities are organized in full compliance with regulatory requirements. The presentation is
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		questions from the audience are given with difficulty, uncertainty or deviation from the topic are possible.	quality, but there may be some text overload or minor visual flaws. The speaker presents the material confidently, but slight hesitation or monotony of speech is possible. There are attempts to interact with the audience, but they are not always effective. There is interaction between speakers, but there may be inconsistency or uneven distribution of roles. Generally answers audience questions, but some answers may not be detailed enough.	clearly structured and contains a logical sequence of presentation of the material. All key aspects of the plan or performance results are presented and reliable data is used. The slides are professionally designed, the graphics are discreet, the fonts are legible, and the color scheme is not overloaded. The speaker presents the material confidently and clearly, uses expressive means of speech,
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				and maintains eye contact. The presentation is accompanied by explanations, examples, and may include questions for the audience or interactive elements. During a team presentation, the speakers are coordinated, roles are distributed logically, and interaction within the team is well-coordinated. Confidently answers questions from the audience, demonstrating an understanding of the topic and the ability to
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				argue their point of view.
<i>Competence: OPK-1 Capable of finding, formulating and solving current and significant problems in applied and computer mathematics</i>				
ID-1 OPK-1 Finds and formulates significant problems of applied and computer mathematics. ID-2 OPK-1 knows and uses methods for solving significant problems of applied and computer mathematics.	Identifies unimportant or irrelevant issues. The analysis is superficial or non-existent, and there is no attempt to put the problem into context. The argumentation is weak or completely absent. Either does not use scientific sources or refers to unreliable data. Completely absent, the topic is addressed without any new perspective. Poorly versed in mathematical methods, uses them inappropriately or with gross errors. Selects inappropriate or outdated methods to solve problems. Unable to solve a problem or makes critical errors. Cannot explain his choices, applies methods without understanding their essence. Does not own modern software or refuses to use it. Works mechanically, without analyzing or adapting methods to the task.	Identifies the problem, but it may be minor or not urgent enough. The problem statement is not clear enough or contains inaccuracies. The analysis is superficial, without sufficient consideration of the context and existing research. Explains the problem, but the arguments are poorly supported by facts or examples. Relies on a limited amount of material and sometimes uses unconfirmed or outdated data. There is no original approach; the problem is treated in a formulaic manner. Familiar with the methods, but uses them without full understanding. Sometimes it chooses a less efficient solution method, which leads to additional calculations or errors. Solves problems, but there may be errors in calculations or	Identifies important issues, but there may be minor flaws in the choice of topics. Formulates the problem correctly, but may use redundant or insufficiently precise formulations. Analyzes the problem, but does not always cover all its aspects. Explains the significance of the problem, but the argumentation may not be deep enough. Uses scientific papers and articles, but may not have enough sources or may not have the most up-to-date data. Demonstrates unconventional thinking, but ideas are not always original or deeply developed. Has a command of	Identifies problems of important theoretical and practical significance in applied and computer mathematics. Formulates the problem clearly and correctly, using mathematical terminology and argumentation. Explores the problem in a broad context, taking into account modern research and practical aspects. Explains the significance of the problem in a well-

		algorithms. Explains the choice of method superficially, without comparison with alternatives. Uses mathematical software but does not use its advanced features. Uses standard methods without trying to optimize solutions.	the basic methods for solving problems in applied and computer mathematics, but may make minor errors. Generally selects an appropriate method, but sometimes does not consider more effective alternatives. Solves problems correctly, but may have difficulty working with non-standard cases. Can explain his choice, but the reasoning is not always complete or deep. Can work with mathematical programs, but does not use them to their full potential. Can offer unconventional solutions, but without deep research.	reasoned manner and provides examples of its impact on other areas. Based on scientific publications, modern research, and data from reliable sources. Offers an original or non-standard view of the problem, reveals new aspects. Demonstrates a strong command of modern mathematical methods, including analytical, numerical, and algorithmic approaches. Able to analyze a problem and select the optimal solution
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				taking into account the specifics of the task. Successfully applies methods in practice, achieving correct and substantiated results. Clearly explains why the chosen method is appropriate for solving the problem, compares alternative approaches. Proficient in specialized software (MATLAB, Python, Maple, etc.) and applies it in calculations. Offers original ideas for modifying or adapting methods
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				to solve complex problems.
<i>Competence: OPK-2 is capable of creating and exploring new mathematical models in the natural sciences, improving and developing concepts, theories and methods</i>				
ID-1_{OPK-2} Conducts research into new mathematical models in the natural sciences ID-1_{OPK-2} Develops new and improves existing concepts, theories and methods	Poorly oriented in the theoretical base and existing models. Unable to develop or adapt a mathematical model. Does not evaluate models or does so with gross errors. Applies methods incorrectly or does not use them at all. Doesn't see how mathematical models can be applied in the natural sciences. Either he doesn't know the math programs or he uses them incorrectly. Cannot provide convincing evidence to prove the correctness of his conclusions. Does not participate in scientific research and conferences. Not familiar with modern concepts, theories and methods. Incapable of formulating new scientific ideas. Does not introduce any changes to existing theories and methods. The ideas lack argumentation or contradict scientific principles. The developments have no practical value.	Familiar with basic mathematical models, but does not delve into their principles and rationale. Able to adapt existing models, but has difficulty developing new ones. Understands models but does not critically analyze them. Uses a limited set of methods and allows for inaccuracies in calculations. Applies models formally, without taking into account the real context. Knows basic software functions, but does not use advanced tools. Explains models superficially and does not always provide correct arguments. Works on scientific papers, but without significant contribution to research activities. Familiar with the basic concepts, but does not have a deep enough understanding of their relationship to contemporary scientific problems.	Has a good understanding of key models but may struggle with new concepts. Develops mathematical models, but without significant innovation or deep analysis. Evaluates models but does not always suggest effective improvements. Has a command of analytical methods, but applies them with minor errors or without sufficient depth. Can apply models to real-world problems, but does not always take into account all the nuances. Has knowledge of mathematical software, but does not use it to its full potential. Generally	Demonstrates a confident command of modern mathematical models applicable to the natural sciences. Develops and substantiates original mathematical models for describing natural phenomena and processes. Able to critically evaluate existing models, identify their limitations and suggest improvements. Uses modern mathematical methods, including numerical

	Does not have the necessary software. Does not participate in scientific discussions, conferences, or publications. Completely absent, only a template approach is used.	Makes minor modifications to existing methods, but does not formulate fundamentally new concepts. Improvements are minor or superficial, without serious analysis. There are errors or gaps in the logic of reasoning, the argumentation is weak. The proposed methods are difficult to adapt to real-world problems. Limited knowledge of specialized software, use of only basic functions. Rarely participates in conferences or publications, limiting himself to coursework or diploma theses. Uses standard approaches and does not show significant originality.	substantiates his work, but does not always use the most relevant or substantiated sources. Prepares scientific materials, but does not always actively participate in scientific events. Understands basic theories and methods, but does not always embrace the latest trends. Formulates new approaches, but they may require further refinement or clarification. Provides improvements to existing methods but does not make a significant scientific contribution. The ideas are clearly presented, but the argumentation may not be deep enough. New methods are applicable in practice, but there may be difficulties in adapting them.	analytical and statistical approaches. Demonstrates how a mathematical model can be used to solve real scientific problems. Uses specialized software (MATLAB, Python, Wolfram Mathematica, etc.) for modeling and analysis. Provides compelling evidence to support the model's validity, drawing on relevant research and data. Presents research results at conferences, seminars or in scientific articles. Demonstrates excellent
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			Has knowledge of the necessary software, but does not use it to its full potential. Presents his work, but publications or reports are limited to small studies. Demonstrates innovative thinking, but ideas require refinement or additional argumentation.	knowledge of current concepts, theories and methods, their history and modern development trends. Independently formulates and justifies new concepts, theories, or methods using a creative and scientifically sound approach. Able to critically analyze current scientific approaches and make meaningful improvements. The ideas developed are distinguished by their clarity, internal logic and well-reasoned
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				scientific validity. New or improved methods find application in real-world problems, as confirmed by examples and experiments. Proficient in mathematics, statistics and software for developing and testing new theories. Presents the results of the work in the form of publications, conference reports, and scientific discussions. Offers original solutions, goes beyond standard methods, and
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				formulate s new scientific hypotheses.
<i>Competence: OPK-3 is capable of independently creating application software based on modern information technologies and network resources, including domestically produced ones.</i>				
ID-1 OPK-3 Independently creates application software products ID-2 OPK-3 Knows and can find modern information technologies, including domestically produced ones, necessary for the creation of applied software products	Does not know programming languages or uses them incorrectly. The program does not start or does not perform its stated functions. The code is chaotic, unreadable and cannot be improved. Missing or implemented incorrectly. Ignores data protection and testing. There is a complete lack of documentation It is impossible to improve the program without rewriting it from scratch. Uses outdated or inappropriate tools. Cannot explain how the program works and what problems it solves. Not familiar with modern information technologies. Cannot find or analyze technologies, uses only already known tools. Incapable of selecting and implementing the required technology in software product development. Uses limited, outdated, or inappropriate tools. Does not evaluate technologies, uses them without understanding their features.	Understands basic concepts but uses a limited set of tools. The program performs basic functions, but has shortcomings, errors, or insufficient functionality. The code is unstructured, does not scale well, or is complicated by redundant solutions. Uses a database, but makes mistakes in organizing data storage. Tests the program manually but does not use automated testing. The program description is superficial or absent. Fixing bugs requires significant changes to the code. Works only with basic tools, avoids new technologies. The description of the program's operation is incomplete or not clear enough. Familiar with some modern tools, but poorly aware of their relevance. Can find	Proficient in basic programming languages and technologies, but sometimes makes minor mistakes. Creates functioning software, but it may need some improvement or optimization. The code structure is logical, but may not be the most efficient or flexible. Uses a database, but does not always optimize queries or data structure. Knows the basics of testing and security, but applies them selectively. Describes the main aspects of the program's operation, but the documentation may be incomplete. Makes corrections and changes, but this requires significant effort. Uses modern tools, but does not always master new	Proficient in modern programming languages (Python, C++, Java, etc.), libraries, and development tools. Independently develops and brings to operational status application software, including user interface, data processing and logic. Designs a competent software architecture, taking into account the principles of modularity, scalability, and performance.

		information, but is not always able to evaluate its reliability and applicability. Uses technology, but is often limited to basic capabilities. Works with a limited set of tools and avoids learning new ones. Selects technologies intuitively, without deep analysis.	technologies. Can explain functionality, but does not always justify technical solutions. He understands modern information technologies, but does not always know the latest updates. Finds the necessary technologies, but does not analyze them in depth. Uses found tools, but does not always fully exploit their capabilities. Works with multiple languages and frameworks, but may avoid complex or new tools. Keeps up with new technologies, but is not always actively involved in professional communities.	Confidently uses relational and non-relational databases (MySQL, PostgreSQL, MongoDB, etc.). Implements vulnerability protection, writes tests (unit testing, integration testing), and creates clear and structured documentation for users and developers. Can upgrade the product, implement new features and fix bugs. Well-versed in modern information technologies, including domestic and foreign developments. Confidently and
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				quickly finds the necessary technologies, analyzes their advantages and disadvantages. Able to select and effectively use tools for creating application software products. Proficient in various programming languages, libraries, frameworks, cloud services, and DevOps tools. Knowledge of domestic IT products (OS, databases, development platforms) and the ability to adapt them to specific tasks.
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Competency assessment criteria *

An "excellent" grade is awarded to a student if the Technological Process is developed with a high degree of detail, taking into account all key stages and factors. A comprehensive analysis of the process's economic efficiency is presented, along with cost and profitability calculations. The project meets current environmental and industrial safety requirements, and measures to

minimize negative environmental impacts are considered. Modern technologies and approaches to materials processing are utilized, and process optimization elements are implemented. The project fully complies with the assignment and is designed in accordance with established standards. A detailed project implementation plan is presented, addressing all key aspects (goals, objectives, resources, risks, and deadlines). The project was successfully implemented throughout all stages of the life cycle using modern management methods. A performance evaluation system is implemented, ensuring timely monitoring of key performance indicators. Reasonable cost, profitability, and potential profit calculations are presented. Potential for further development and improvement are considered, and scaling strategies are proposed. The project fully complies with technical, economic, and legal regulations and is designed in accordance with established standards. Employee responsibilities are clearly defined, and effective coordination is ensured. A detailed work plan, including deadlines, resources, and milestones, has been developed and implemented. Modern HR management methods are successfully implemented, and employee motivation is ensured. Any issues that arise in the production process are quickly and effectively resolved.

Strategies for improving work efficiency and minimizing costs are employed. Production activities are organized in full compliance with regulatory requirements. The presentation is clearly structured and follows a logical sequence. All key aspects of the plan or performance results are presented, using reliable data. Slides are professionally designed, with discreet graphics, legible fonts, and a minimalist color scheme. The presenter presents the material confidently and clearly, uses expressive language, and maintains eye contact. The presentation is accompanied by explanations and examples, and may include questions for the audience or interactive elements. During team presentations, speakers are coordinated, roles are logically distributed, and teamwork is smooth. Confidently answers audience questions, demonstrating an understanding of the topic and the ability to argue their point of view. Identifies problems of significant theoretical and practical significance in applied and computer mathematics. Formulates the problem clearly and correctly, using mathematical terminology and argumentation. Explores the problem in a broad context, taking into account modern research and practical aspects. Explains the significance of the problem in a well-reasoned manner and provides examples of its impact on other areas. Draws on scientific publications, modern research, and data from reliable sources. Offers an original or innovative perspective on the problem, identifying new aspects. Demonstrates confident use of modern mathematical methods, including analytical, numerical, and algorithmic approaches. Can analyze a problem and select the optimal solution method, taking into account the specifics of the task. Successfully applies methods in practice, achieving correct and justified results. Clearly explains why the chosen method is appropriate for solving the problem and compares alternative approaches. Proficient in specialized software (MATLAB, Python, Maple, etc.) and applies it in calculations. Offers original ideas for modifying or adapting methods to solve complex problems. Demonstrates confident use of modern mathematical models applicable in the natural sciences. Develops and substantiates original mathematical models to describe natural phenomena and processes. Able to critically evaluate existing models, identify their limitations, and suggest improvements. Utilizes modern mathematical methods, including numerical, analytical, and statistical approaches. Demonstrates how a mathematical model can be used to solve real-world scientific problems. Employs specialized software (MATLAB, Python, Wolfram Mathematica, etc.) for modeling and analysis. Provides compelling arguments for the correctness of the model, relying on current research and data. Presents research results at conferences, seminars, and in scientific articles. Demonstrates an excellent knowledge of current concepts, theories, and methods, their history, and current development trends. Independently formulates and substantiates new concepts, theories, or methods, applying a creative and scientifically sound approach. Can critically analyze current scientific approaches and make significant improvements. Developed ideas are clear, logical, and scientifically sound. New or improved methods are applied to real-world problems, as supported by examples and experiments. Proficient in mathematical,

statistical, and software tools for developing and testing new theories. Presents work results in the form of publications, conference reports, and scientific discussions. Offers original solutions, goes beyond standard methods, and formulates new scientific hypotheses. Proficient in modern programming languages (Python, C++, Java, etc.), libraries, and development tools. Independently develops and finalizes application software, including the user interface, data processing, and logic. Designs a sound software architecture, taking into account the principles of modularity, scalability, and performance. Confidently uses relational and non-relational databases (MySQL, PostgreSQL, MongoDB, etc.). Implements vulnerability protection and writes tests (unit testing, integration testing). Creates clear and structured documentation for users and developers. Can modernize the product, introduce new features, and fix bugs. Is well-versed in modern information technologies, including domestic and international developments. Confidently and quickly identifies necessary technologies and analyzes their advantages and disadvantages. Ability to select and effectively use tools for developing applied software products. Proficient in various programming languages, libraries, frameworks, cloud services, and DevOps tools. Knowledge of domestic IT products (OS, databases, development platforms) and the ability to adapt them to specific tasks.

A "Good" grade is awarded to a student if the Technological Process is designed correctly, but may contain minor flaws or insufficient detail. A cost-benefit analysis is presented, but calculations are not comprehensive in all aspects. Key safety requirements are considered, but minor omissions are possible. Modern technologies are used, but without significant innovations or optimizations. The project meets the key requirements of the assignment, but may contain minor flaws in presentation or calculations. The project is thoroughly planned, but with minor omissions in detail. The project is being successfully implemented, but management could be optimized to improve efficiency. Key performance indicators are monitored, but there may be shortcomings in the control system. The project's economic feasibility is presented, but more detailed calculations may be required. Project development paths are considered, but in-depth analysis of scalability options is not included. The project meets key regulatory requirements, but minor design flaws may exist. Responsibilities are assigned, but minor coordination gaps are possible. The work plan is developed and is being implemented, but minor deviations from the schedule are possible. Management is well-functioning, but there may be minor issues with staff motivation. Issues are resolved in a timely manner, but minor delays or omissions are possible. Basic efficiency improvement methods are applied, but the full potential for optimization has not been realized. Operations meet key standards, but minor omissions may occur. The presentation is logically structured, but there may be minor flaws in the presentation logic. The main information is presented, but some aspects may be superficial. The presentation design is generally high-quality, but text overload or minor visual flaws may occur. The presenter presents the material confidently, but minor hesitations or monotony are possible. There are attempts to interact with the audience, but this is not always effective. There is interaction between speakers, but there may be inconsistency or an uneven distribution of roles. Generally answers audience questions, but some answers may be insufficiently detailed. Identifies important issues, but there may be minor flaws in the choice of topics. Formulates the problem correctly, but may use redundant or insufficiently precise wording. Analyzes a problem, but does not always cover all its aspects. Explains the significance of the problem, but the argumentation may not be deep enough. Uses scientific papers and articles, but may not include enough sources or the data is not up-to-date. Demonstrates lateral thinking, but ideas are not always original or deeply developed. Has a command of basic methods for solving problems in applied and computer mathematics, but may make minor errors. Generally selects an appropriate method, but sometimes fails to consider more effective alternatives. Solves problems correctly, but may experience difficulty working with non-standard cases. Can explain their choices, but the argumentation is not always complete or deep. Is proficient with mathematical programs, but does not utilize them to their full potential. Can propose unconventional solutions, but without in-depth analysis. Familiar

with key models, but may have difficulty working with new concepts. Develops mathematical models, but without significant innovations or in-depth analysis. Evaluates models, but does not always suggest effective improvements. Proficient in analytical methods, but applies them with minor errors or insufficient depth. Can apply models to real-world problems, but does not always consider all nuances. Proficient in mathematical software, but does not utilize it fully. Generally provides rationale for their work, but does not always utilize the most current or well-founded sources. Prepares scientific materials, but does not always actively participate in scientific events. Understands basic theories and methods, but does not always embrace the latest trends. Formulates new approaches, but these may require further development or clarification. Improves existing methods, but does not make a significant scientific contribution. Ideas are clearly presented, but the argumentation may lack depth. New methods are applicable in practice, but adaptation may be difficult. Proficient in the necessary software, but does not utilize it fully. Presents their work, but publications or reports are limited to small studies. Demonstrates innovative thinking, but ideas require further development or additional argumentation. Proficient in basic programming languages and technologies, but occasionally makes minor errors. Creates functioning software, but it may require refinement or optimization. Code structure is logical, but may not be the most efficient or flexible. Uses a database, but does not always optimize queries or data structure. Knows the basics of testing and security, but applies them selectively. Describes the main aspects of program operation, but documentation may be incomplete. Makes corrections and changes, but this requires significant effort. Uses modern tools, but does not always master new technologies. Can explain functionality, but does not always justify technical solutions. Understands modern information technologies, but does not always stay up to date with the latest updates. Identifies relevant technologies, but does not analyze them in depth. Uses discovered tools, but does not always fully utilize their capabilities. Works with multiple languages and frameworks, but may avoid complex or new tools. Follows new technologies, but does not always actively participate in professional communities.

A "satisfactory" grade is awarded to a student if: A simplified technological process has been developed, possibly with inaccuracies or missing steps. The cost-benefit analysis is presented superficially or incompletely. Only basic safety aspects are considered, and measures to reduce environmental impact are not presented. Standard technologies are used without attempts at optimization or the introduction of new solutions. The project is partially completed, with logical inconsistencies or calculation errors. The project implementation plan is presented, but contains significant gaps. Project implementation is difficult, and management issues are observed. Benchmarks are not adequately monitored, and data analysis is fragmented. A general cost-benefit analysis is presented, but a detailed economic justification is missing. Further development issues for the project are not developed or are proposed in general terms. The project is partially completed, with possible calculation, management, or documentation errors. There are gaps in the distribution of responsibilities and employee coordination. Planning is underway, but there are significant delays and insufficient control. HR management is basic, and employee motivation is weak. Problems are resolved with delays or incompletely. A systematic approach to improving efficiency and reducing costs is lacking. Operational disruptions exist, with organizational and regulatory shortcomings. The presentation is poorly structured and logically structured in places. Only the main points are presented, with important details or supporting evidence missing. The slides are overloaded with text, with poor color combinations and sloppy elements. The presentation is monotonous, with frequent hesitation and a lack of expressiveness. Audience interaction is minimal, with the presentation resembling a monologue. During a team presentation, there is a lack of coordination among the speakers and an uneven distribution of roles. Answers to audience questions are difficult, with uncertainty or deviations from the topic possible. The problem is identified, but it may be secondary or not sufficiently relevant. The problem statement is insufficiently clear or contains inaccuracies. The analysis is

superficial, with insufficient consideration of context and existing research. The problem is explained, but the arguments are poorly supported by facts or examples.

Relies on a limited amount of material, sometimes using unconfirmed or outdated data. Lacks an original approach, and approaches the problem in a formulaic manner. Familiar with methods, but applies them without a full understanding. Sometimes chooses a less-than-effective solution method, which leads to additional calculations or errors. Solves problems, but errors in calculations or algorithms are possible. Explains the choice of method superficially, without comparing with alternatives. Uses mathematical software, but does not utilize its advanced features. Uses standard methods without striving to optimize solutions. Familiar with basic mathematical models, but does not delve into their principles and justifications. Able to adapt existing models, but struggles to develop new ones. Understands models, but does not critically analyze them. Uses a limited set of methods, allowing for inaccuracies in calculations. Apply models formally, without considering the real-world context. Familiar with basic software functions, but does not utilize advanced tools. Explains models superficially, not always providing correct arguments. Works on scientific materials, but does not significantly contribute to research. Familiar with basic concepts, but lacks a thorough understanding of their relevance to contemporary scientific problems. Makes minor modifications to existing methods but does not formulate fundamentally new concepts. Improvements are minor or superficial, without serious analysis. There are errors or gaps in logic, and the argumentation is weak. Proposed methods are difficult to adapt to real-world problems. Limited proficiency in specialized software, using only basic functions.

Rarely participates in conferences or publications, limiting themselves to coursework or theses. Uses standard approaches and shows little originality. Understands basic concepts but uses a limited set of tools. The program performs basic functions, but has flaws, errors, or insufficient functionality. The code is unstructured, scales poorly, or is complicated by redundant solutions. Uses a database, but makes errors in data storage organization. Tests the program manually, but does not use automated testing. The program description is superficial or absent. Bug fixes require significant changes to the code. Works only with basic tools and avoids new technologies. The program description is incomplete or not clear enough.

Familiar with some modern tools, but poorly aware of their relevance. Can find information, but is not always able to evaluate its reliability and applicability. Uses technology, but often limits themselves to basic capabilities. Works with a limited set of tools and avoids learning new ones. Chooses technologies intuitively, without in-depth analysis.

A student is given a "failing" grade if the Technological Process is modeled with significant errors or is absent. A cost-benefit analysis is missing or inadequate. Environmental and industrial safety requirements are ignored. The project lacks new solutions and utilizes outdated technologies. The work does not meet the specifications, contains critical errors, and lacks a structured presentation. The project plan is absent or presented in an unsystematic manner. Project implementation is either not ongoing or is characterized by serious problems. A performance monitoring and analysis system is lacking. The economic feasibility is poorly developed, and there is a high risk of loss. There are no provisions for further development and scaling of the project.

The project does not meet regulatory requirements; there are critical errors in calculations, management, and presentation. There is a lack of clear division of responsibilities, and work is chaotic. Planning is absent or perfunctory, and execution oversight is minimal. Management is ineffective, with a lack of motivation and oversight of employees. Emerging issues are ignored or resolved in a timely manner. Production processes are not optimized, potentially resulting in significant losses of time and resources. Production activities are conducted with serious violations of regulatory requirements. The presentation lacks a clear structure, and the sequence of information delivery is chaotic. Key aspects of the topic are poorly covered or missing, and the materials are poorly prepared. Slides are overloaded with text, unreadable, or poorly

formatted. The speaker reads without expression, uses poor intonation, and stutters frequently. There is no interaction with the audience, and the material is presented formally. The team lacks coordination, and presenters fail to coordinate information with each other. The speaker either does not answer questions or does so hesitantly, making mistakes and deviating from the topic. Identifies unimportant or irrelevant problems. Analysis is superficial or absent, with no attempt to consider the problem in context. Argumentation is weak or completely absent. Either does not use scientific sources or cites unreliable data. Completely absent, the topic is addressed without any new perspective. Poorly versed in mathematical methods, uses them inappropriately or with serious errors. Chooses inappropriate or outdated methods to solve problems. Unable to solve a problem or makes critical errors. Unable to explain their choices, applies methods without understanding their essence. Lacks knowledge of modern software or refuses to use it. Works mechanically, without analyzing or adapting methods to the task. Lacks knowledge of programming languages or applies them incorrectly. The program does not start or does not perform the stated functions. The code is chaotic, unreadable, and cannot be improved. Absent or implemented incorrectly. Ignores data security and testing. Documentation is completely lacking. The program cannot be improved without rewriting from scratch. Uses outdated or inappropriate tools. Unable to explain how a program works and what problems it solves. Unversed in modern information technology. Unable to identify or analyze technologies, using only familiar tools. Incapable of selecting and implementing the right technology in software development. Uses limited, outdated, or inappropriate tools. Fails to evaluate technologies, using them without understanding their specific features.

Assessment tools for educational practice
Scientific Research Work (obtaining basic research skills) / Научно-исследовательская работа (получение первичных навыков научно-исследовательской работы)

2.1. Tasks to assess knowledge gained in practice

Controlled competencies or their parts (competence code)	Formulation of the task	
UK-2 UK-3 OPK-1 OPK-2 OPK-3	Task 1	Develop proposals for the use in practical activities of the results obtained during the completion of educational assignments.
	Task 2	Study the mathematical model of the corresponding type.
UK-2 UK-3 OPK-1 OPK-2 OPK-3	Task 1	Apply algorithmic and software solution in the relevant field.
	Task 2	Apply mathematical modeling methods in the relevant field.
UK-2 UK-3 OPK-1 OPK-2 OPK-3	Task 1	Develop proposals for the use in practical activities of the results obtained during the completion of educational assignments.
	Task 2	Study the mathematical model of the corresponding type.
UK-2 UK-3 OPK-1 OPK-2 OPK-3	Task 1	Apply algorithmic and software solution in the relevant field.
	Task 2	Apply mathematical modeling methods in the relevant field.

2.2. Tasks to assess skills and abilities acquired in practice

Controlled competencies or their parts (competency code)	Formulation of the task	
UK-2 UK-3 OPK-1 OPK-2 OPK-3	Task 1	Develop proposals for the practical use of the results obtained during the completion of educational assignments, taking into account the specifics of the processes and phenomena being studied.
	Task 2	To study the mathematical model of the corresponding type and conduct a comparative analysis.
UK-2 UK-3 OPK-1 OPK-2 OPK-3	Task 1	Develop and implement an algorithmic and software solution in the relevant field.
	Task 2	Develop a mathematical model in the relevant area.
UK-2	Task 1	Develop proposals for the practical use of the results

UK-3 OPK-1 OPK-2 OPK-3		obtained during the completion of educational assignments, taking into account the specifics of the processes and phenomena being studied.
	Task 2	To study the mathematical model of the corresponding type and conduct a comparative analysis
UK-2 UK-3 OPK-1 OPK-2 OPK-3	Task 1	Develop and implement an algorithmic and software solution in the relevant field
	Task 2	Develop a mathematical model in the relevant field

3. Methodological materials defining the procedures for assessing knowledge, skills, abilities and (or) work experience, characterizing the stages of competence development

The procedure for completing the training *Research work* practices (acquiring basic research skills) includes the following stages:

- preparatory;
- functional-activity-based;
- final.

At each stage of the internship, ongoing monitoring of competency development is carried out. The tasks offered to the student allow them to test the following competencies: UK-2, UK-3, OPK-1, OPK-2, and OPK-3.

The assignments require mastery of competencies at different levels: basic and advanced . At the basic level, students are expected to use known methods and technologies to solve production problems, while at the advanced level, a heuristic approach to solving assigned production tasks is added.

When checking assignments, the following are assessed:

- consistency and rationality of task execution;
- quantity and quality of studies conducted;
- independent contribution to the range of issues studied.

When checking reports, the following are assessed:

- correctness of design;
- quality of the results presented;
- the quality of the presented graphic and tabular material.

When defending a report, the following are assessed:

- the student's proficiency in the material being presented;
- independence of judgment;
- the ability to make informed conclusions.