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REVIEWERS' REPORT

**ON THE RESULTS OF THE EXTERNAL EVALUATION
OF THE MASTER'S EDUCATIONAL PROGRAMME**

**Mechanics and Mathematical Modelling
in the field Mechanics and Mathematical Modelling**

**IMPLEMENTED IN
SAINT PETERSBURG STATE UNIVERSITY (SPBU)**

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Moscow – 2022

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GLOSSARY

Abbreviations

Abbreviation	Transcript
ECTS	European Credit Transfer System
GCM	Graduate competency model
GQW	Graduate qualification work
HEI	Higher educational institution
IMS	Integrated Management System
IQAS	Internal Quality Assurance System
USE	Unified State Exam ¹

Types of Competencies

Abbreviation	Transcript
GCC	General cultural competencies
GPC	General professional competencies
PAC	Professional applied competencies
PAcC	Professional academic competencies
PC	Professional competencies
UC	Universal competencies

¹ The Unified State Exam is an exam in the Russian Federation. It is in fact a series of exams every student must pass after graduation from school to enter a university or a professional college.

SUMMARY OF THE PROGRAMME

The educational programme «Mechanics and Mathematical Modelling» is implemented in the fields of studies Mechanics and Mathematical Modelling by St. Petersburg State University, by Hydroaeromechanics, Elasticity Theory, Theoretical and Applied Mechanics, Physical Mechanics Departments of the Faculty of Mathematics and Mechanics and leads to the award of the Master's degree. The programme is managed Elena Kustova, Professor of the Department of Hydroaeromechanics of St. Petersburg State University.

Place of the implementation – Russia, 199034, St. Petersburg, Universitetskaya nab., 7-9;

Actual address: Russia, 198504, St. Petersburg, Peterhof, Universitetskiy ave., 28;

Training period – 2 years;

Form of education – full time,

The year of the beginning of the implementation of the programme is 2011.

The number of academic hours in one credit (36 hours in one credit) meets the requirements of internal regulatory documents of the educational organization of higher education (clause 2.3 of the order of the first Vice-rector of 09.08.2018 No. 7828/1 "On approval of the Educational Standard of Higher Education of St. Petersburg State University" <https://spbu.ru/sveden/eduStandarts>).

The programme corresponds to the 7th level of the National (NQF)/European (EQF) qualification framework.

The programme is implemented in accordance with the following regulatory documents:

1. The Federal Law of the Russian Federation of December 29, 2012 No. 273. «On Education in the Russian Federation».

2. Federal Law of November 10, 2009 No. 259-FZ (effective as amended on March 8, 2015) “On Moscow State University named after M.V. Lomonosov and St. Petersburg State University.

3. Professional Standard 01.001 “Teacher (Teaching Activities in the sphere of Preschool, Elementary, Basic and Secondary General Education) (Preschool) Teacher)” approved by Order No.544H of the Ministry of Justice of the Russian Federation, dated 18.10.2013 (as amended on 25.12.2014 and 5.08.2016).

4. Professional Standard 01.003 “Teacher of Children and Adult Supplementary Education” approved by Order No.68H of the Ministry of Labour and Social Security of the Russian Federation, dated 11.02.2014.

5. Professional Standard 40.008 “Specialist in Arrangement and Management of Research and Development” approved by Order No.298H of the Ministry of Labour of the Russian Federation, dated 05.05.2018, as amended with Orders No.727H of the Ministry of Labour and Social Security of the Russian Federation, dated 12.12.2016.

6. Professional Standard 40.011 “Research and Development Specialist” approved by Order No.121H of the Ministry of Labour of the Russian Federation, dated 04.03.2014, as amended with Orders No.727H of the Ministry of Labour and Social Security of the Russian Federation, dated 12.12.2016.

The University has a license to conduct educational activities (<https://spbu.ru/openuniversity/documents/licenziya>) and state accreditation for the programme

August 05, 2027.

At the time of accreditation, 33 people are enrolled in the program.

On budgetary provisions	On a paid basis	On employers-sponsored basis
32	1	0

Online visit was carried out within the external assessment of the programme during the period from 26th till 27th September 2022.

Strength of the programme

1. The share of students with good scores based on the results of state qualification activities (national final exam and/or GQW defense (for three last years) is 100%.

2. The Programme graduates are capable of setting and solving theoretical and practical tasks in the sphere of engineering and mathematic simulation, as well as allied subject areas (from bioengineering to space crafts, from teaching mathematics and informatics at high school to development of custom-made software and experimental equipment). The Programme provides fundamental education in the sphere of mathematics and engineering and makes it possible to learn how to use scientific methods of engineering and mathematic physical process simulation. This can be supported with the results of direct competence assessment provided in this report. Students being interviewed show a sufficient level of competencies formed.

3. GQW's topics are based on requests from production entities and experimental work tasks being solved by the University's teachers. For instance, in 2022 in the course of the state final defense, defended GQWs were dedicated to: «Computer Simulation of Water Nonstationary Flow in a Channel with Obstacles»; «Temperature and Temporal Effects of Liquid Media Cavitation»; «Continuous Main Pipeline Durability Simulation». All master programme GQW's topics are to be agreed by employers' representatives (e.g., Institute for Machine Science of RAS) and approved at the meetings of Study Methodical Commission's for the Mathematics area of study.

4. GQW results are used in production companies. For instance, in 2022 in the course of the national final qualification, defended GQWs were dedicated to: «Computer Simulation of Water Nonstationary Flow in a Channel with Obstacles»; «Temperature and Temporal Effects of Liquid Media Cavitation»; «Continuous Main Pipeline Durability Simulation». All master programme GQW's topics are to be agreed by employers' representatives (e.g., Institute for Machine Science of RAS) and approved at the meetings of Study Methodical Commission for the Mathematics area of study.

5. Students have opportunity to carry out research work using collective grants, to participate in youth project competitions, and to present papers at international conferences. There are external sources such as Russian Foundation for Basic Research (RFBR) and Russian

Scientific Foundation (RSF), Presidential grants and grants provided by the Government of Saint Petersburg. Research work can be also conducted via internal funding distributed on the basis of competition. Students take part in grants provided by RFBR and RSH as executors mostly.

6. Knowledge obtained may be used not only in the sphere of engineering and mathematic simulation, but also in development projects related to digital economy and other allied informational projects.

7. In the framework of this programme there is cooperation with leading national and foreign scientific centers, research and production organizations, and Russian production entities, which provides for an opportunity of successful subsequent employment. These may include the Institute for Machine Science of RAS, “Special Design Bureau of Electric Instrument Engineering” LLC, Saint Petersburg State Unitary Enterprise “Saint Petersburg Informational and Analytical Center”, “Mail.Ru Group”, LLC, “Sberbank Technologies”, GSC.

8. Programme graduates are highly demanded at scientific and educational organizations, both in and outside Russia.

9. The Programme development strategy is based on the region’s social and economic development strategy.

10. The Programme objectives are aligned with the regional labour market demands.

11. The Programme development strategy for 2022–2025 takes into account perspectives and needs of the regional, federal and local labour markets.

12. Employers actively participate in the analysis, engineering and implementation of the Educational Programme.

13. The Educational Programme is consistent with the labour market demands, Programme objectives, and employers’ opinions are considered in the course of formation thereof.

14. E-learning is used in implementation of the Educational Programme:

15. The Programme is aimed as a highly qualified specialist. It should be noticed that under the Educational Programme students learn courses that require self-writing a programme code for physical phenomena calculation and creation of a special calculation module, both with software languages (Python, C++,...), and open integrated platforms (OpenFOAM, SALOME,...). Skills obtained via these activities improve qualification of a future specialist allowing him/her to understand better specific features of computation mechanisms being used.

16. High publication activity of the higher education teaching personnel. 97% of teachers have published their scientific works in Russian magazines (323 articles) and foreign magazines (235 articles) through 2019–2022. Of them, 288 publications are included in databases’ magazines (Scopus, WoS).

17. Students take active part in the scientific activity. Eighteen students (55% of the total number of students under the Programme) mentored by the higher educational institution’s teachers received grants/scholarships from employers (including representatives of large organizations) and executive power bodies of Russia and other countries.

18. The group of teachers and scientific staff provide teaching in all fields of the modern engineering, as well as in interdisciplinary fields at the interface of chemistry, physics, biology, computation mathematics and other sciences.

19. The teaching staff of the Programme is involved in implementation of crucial innovative projects related to thin-walled design engineering, space craft dynamics, rotor dynamics, bioengineering, experimental aerodynamics, physical and chemical gas dynamics, multi-layer nanotube research, characteristics of shape memory materials, strongly nonequilibrium processes in non-homogenous and structured media engineering, etc.

20. Major attention is paid to creative R&D work and thorough material study based on the specialty selected.

21. Sufficiency of facilities and equipment for Programme implementation. Students learn allied programmes to solve tasks of theoretical engineering, aerohydrodynamics and solid mechanics (ANSYS, FLUENT, etc.) and create own algorithms and software for specific tasks of modern engineering using the cutting-edge equipment.

22. Operating experimental units at own laboratories, combining opportunities of theoretical and experimental approaches allow students studying comprehensively most complex problems of mechanics and being deeply involved in the scientific activity.

23. There is a great number of creative, entertainment and other non-academic events helping students to move forward in the all-way round manner, to adapt socially and to implement their creative potential.

24. Helping first-year students to adapt to the educational process and to communicate with other students making it easier to be involved comfortably into the learning process and faster for students under the Programme to adapt.

25. Helping students with financial and difficult life situations resulting in students getting timely and full support from the institution and being able to continue studying under the Programme, despite a difficult life situation.

26. There is a large infrastructure making the learning process comfortable and convenient.

27. There is a center of psychological help that provides for comprehensive psychological help to students, including students under the Programme, maintaining healthy atmosphere in groups.

28. Help in getting employed via various vacancy proposals by employers.

29. There is a great number of career aptitude events and arrangement of the Doors Open Days that increase recognizability of the University and the Educational Programme attracting more applicants.

30. Documents may be submitted online, students may submit documents to get enrolled to the Educational Programme, while being outside Saint Petersburg, thus, students not only from Saint Petersburg, but also from other cities of Russia, may be attracted, which increases internal academic mobility.

31. Attraction of most highly trained students via the incentive system that increases the general knowledge level of students under the Programme.

32. Rendering various help to foreign applicants upon enrollment and during study.

Weaknesses of the programme

1. The system of financial and nonfinancial motivation is almost not related to monitoring of the faculty's activity, but is based on the faculty being able to participate in internal and external competitions. This approach results in only 5% of the faculty being satisfied with the motivation system to the fullest extent; and less than a half (48%) of the teaching staff is generally satisfied with the HR policy.

Recommendations

1. It is recommended to specify the content of and to distinguish "Production Training (Research and Development)", "Educational (Introductory) Internship", "Educational Internship (Research and Development)", "Computer Technologies in Fundamental Studies" disciplines. To do this and for students to obtain independent professional work experience, production training (including the online mode) should be done at specialized third-party organizations.

2. More active works in the "Production Training" discipline would be more useful. It seems that in reference to this discipline, third-party entities are visited now mainly only by those students, who are planning to write their GQWs there. At the same time, making this procedure mandatory for all students enrolled in the Educational Programme could widen significantly their professional horizons, since this would let them learn work environment at organizations that use research output obtained at the University, and bring attention to those aspects, which must be taken into account, when the results obtained are applied in production, technologies and practice. Reflections could be made upon recommending all students to take up the short-term production training (no more than several weeks) at the end of the first semester of the Educational Programme, with mandatory visits to entities that are the University's partners, including industrial, field-specific, scientific and technological entities and sites, Russian military and industrial complex, etc.

3. It is recommended to pay attention to specification of "Educational (Introductory) Internship", "Educational Internship (Research and Development)" discipline parameters, especially regarding getting the final score. There is, probably no great point in asking students to prepare a report at the end of the first study semester, when major results have not been obtained. Don't forget that one of key objectives of these disciplines is getting experience by students in conduction of independent professional activities, and the practical training itself can be done not only as a part of the home assignment, but also at other sites such as educational and production facilities, laboratories, experimental and resource centers, and even at entities being practical training bases, etc.

4. The study load under commercial packages of physical and mathematic simulation and automated engineering systems, both foreign (ANSYS, Comsol, SolidWorks, etc.) and national (Компас (Compass), Логос (Logos), Fidesys, etc.), is recommended to be expanded, where possible. However, there are few free student license packages and associated limitations may put significant obstacles in the way of solving simulated physical tasks.

5. The system of collecting the required number of scores to get a final score may be reviewed as a tool that allows learning various disciplines effectively. However, such disciplines

as “Computer Technologies in Fundamental Studies” probably should have a mandatory component, namely, preparation and presentation of a paper work on a topic agreed, failure to do which would result in this course not being completed. Visiting by students of scientific seminars and conferences should be taken into account for sure; however learning how to present to the public own research results is one of the key aspects in training future graduates of the Educational Programme under review.

6. The faculty’s involvement in the Educational Programme development and update activities is recommended to be increased in general to ensure full understanding of objectives, tasks and the strategy of the Educational Programme. To do this, it is sufficient to hold regularly (once a year) an online-lecture covering description, characteristics and other parameters of the Education Programme.

7. It is essential to continue development of facilities and equipment for comprehensive implementation of e-learning into the educational process.

8. It is necessary to arrange the systemic work on formation and development of high-potential employees. During 5 recent years, only 3 members of the scientific and academic staff managed to take higher job positions. Individual ways of competence development must be elaborated for high-potential employees.

9. To improve the degree of teachers’ satisfaction with the motivation system, an open system considering results of various faculty’s activities must be developed.

10. Since many packages of physical and mathematic simulation and automated engineering systems are costly, and those must be studied by students to take up commercially programme packages, funding in this field must be increased for chairs to purchase necessary software license types (ANSYS, Comsol, SolidWorks Compass, Logos, Fidesys, etc.).

Additional information

During the online visit, students, teachers, employees, employers, and graduates were interviewed.

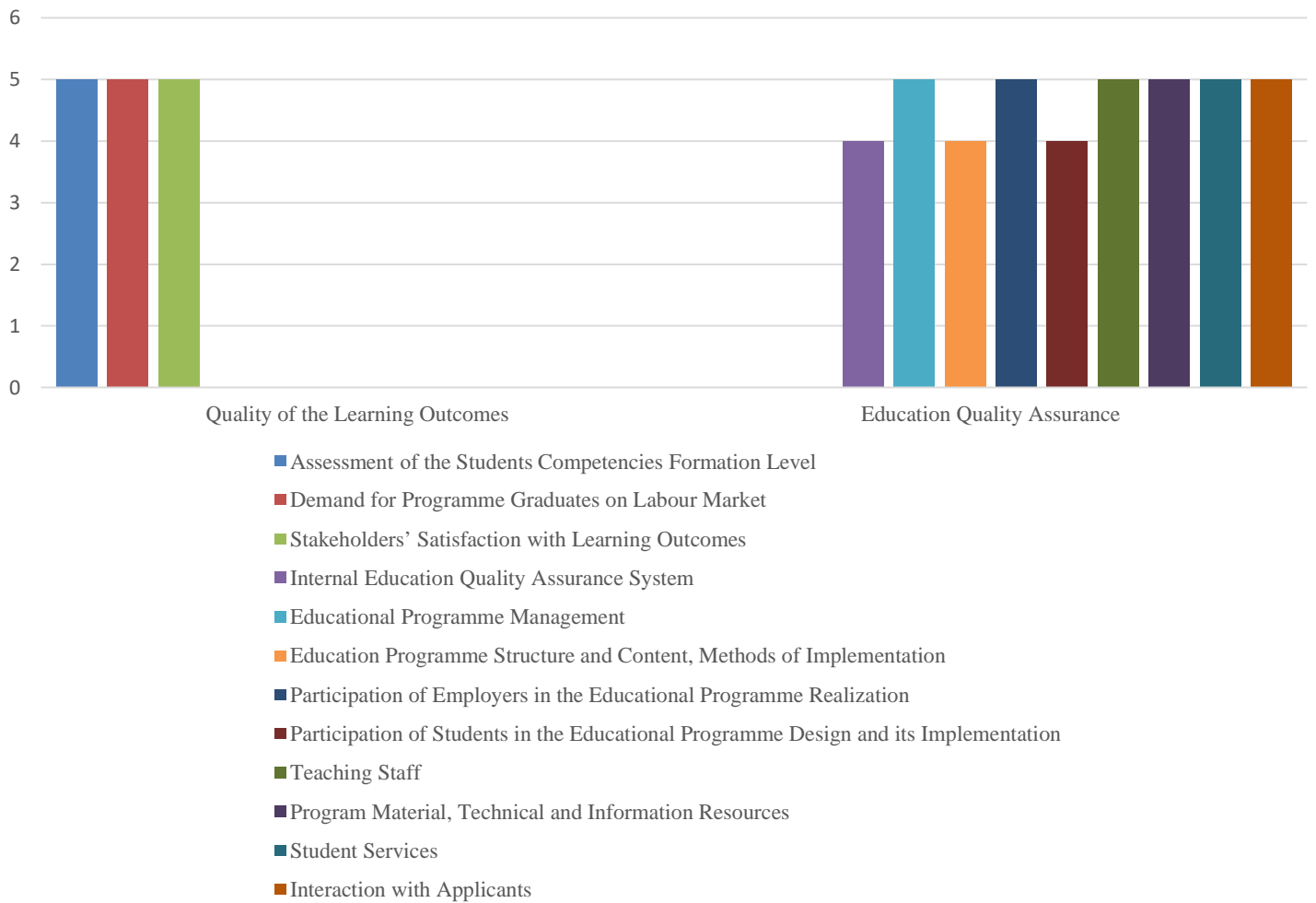
All participants in the educational process are informed about the objectives of the educational program and, as far as possible, participate in adjustments to achieve the goals set.

According to the results of the interview, experts conclude that conditions have been created in the University for the implementation of the educational program in accordance with the stated goals.

Assessment profile of the learning outcomes and education quality assurance

№	Criterion	Assessment	
I	<i>Quality of the learning outcomes</i>		
	1.	Assessment of the Students Competencies Formation Level	<i>excellent</i>
	2.	Demand for Programme Graduates on Labour Market	<i>excellent</i>
	3.	Stakeholders' Satisfaction with Learning Outcomes	<i>excellent</i>
II	<i>Education Quality Assurance</i>		
	1.	Internal Education Quality Assurance System	<i>good</i>
	2.	Educational Programme Management	<i>excellent</i>
	3.	Education Programme Structure and Content, Methods of Implementation	<i>good</i>
	4.	Participation of Employers in the Educational Programme Realization	<i>excellent</i>
	5.	Participation of Students in the Educational Programme Design and its Implementation	<i>good</i>
	6.	Teaching Staff	<i>excellent</i>
	7.	Program Material, Technical and Information Resources	<i>excellent</i>
	8.	Management of Human Resources, Material, Technical and Financial Resources of the Programme	<i>excellent</i>
	9.	Student Services	<i>excellent</i>
10.	Interaction with Applicants	<i>excellent</i>	

Assessment profile of the learning outcomes and education quality assurance



QUALITY OF THE LEARNING OUTCOMES

Criterion 1. Assessment of the Students Competencies Formation Level

Criterion assessment: *excellent*

Main characteristics of the programme

During online visit, a direct assessment of the graduate students' competencies was carried out. There were 6 second year students who participated in the direct assessment, which is 46% of the graduating course.

During the direct assessment of graduates, evaluation tools prepared by experts were used.

To analyze the development of competencies, the experts selected the following ones:

1. Assessment of general cultural (universal) competencies:

1.1. UC-1 A graduate is able to define the scope of tasks, to plan, to implement own project, including entrepreneur one, in the sphere of professional activities.

1.2. UC-2 A graduate is able to establish and maintain social and professional relationships considering legal consequences from the perspective of antipathy toward corrupt conduct and manifestation of extremism.

1.3. UC-3 A graduate is able to apply information acquisition and handling methods in the sphere of professional activities considering cutting-edge digital economy technologies, artificial intelligence and data science, as well as informational security.

2. Assessment of general professional competencies:

2.1. GPC-2 A graduate is able to develop new mathematic simulation methods in research and development activities.

2.2. GPC-3 A graduate is able to develop new experimental study methods and use cutting-edge equipment in the sphere of professional activities.

2.3. GPC-4 A graduate is able to use and create effective software means to solve engineering tasks.

3. Assessment of professional competencies (core competencies), including competencies that reflect the requirements of the regional and/or federal labor market, depending on the main consumers of program graduates:

3.1. PAcC-1 A graduate is able to apply physical and mathematic research methods in analyzing engineering issues based on the knowledge of fundamental physical and mathematic disciplines and computer sciences, as well as skills of scientific knowledge presentation in terms of issues and tasks.

3.2. PAcC-2 A graduate is able to conduct an independent analysis of a set task, to select a correct method to solve it, to make and implement an algorithm.

3.3. PAcC-3 A graduate is able to use and develop physical and computer models of real world objects and phenomena, environments, bodies and structures, and to use cutting-edge experimental equipment.

When assessing the quality of education, experts reviewed 8 graduate qualification works (GQWs), which is 100% of the last year's GQWs. The experts conclude that the reviewed GQWs meet the requirements stated below as follows:

GRADUATE QUALIFICATION WORK

№	Objects of assessment	Reviewers' comments
1.	The topic of GQW corresponds to the field of degree and the current level of development of science, equipment and (or) technology in the field of the program.	100%
2.	The tasks and contents of the GQW are aimed at confirming the competencies formation of the graduate.	100%
3.	The degree of use of the materials collected or received during the pre-graduation practical training and the preparation of term papers in the independent research units of the GQW.	100%
4.	The topic of GQW is defined by the requests of the industry organizations and the tasks of the experimental activity solved by the teachers of EI.	100%
5.	The results of GQW find practical application in the industry.	100%
6.	The degree of use of the results of the R&D of the Chair, faculty and third-party research and production and/or research organizations in the implementation of independent research parts of the GQW.	100%

Strengths:

1. The share of students with good scores based on the results of state qualification activities (national final exam and/or GQW defense (for last three years) is 100%.

2. The Programme graduates are capable of setting and solving theoretical and practical tasks in the sphere of engineering and mathematic simulation, as well as allied subject areas (from bioengineering to space crafts, from teaching mathematics and informatics at high school to development of custom-made software and experimental equipment). The Programme provides fundamental education in the sphere of mathematics and engineering and makes it possible to learn how to use scientific methods of engineering and mathematic physical process simulation. This can be supported with the results of direct competence assessment provided for in this report. Students being interviewed show a sufficient level of competencies formed.

Recommendations:

1. No.

Criterion 2. Demand for Programme Graduates on the Labour Market

Criterion assessment: *excellent*

Main characteristics of the programme

Analysis of the role and place of the programme

A specialist, who successfully completed the Educational Programme, has deep fundamental knowledge of engineering laws, knows how to use methods of complex engineering process mathematic simulation and ways of their computer and experimental processing. Such specialists are highly demanded at federal, regional and international labour markets.

The University conducts assessment of demand parameters using a number of direct and indirect methods:

- Student and graduate surveys.
- Employers' representatives taking part in commissions for relevance assessment of disciplines given and applicability of ways of teaching materials presentation.
- Employment aspect surveys of employers' representatives.
- Analysis of graduates' work results following short-term (up to 5 years) an long-term (over 5 years, including as future faculty colleagues and research associates) time periods.
- Work of specialized structural units involved in graduate employment and career development.
- The dialogue between the faculty and chair executives with scientific colleagues, scientific associates, representatives of industrial, field-specific entities and scientific and technological production sites, Russian military and industrial complex.
- Participation in scientific regional, federal and international seminars and conferences, presentation of paper works.
- Receiving grants, projects from various funds, contract conclusions (related to the University's activities and inter-disciplinary fields), performance of works.
- Publication of results in well-established scientific editions, including world's highly-rated magazines.

Analysis of the information indicators submitted by the university

More than 80% of graduates work in their degree fields, prevailing share of Programme graduates are employed with companies meeting their career expectations (over 57%). 29% and 14% of responders said they were unsatisfied or had difficulties with giving an answer, respectively. These numbers could probably be lower if older graduates were interviewed.

About 30 % of students receive job invitations under projects funded by scientific funds, getting positions of research assistants while still studying (by means of temporary or project employment). Here, for instance master's students Gabrielyan A. and Gimadiev V. are executors of RSF's projects. Master's student Gabrielyan A. was also an executor of the RFBR's project that was mutually implemented by Saint Petersburg State University and the Institute of Technical Acoustics (Vitebsk, Belarus).

Following completion of the study, more than 30% of graduates receive recommendations to proceed with research studentship with subsequent employment.

Average salary of a graduate immediately after graduation is RUB25,000. One year after completion of the Educational Programme, the salary is expected to increase to RUB40.000 and to RUB50,000.

Please note that these numbers are related not only with graduates' qualification, but also with availability of ongoing funded projects at the employer's entity. Where these are numerous, the share of employed graduates and the average salary are expected to be higher.

- The percent of students combining education at a university with work in the professional field – 28%. Since the study requires full-time attendance during 6 days a week, student employment is not a rational strategy of conduct. However, there are students, who are part-time employees on the temporary or project work basis.

- Percent of graduates who have successfully employed within one year after completing the programme – 80%.

- Percent of students working in their professional field in the region – more than 85%.

- Percent of students working in their professional field out of region – less than 15%.

- Percent of programmes graduates to the nationwide percent of graduates in this field– 30%.

Strengths:

1. Students have opportunity to carry out research work using collective grants, to participate in youth project competitions, and to present papers at international conferences. There are external sources such as Russian Foundation for Basic Research (RFBR) and Russian Scientific Foundation (RSF), Presidential grants and grants provided by the Government of Saint Petersburg. Research work can be also conducted via internal funding distributed on the basis of competition. Students take part in grants provided by RFBR and RSH as executors mostly.

Recommendations:

1. The results of assessment procedures conducted implicitly demonstrate that the Educational Programme graduates are highly qualified and are in demand at various organizations with a wide variety of activities. In this regard, the University's management is recommended to consider increasing the number of state-financed openings under the Educational Programme up to 18-20 places, since current 15 ones are insufficient.

Additional information

The Programme graduates have the whole spectrum of qualifications making them independent specialists demanded not only by scientific organizations in terms of the Programme fields, but also by production and scientific and technological entities, where implementation of their knowledge in allied sphere is essential.

Criterion 3. Stakeholders' Satisfaction with Learning Outcomes

Criterion assessment: *excellent*

Main characteristics of the programme

Share of employers who believe that the competencies of graduates of the programme:

- are substantially compliant with the professional requirements in the industry – theoretical knowledge 67%, practical knowledge 34%.
- mostly meet modern professional requirements in this industry with minor deficiencies – theoretical knowledge 33%, practical knowledge 33%.
- few graduates whose competencies meet modern requirements for specialists in this industry – practical knowledge 33%.

Percentage of graduates who are fully satisfied with the learning outcomes – 86%.

Strengths:

1. The program allows students to gain deep fundamental knowledge and skills. The knowledge gained can be used not only in the areas of mechanical and mathematical modeling, but also in the development of projects in the field of the digital economy and other applied information projects.

2. In the framework of this programme there is cooperation with leading national and foreign scientific centers, research and production organizations, and Russian innovational companies, which provides for an opportunity of successful subsequent employment. These may include the Institute for Machine Science of RAS, “Special Design Bureau of Electric Instrument Engineering” LLC, Saint Petersburg State Unitary Enterprise “Saint Petersburg Informational and Analytical Center”, “Mail.Ru Group”, LLC, “Sberbank Technologies”, GSC.

Recommendations:

1. No.

Additional information

The self-evaluation report provides information on the results of employers’ satisfaction with the quality of graduates training survey. The employers are generally satisfied with the quality of the training.

The Programme graduates are ready to professional work at R&D, design and engineering institutes, building industry, mechanical engineering, rocket and space industry, mass communication computerization means and other technical and natural science fields. Graduates may be involved in scientific research related to development and application of mathematic methods aimed at solving fundamental and allied tasks of natural sciences, engineering, economy and management. Graduates may become scientific associates, R&D specialists, experts in organization and management of R&D activities, and high and higher education teachers.

EDUCATION QUALITY ASSURANCE

Criterion 1. Internal Quality Assurance System

Criterion assessment: *good*

Main characteristics of the programme:

The Education Quality Monitoring Center of St Petersburg State University continuously monitors the quality of education (<https://spbu.ru/nauka/laboratorii-i-centry/centr-monitoringa-kachestva-obrazovaniya-spbgu>). It conducts a systematic and comprehensive collection of information on the quality of education at St. Petersburg State University among all participants in the educational process (students, lecturers, teaching and support staff) to provide them with data on the degree of success of educational activities and achievement of goals, including the programme under review.

Education quality monitoring of the program being accredited is performed by the Education Quality Control Commission (audit of syllabi, module, practice syllabi in terms of the Fund of Assessment Means and testing and assessment equipment) and quality teams created to carry out regular independent evaluation of education quality. Monitoring results are heard at the meeting of the Study Methodical Commission: education quality issues are discussed at each Study Methodical Commission's meeting, i.e. at least once a month. Educational Programme development issues, including education quality, are discussed at the meeting of the division's Academic Council and the Mechanics Educational Programme Council twice a year.

Method of collection and analysis of the educational process participants' feedback (administration members, teachers, students):

- Students survey to assess education quality;
- Survey of researchers, teachers and students regarding the degree of satisfaction with the content and conditions of the educational activity performance, educational environment comfortability at Saint Petersburg State University;
- Students survey about the quality of education received, employment and career development, as well as employers survey about whether the level of qualification of Saint Petersburg State University's graduates is consistent with modern labour market requirements;

The University has the complaint review procedure. Questions, proposals and complaints are submitted via the Virtual Reception at Saint Petersburg State University's website (<https://guestbook.spbu.ru/vse-obrashcheniya.html>).

Regular education quality monitoring results are provided to students (via the student board and meetings arranged between the Study Methodical Commission and students), teachers (by discussing monitoring results at divisions' meetings) and the management and administrative staff of the Educational Programme (via participation of the management and administrative staff members in the Study Methodical Commission's meeting, where monitoring results are discussed).

The Programme accreditation is performed for the first time.

Strengths:

1. The Programme development strategy is based on the strategy of the region's social and economic development that facilitates graduates to get their jobs in the region and be in demand at the local labour market.

2. The Programme objectives are consistent with the local labour market demands, in particular, participation of potential employers in the programme implementation reduces the adaptation period upon employment as graduates know necessary programme packages.

Recommendations:

1. To implement in full quality management system procedures to ensure consistent correlation of education results with labour market requirements; for this purpose, all participants of the educational process should be involved, and regular internal audit should be carried out to identify risks and to make decisions on minimization thereof.

2. To strengthen feedback with employers and graduates in order to improve competitiveness of graduates upon employment and adaptation to the professional environment. To do this, proposals regarding material (laboratory) and informational support improvement and inclusion in the academic plan of certain disciplines aimed at formation of professional competencies should be submitted based on the results of meetings with employers and graduates.

Criterion 2. Educational programme management

Criterion assessment: *excellent*

Main characteristics of the programme:

The programme development strategy

The Programme development strategy for 2022-2025 considers perspectives and needs of regional, federal and local labour markets, which are analyzed based on reports of federal and regional statistical services with involvement of specialists from the [Resource Center “Center of Sociological and Internet Research”](#) of Saint Petersburg State University. Positioning among other similar programmes in the region is done based on the results of student, graduate and employers' representative surveys, as well as based on recommendations of the Educational Programme Council.

Taking into account the strategist objective of training specialists capable of setting and solving independently theoretical and practical tasks related to engineering and mathematic simulation, as well as in allied fields, the programme development goals set for next 2-3 years are aimed at:

- alignment of academic disciplines' content with the requirements of Professional Standards “Specialist in Arrangement and Management of Research and Development” and “Research and Development Specialist”;
- considering perspectives of regional, federal and local labour markets development, based on the materials of the Annual Labour Forum, the international research-to-practice conference (Saint Petersburg State University is a co-organizer);

- considering field-specific market trends under the Strategy of Scientific and Technological Development of the Russian Federation (approved by Decree No.642 of the President of the Russian Federation “On the Strategy of Scientific and Technological Development of the Russian Federation”, dated December 1, 2016);

- considering labour market needs in mathematic simulation specialists in engineering and knowledge-intensive industries identified, also, based on graduates’ feedback, with the results to be discussed at the Study Methodical Commission’s meeting.

The Programme’s management carries out strategic planning and analyzes goals accomplished upon annual updating the Programme based on proposals of teachers, the Study Methodical Commission and the Educational Programme Council.

Creation of student population formation trends is taken into account in the work of Saint Petersburg State University’s structural units involved in applicant enrollment, as well as teachers’ participation in this work. For instance, a scientific coordinator took part in presentation of this Educational Programme during applicant-aimed events.

The programme management system

The Educational Programme management system is regulated with the Charter of Saint Petersburg State University, Study Regulations for main educational Bachelor, Specialist, Master and secondary vocational education at Saint Petersburg State University, local regulations.

The general programme management system includes the following key units:

- Dean of the Mathematic and Engineering Division – HR support and coordinating structural units’ activities at various levels;

- Chairman of the Study Methodical Commission – Programme implementation quality assurance, including teaching and learning materials;

- Research Coordinator of the Programme – research coordination of the Educational Programme, arrangement of academic and scientific works interaction, informing Educational Programme’s participants of perspective science and engineering development directions under the relevant scientific trend, performance of coordinating, consultative and analytical functions;

- Chairs’ Heads – agreement of pedagogic instructions;

- Educational Programmes ‘ Management – teaching and learning and documentation support of educational programmes, educational programme quality control;

- Academic management – support of the academic process, practices, control over adherence to unified rules, students’ status change, keeping personal records, etc.;

- Mechanics Educational Programme Council – elaboration of the Educational Programme Development Strategy.

Employers take part in analysis, design and implementation of the Educational Programme by following means:

- Participation in meetings of Educational Programme Councils:<https://spbu.ru/universitet/podrazdeleniya-i-rukovodstvo/sovety-obrazovatelnyh-programm/sovet-obrazovatelnyh-0>;

- inclusion to state examination boards of employers' representatives to perform independent evaluation of graduates' competencies;
- participation in academic and scientific programme events (conferences, workshops);
- participation in the work of the Study Methodical Commission.

Relevant services of Saint Petersburg State University, in particular, the Education Quality Monitoring Center, regularly hold student surveys regarding satisfaction with organization and conditions of the Saint Petersburg State University's educational activity; these surveys' results are analyzed and taken into account by the Educational Programme's management.

Representatives of the Student Board take part in the Study Methodical Commission's (regulated with the Study Methodical Commission's regulations) and the Division's Academic Council's activities (<https://spbu.ru/openuniversity/documents/sostav-uchenogo-soveta-matematiko-mehanicheskogo-fakulteta>). The Division' Dean regularly holds meetings with the Student Board's members.

All students interviewed confirmed that they were unable to influence on the content and parameters of disciplines (modules, practices) of the Educational Programme.

Mutual recognition of study periods is done according to the [Procedure of Enrollment to Higher Education Bachelor, Specialist and Master Programmes \(approved by Order No.1076 of the Ministry of Education of Russia, dated 21.08.2020, as subsequently amended\)](#).

Results of the study completed are credited based on the application of a student or his/her parents (legal representatives) of a minor student based on documents that evidence the study completed according to [Order on Approval of the Procedure of Credit by Saint Petersburg State University of Results of Completion of Academic Subjects, Course, Disciplines \(Modules\), Practice, Additional Educational Programmes of Saint Petersburg State University by Students](#).

According to [Convention on the Recognition of Qualifications Concerning Higher Education in the European Region](#), academic qualifications and supporting documents are recognized when states signed the Convention are involved.

Website

A general description of the programs, including the following information, is available on the official websites of the program:

- program objectives;
- level of education, form of education;
- qualification awarded based on the results of training;
- availability of state accreditation;
- programme description;
- curriculum;
- methodological or other documents developed to ensure the educational process;
- brief description of the disciplines taught;
- description of the practice;
- participation of employers in the design and implementation of the programme;

- number of budget places.
- material and technical support of educational activities, including information on the availability of equipped classrooms, facilities for practical classes, libraries, sports facilities, training, and education facilities.

The webpage is available in Russian language: <https://spbu.ru/sveden/education>.

There is an official page in social network (Vkontakte): <https://vk.com/mechspbu>.

Information on chairs implementing the Programme, including data on teachers, potential sites for production internship, graduate employment, etc., is posted at the website of the mathematic and engineering chair:

https://www.math.spbu.ru/rus/mechanics_chair.html.

Strengths:

1. Program development strategy for 2022-2025 takes into account the prospects and needs of the regional, federal, local labor markets.
2. Active participation of employers in the Educational Programme review, design and implementation making it possible to adapt it to the labour market requirements.

Recommendations:

1. It is recommended to improve students' feedback mechanisms in order to increase students' involvement with the Educational Programme management. To do this, regular (at the end of each semester) meetings with students, where they will be able to evaluate (via survey or interviews) the Educational Programme quality and disciplines studied and to suggest how same can be improved, including its individual components, should be held.

Criterion 3. Educational Programme Structure and Content, Methods of its Implementation

Criterion assessment: *good*

Main characteristics of the programme:

Compliance with labour market requirements, programme's objectives and consideration of stakeholders' opinions

The Programme is aimed at training specialists, who are able to set and solve independently engineering and mathematic simulation theoretical and practical tasks, as well as those in the allied fields. The competence-aimed educational programme is based on the concept of consistence of all of its structural components, i.e. the content, tests, learning materials, module topics, with stated competencies.

The Educational Programme is aimed at formation of competencies necessary to perform certain labour, job duties (certain labour, official, professional activities), it helps students to obtain not only universal, general academic, but also professional competencies developed on the basis of employment functions set forth in corresponding professional standards.

The following was considered in elaboration of the content:

– Federal State Higher Education Standard for Master’s specialty 01.04.03 “Engineering and Mathematic Simulation”;

professional standards:

– 40.008 “Specialist in Arrangement and Management of Research and Development” (Order No.86H of the Ministry of Labour of Russia, dated 11.02.2014) (registered in the Ministry of Justice of Russia No. 31696, dated 21.03.2014), as amended with Orders No.727H of the Ministry of Labour and Social Security of the Russian Federation, dated 12.12.2016 (registered by the Ministry of Justice of the Russian Federation No. 45230, dated January 13, 2017);

– 40.011 “Research and Development Specialist” (Order No.121H of the Ministry of Labour of Russia, dated 04.03.2014) (registered in the Ministry of Justice of Russia No.31692, dated 21.03.2014), as amended with Orders No.727H of the Ministry of Labour and Social Security of the Russian Federation, dated 12.12.2016 (registered by the Ministry of Justice of the Russian Federation No. 45230, dated January 13, 2017);

– “Teacher (Teaching Activities in the sphere of Preschool, Elementary, Basic and Secondary General Education) (Preschool) Teacher)” (Order No.544H of the Ministry of Labour and Social Security of the Russian Federation, dated 18.10.2013 (as amended on 25.12.2014) (registered by the Ministry of Justice of the Russian Federation No. 30550, dated 06.12.2013), as amended with Order No.1115H of the ministry of Labour and Social Security of the Russian Federation, dated 25.12.2014) (registered by the Ministry of Justice of the Russian Federation No. 36091, dated February 19, 2015) and Order No.422H, dated August 5, 2016 (registered by the Ministry of Justice of the Russian Federation No.43326, dated August 23, 2016);

– “Teacher of Children and Adult Supplementary Education” (Order No.298H of the Ministry of Labour and Social Security of the Russian Federation, dated 05.05.2018) (registered by the Ministry of Justice of the Russian Federation No. 52016, dated 28.08.2018).

The Educational Programme Council (EPC) takes part in generating the content of the Programme and includes leading Russian and foreign scientists and representatives of employers and professional communities. Relevance of Educational Programme professional competencies and a number of disciplines implementing such competencies are, among other, discussed at EPC’s meetings (<https://spbu.ru/openuniversity/documents/protokol-zasedaniya-soveta-osnovnoy-obrazovatelnoy-programmy-45>).

In the course of elaborating the content of the Educational Programme, employers are involved via:

- employers’ participation in the work of Educational Programme Councils;
- Inclusion of employers’ representatives in Study Methodical Commissions;
- foundation of State Examination Boards with employers’ representatives (at least 50% of members of State Examination Boards accounts for employers’ representatives);
- participation of employers’ representatives in the review of Saint Petersburg State University’s educational programmes, in particular, for conformity with professional standards and labour market requirements;
- participation of employers in elaboration of scientific research topics, subjects of students’ graduate qualification works;

– involvement of professional society’s representatives in teaching under the Educational Programme, production internship management, review of scientific and research projects and graduate qualification works of students.

The Fund of Assessment Means of the Educational Programme consists of:

1. The Fund of Assessment Means by disciplines (modules), practices;

- seminar and master class questions,
- round table/discussion/dispute/debate topics,
- group and (or) individual project topics,
- topics of compositions, reports, papers, GQWs,
- variants of test/quiz assignments,
- laboratory work, practical work assignments,
- exam papers, pass-fail test/exam assignment variants,
- tests,
- reports on completed production internships,
- other activities based on discipline (module) syllabis, and
- practical training.

2. The Fund of Assessment Means for state final examination.

- list of competencies with stages of their formation in the course of the Educational Programme learning, as well as competence indicators;
- description of competence evaluation parameters and criteria at different stages of formation thereof, assessment scale description;
- methodological materials defining education result assessment procedures for disciplines (modules), practical training, as well as the educational programme completion results.

In making up assignments for seminars and practical training, materials developed on the basis of real practical situations are used. As an example, the list for “Gas Dynamics Applied Tasks” discipline is provided below:

1. Classification of tasks of applied aerodynamics tasks: internal and external tasks, stationary and non-stationary flows. Review of experimental methods of solving applied gas dynamics tasks.

2. The concept of phenomena similarity and modelling. Similarity criteria. Dimension theory for various values. Dynamic similarity and phenomena simulation.

3. Specific characteristics of subsonic and supersonic body flow. Optimal aerodynamic bearing forms and air intake devices. Streams in contractors and diffusion cells. De Laval nozzle.

4. Turbulent streams. General characteristics of streams. Stream length parameter change. Homogenous gas subsonic stream. Supersonic isobaric jets. Overexpanded, underexpanded streams. Supersonic gas stream outflow from the non-adapted nozzle. Stream parameter calculation.

5. Ejector charts. Ejector work process. Gas ejector calculation. Critical work modes. Ejector lock. Ejector characteristics.

6. Two-phase media. Key characteristics. Gas disperse flows. Interaction of gas suspension particulate matter with the body surface.

7. Methods of flowing gas local heating for body aerodynamic feature alternation. Mechanisms leading to body flow alternation in case of local power supply.

8. Aerodynamic experimental methods. Permanent action aerodynamic tubes. Working part and nozzle of a supersonic tube. shock tubes.

9. Measurement error. Device own frequencies. Membranes. Inductive receivers. Strain-gauge indicators. Piezoelectric and capacitance transducers. Pickup calibration.

They are consistent with stated competencies, professional standards.

The Fund of Assessment Means for the Educational Programme is formed of the Fund of Assessment Means for certain disciplines posted in open access at the Saint Petersburg State University's website (<https://spbu.ru/sveden/education>).

Curricula

This Educational Programme provides for the full-time mode of study at Saint Petersburg State University. Curricula are annually verified by the Vice rector for Academic Affairs.

According to the [Higher Education Standard of Saint Petersburg State University](#), the Educational Programme may include studying based on individual educational paths that are perceived as a combination of disciplines (modules), practical training completed by a student considering specific features and (or) his/her educational needs, with the content and procedure to be established with the programme and the academic plan.

According to the Programme's characteristics, education is individualized by choosing elective disciplines (e.g. according to Order No.1443/1, dated 22.02.2022, the following disciplines are available for selection (optional) from five various discipline sets: [053192] Structure and Properties of Composites, [001325] Mathematical Modelling in Deformable Body Mechanics. Part 1, [001320] Additional Chapters of Deformable Body Mechanics. Part 1, etc.) and including in the educational programme of online courses (058059_Digital culture: technology and safety (EO), 060011_Language of effective communication in the digital community (online course), 060016_Business management (online course), 060018_Theory and practice of corrupt conduct and extremism manifestation counteracting (online course), 060019_Continuous studying modern issues (online course)). The procedure of elective discipline choosing is provided for in Chapter 2.1 of [Saint Petersburg State University's Study Regulations](#).

First-year students must submit an application for choosing elective disciplines covered with the curricula during the first two semesters, within two week following the beginning of the first study period; priorities should be specified via the Personal Account at the Saint Petersburg State University's portal.

The Programme's structure ensures its completion by students with various initial knowledge levels. The study plan includes a number of elective disciplines (e.g. those are specified in Order No.1443/1, dated 22.02.2022, in various parts of the first two study semesters and in other relevant orders on the curriculum approval) aimed at updating basic knowledge in corresponding mechanics fields, which if completed makes it possible for students with different initial knowledge level to become involved well with the study process.

Besides, the underlying activity under the Master's programme is R&D work to be carried out by each student individually. During such work a supervisor may adapt assignments for a student taking into account his/her initial level of knowledge.

Teaching and learning materials

The syllabus has been developed for each discipline included in the competence-oriented study plan. The Quality Control Commission (QCC) under the Study Methodical Commission for mathematics area of study performs audit of all syllabi related to Educational Programmes being implemented, twice a year. Based on the syllabi audit, the QCC elaborates recommendations for syllabi update.

Teaching and learning materials' content and structure are regulated with the discipline syllabus form.

Interaction between various structural units is regulated by Order No.13058/1, dated 24.12.2019 (<https://spbu.ru/file/45992/download?token=khR-XJ7f>), which sets forth work regulations of Study Methodical Commissions for particular areas of study (fields of specialization). This Order provides for functions of Study Methodical Commission's chairman; forms and procedure of Study Methodical Commission's meetings; forms of interested persons' applications to the Study Methodical Commission; procedure of registration, review and review terms of applications. The schedule of annual work of Study Methodical Commissions is also annexed.

Elaborated teaching and learning materials of disciplines correspond to internal normative documents of the University. Developed teaching and learning materials are consistent with the Programme objectives, which is evidenced with goals of syllabi related to disciplines covered by the Educational Programme curriculum.

Syllabi

Syllabi of various disciplines are reconciled for absence of repetitions of lesson topics. Distribution of academic disciplines of the study plan also corresponds to the logical sequence of their completion.

According to corresponding orders on approval of the competence-oriented curriculum and teaching and learning materials, each discipline of the curriculum is aimed at formation or development of one or several competencies of a graduate. The competence-oriented curriculum of the Educational Programme provides for which competencies are developed by a certain discipline. Teaching and learning materials contain relevant competencies achievement indicators.

General professional and special disciplines (professional cycle disciplines) include modern science, engineering and technological achievements in the field of study. This is demonstrated by:

1. Application of the modern Scientific Park of Saint Petersburg State University in the educational process.
2. Availability of relevant scientific literature in disciplines' syllabi.

3. Classes are conducted by teachers, who are executors under research projects and grants executors. State-of-the-art scientific, engineering and technological advances are used during such classes. For example, Istomin Vladimir, a developer of the discipline named Mathematic Modelling in Aerohydromechanics. Part 1: <https://gam.spbu.ru/staff/13-staff/52-istomin.html>

4. Subjects of research projects, term papers and GQWs are proposed based on ongoing R&D projects.

Following types of training are used in the educational process: discussions, debates, case method, lecture by two lecturers at the same time, lecture with pre-planned mistakes, analysis of real professional activity cases.

Lessons with application of interactive study methods:

- “Urgent Issues of Deformed Solid Body Mechanics” (pechkucha technologies, debates, discussions in foreign (English) language are used during lessons) – 30%;
- “Scientific Work Organization Fundamentals” (lectures in the form of a dialogue and discussion with the audience, consulting lectures, fulfillment of lab works) – 50%;
- “Special Urgent Mechanics Tasks. Part 1” and “Special Urgent Mechanics Tasks. Part 2” (workshops with students’ reports and subsequent discussion thereof with the audience – 60%.

Practices and final state examination

Teaching and learning materials of practical training are developed taking into account competencies formed during such training and are subject to review by the Study Methodical Commission that includes employers. The practice training is conducted via inclusion of students in R&D activities carried out at subdivisions of Saint Petersburg State University or partner organizations. Practical training assignments are elaborated based on the subjects of a research project and GQW of a certain student.

In the course of students’ interview it was revealed that students were unaware of that they had completed the production internship (R&D work), they also were unable to distinguish between educational internship types (introductory and R&D work).

General issues concerning state final qualification are regulated with the Study Regulations of Saint Petersburg State University.

State final examination for the Educational Programme being assessed is performed according to the study plan in the form of GQW defense. Requirements to the GQW’s structure, content and arrangement, GQW assessment methods and criteria are envisaged in orders on methodological support of state final examination for a certain year.

GQWs are defended in the presence of the State Examination Board consisting of employers and faculty members of Saint Petersburg State University (in particular, of the Division of Mathematics and Mechanics) according to methodological instructions set forth in the Decree of the First Prorector for teaching activities “On Constituting State Examination Boards in 2022” (https://edu.spbu.ru/files/2022/20220309_2023_1.pdf). The employer to faculty proportion in the State Examination Board for the Educational Programme is 50/50. The State Examination Board is established based on a recommendation of the State Final Exam coordinator for the

Educational Programme; a nominee of the State Examination Board's chairman is to be agreed on at the meeting of the Study Methodical Commission for Mathematics are of study and is approved by the Decree of the First Vice rector for Academic Affairs of Saint Petersburg State University on an annual basis.

GQWs are defended at the State Examination Board's open meeting, where at least two thirds of its members are present (subject to audio- and/video recording). State Final Examination is regulated by Decree Bo.5003/1 of the First Vice Rector for Academic Affairs of Saint Petersburg State University "On Approval of the State Final Examination Regulations in 2022", dated 29.04.2022 (https://edu.spbu.ru/files/2022/20220429_5003_1.pdf). Student evaluation decisions are made at the State Examination Board's closed meeting via secret ballot. If students have questions about scores assigned by the State Examination Board, its members provide their comments.

If a student disagrees with the defense procedure, he/she may file an appeal to be reviewed at the meeting of the Educational Programme Appeal Commission, which members are to be agreed on at the meeting of the Study Methodical Commission by the Decree of the First Vice rector for Academic Affairs of Saint Petersburg State University in the same manner as with the State Examination Board. The Educational Programme Appeal Commission's members for 2022 are approved by Decree No.5322/1 of the Vice Rector for Academic Affairs, dated 11.05.2022 (https://edu.spbu.ru/files/2022/20220511_5322_1.pdf). The work procedure of the Appeal Commission is regulated according to Order No. 5003/1 "On Approval of the State Final Examination Regulations in 2022", dated 29.04.2022 (https://edu.spbu.ru/files/2022/20220429_5003_1.pdf).

Students, who were assigned a failing grade for GQW defense, shall be expelled from the University on next day after GQW defense. State Final Examination can be repeated not more than twice and not earlier than in 10 months and not later than in 5 years following the State Final Examination a student failed.

Subjects of research projects and GQWs are fundamental and should be applicable in nature, are aimed at solving real scientific problems and allow evaluating the degree of professional competencies formation in the course of state final qualification. GQWs' subjects are to be agreed on by employers' representatives and to be approved at the meetings of the Study Methodical Commission for Mathematics area of Study.

In the course of GQW defense, members of the State Examination Board are suggested to give scores based on five criteria set forth in Order No.10310/1 of the First Vice Rector for Academic Affairs "On Methodological Support of State Final Examination in 2022 (BM.5506.*)", dated 27.10.2021 (https://edu.spbu.ru/files/2021/20211027_10310_1.pdf). Each of such criteria set forth in the Order is aimed at evaluation of a number of competencies, which a student must have based on the study results according to the competence-oriented study plan. Each criterion is assessed based on the algorithm provided in the Order, making it possible to evaluate completely the degree of a student's competencies formed.

GQW assessment procedure and criteria, as well as the procedure of State Final Examination are provided in Order No.10310/1 of the First Prorector for teaching activities of Saint Petersburg State University "On Methodological Support of State Final Qualification in

2022 (BM.5506.*)”, dated 27.10.2021. This Order is available at: https://edu.spbu.ru/files/2021/20211027_10310_1.pdf.

E-learning

Saint Petersburg State University Development Strategy up to 2030 is aimed at creation of management technologies that ensure cooperation in the educational and scientific activity both in Russia and internationally based on functioning of the informational environment that provide access to intellectual and informational resource of Saint Petersburg State University. This will give opportunities to use in the Educational Programme e-learning technologies and distant educational technologies.

E-learning implementation at Saint Petersburg State University is associated with several aspects.

1. Infrastructure and digital environment:

- unified university user accounts at enrollment to or employment with Saint Petersburg State University to have access to centralized informational systems.
- access based on unified user accounts to all digital resources of Saint Petersburg State University (e-mail, Blackboard, Delo document flow e-system, 1S, SAP, MS Teams to licensed electronic resources, etc.).
- informational and technical user support system, including registration of applications and incidents, setting up IT equipment in class rooms, labs, work places and remote access to the IT infrastructure.
- student’s personal account at Saint Petersburg State University, i.e. the informational service that combines all information related to events, activity results, possibilities (e.g. applications for personal scholarship, etc.);
- electronic schedule displaying event dates, beginning, end time and durations, study locations and other navigational information;
- Saint Petersburg State University’s Blackboard educational process support system, in which e-courses are created for all disciplines taught under all educational programmes with enrollment to e-courses of corresponding students, teachers and assistants.

2. Methodological support of e-learning:

- Faculty training to work in the Saint Petersburg State University’s Blackboard e-system and other electronic systems;
- Introductory training, instructions and consulting, access to interactive references;
- Teachers are provided with templates and reference samples (structure, scenario, control and measuring materials, menu, content examples, etc.) to form e-courses;
- Forum dedicated to methods of organization of e-learning at Saint Petersburg State University.

Content:

- Elaboration of specialized e-formats of learning materials;
- Arrangement of access to electronic libraries, archives and databases;
- Use upon choice of general university electronic online courses in the Saint Petersburg State University’s Blackboard system and on external online platforms;

- Availability of general university templates and corporate style components to develop electronic teaching materials.

In addition, the list of online courses (disciplines) of Saint Petersburg State University was made in execution of obligations under the agreement between Saint Petersburg State University and Moscow State University on cooperating in distant education provision, this list is posted at the official portal of [Saint Petersburg State University's electronic educational resources](#).

Starting from 2018 "Russian History" and "Digital Culture" online courses that are available at the Open Education Platform (developed by teachers of Saint Petersburg State University) were included in study plans.

Teachers involved in the educational process under the Educational Programme are oriented in their work at creation of electronic educational resources and electronic teaching and learning materials on disciplines, including presentations, lecture notes and assignments.

Strengths:

1. The Educational Programme is consistent with labour market requirements, Programme objectives, and employers' opinion is taken into account in its elaboration, which helps to update the Programme regularly based on the labour market requests.

2. E-learning is used in implementation of the Educational Programme:

- infrastructure and digital environment are available:

- e-learning methodological support is provided

- content is present:

Besides, in execution of obligations between Saint Petersburg State University and Moscow State University on cooperating in distant education provision, the list of online-courses (disciplines) of Saint Petersburg State University is posted at the University's official portal of electronic educational resources. Starting from 2018 "Russian History" and "Digital Culture" online courses that are available at the Open Education Platform (developed by teachers of Saint Petersburg State University) were included in study plans.

3. The Programme is aimed as a highly qualified specialist. It should be noticed that under the Educational Programme students learn courses that require self-writing a programme code for physical phenomena calculation and creation of a special calculation module, both with software languages (Python, C++,...), and open integrated platforms (OpenFOAM, SALOME,...). Skills obtained via these activities improve qualification of a future specialist allowing him/her to understand better specific features of computation mechanisms being used.

Recommendations:

1. It is recommended to improve mechanisms of communication with students to increase students' perception of the Educational Programme structure and content. To do this, regular (at the beginning of each semester) meetings with students aimed at clarification of the structure, content and results of discipline (module, practical training) study in the ongoing semester should be held.

2. The name of the discipline “Computer Technologies in Fundamental Studies” should be reflected in its content, ongoing control and intermediate assessment. After that each student’s academic practical training (introductory and research and development) content and intermediate assessment results must be controlled.

3. The study load under commercial packages of physical and mathematic simulation and automated engineering systems, both foreign and (ANSYS, Comsol, SolidWorks, etc.) national (Компас, Логос, Fidesys, etc.), is recommended to be expanded, where possible. However, there are few free student license packages and associated limitations may put significant obstacles in the way of solving simulated physical tasks.

4. More active works in the “Production Training” discipline would be more useful. It seems that in reference to this discipline, third-party entities are visited now mainly only by those students, who are planning to write their GQWs there. At the same time, making this procedure mandatory for all students enrolled in the Educational Programme could widen significantly their professional horizons, since this would let them learn work environment at organizations that use research output obtained at the University, and bring attention to those aspects, which must be taken into account, when the results obtained are applied in production, technologies and practice. Reflections could be made upon recommending all students to take up the short-term production training (no more than several weeks) at the end of the first semester of the Educational Programme, with mandatory visits of entities that are the University’s partners, including industrial, field-specific, scientific and technological entities and sites, Russian military and industrial complex, etc.

5. It is recommended to pay attention to specification of “Educational (Introductory) Internship”, “Educational Internship (Research and Development)” discipline parameters, especially regarding getting the final score. There is, probably no great point in asking students to prepare a report at the end of the first study semester, when major results have not been obtained. Don’t forget that one of key objectives of these disciplines is getting experience by students in conduction of independent professional activities, and the practical training itself can be done not only as a part of the home assignment, but also at other sites such as educational and production facilities, laboratories, experimental and resource centers, and even at entities being practical training bases, etc.

6. The system of collecting the required number of scores to get a final score may be reviewed as a tool that allows learning various disciplines effectively. However, such disciplines as “Computer Technologies in Fundamental Studies” probably should have a mandatory component, namely, preparation and presentation of a paper work on a topic agreed, failure to do which would result in this course not being completed. Visiting by students of scientific seminars and conferences should be taken into account for sure; however learning how to present to the public own research results is one of the key aspects in training future graduates from the Educational Programme under review.

Criterion 4. Participation of Employers in the Educational Programme Realization

Criterion assessment: *excellent*

Main characteristics of the programme:

Employers' involvement

The educational programme has been elaborated considering professional standards and employers' (professional societies') opinions on applicability of graduates' competencies and job functions in professional activity. Many employers actively help graduates to get employed, providing information on opportunities to take up R&D practical training with potential subsequent employment.

Employers are involved via participation in the work of Educational Programme Councils, inclusion in Study Methodical Commissions, in State Examination Boards (at least 50% of the number of members are employers' representatives), participation of employers' representatives in the review of the University's educational programmes for conformity with professional standards and labour market requirements; participation in elaboration of scientific research topics, subjects of students' graduate qualification works, involvement of professional society's representatives in teaching under the Educational Programme, production internship management, review of scientific and research projects and graduate qualification works of students. Most disciplines contain teaching materials developed on the basis of real cases and/or were provided by employers. These include laboratory and computation practical work assignments based on the materials of research work and desirable work on grants.

Interaction with employers

In addition to employers' participation in the student educational process under the Educational Programme, GQWs' subject and implementation issues, various tools of employers involvement in review, design and implementation of the Educational Programme itself are used:

- participation of employers in Educational Programme Boards' meetings;
- inclusion in State Examination Boards of employers' representatives to provide independent assessment of graduates' competencies;
- participation of employers in academic and scientific events of the programme (conferences, workshops);
- participation of employers in the Study Methodical Commission's activities.

Graduates' employment and GQWs

- Employers provide information on opportunities to take up R&D practical training with potential subsequent employment.
- Many employers actively help Educational Programme graduates to get employed due to high qualification of the latter.
- Research projects are regularly applied in practice at employers' organizations, since most research tasks to be solved by students under the Educational Programme are set by employers themselves.

Strengths:

1. Employers take active part in the Study Methodical Commission's works, including development, update and implementation of the Educational Programme: approval of GQWs' subjects, teaching and learning materials update, approval of study plans, etc.
2. Leading scientists, who are world's specialists, professors and RAS members, take part in implementation of the Educational Programme.
3. Employers arrange and provide sponsor support of scientific events (seminars, conferences), in which teachers and the Educational Programme students take part.
4. Educational Programme students receive grants/scholarships from employers and executive power bodies in Russia and abroad.
5. GQW results are used in production practice. For instance, in 2022 in the course of the state final examination, defended GQWs were dedicated to: «Computer Simulation of Water Nonstationary Flow in a Channel with Obstacles»; «Temperature and Temporal Effects of Liquid Media Cavitation»; «Continuous Main Pipeline Durability Simulation». All master programme GQW's topics are to be agreed by employers' representatives (e.g., Institute for Machine Science of RAS) and approved at Study Methodical Commission's meetings related to Mathematics area of study.

Recommendations:

1. To enter into target agreements with employers (these are agreements when employers pay for the students whom they later employ or who are already employed). 33 people were enrolled to the Programme when accreditation took place; no students are or have been enrolled to the target education programme during recent three years. Nonetheless, such enrollment to state-financed place under the Educational Programme area of study leading to an agreement with a state authority or entity would be useful for subsequent employment of graduates in their professional specialty and improve adjacent performance indicators of the Educational Programme.

Criterion 5. Participation of Students in the Educational Programme Design and its Implementation

Criterion assessment: *good*

Main characteristics of the programme:

Students' participation and impact on the educational process

No special measures to encourage students to contribute to the programme content and to arrange the educational process by chairs and the division are provided. Students are encouraged at the general university level. For example, students taking active part in the work of Student Boards receive extra scores in increased scholarship competitions, trip tickets to recreation sites, etc.

Students influence the educational process via participation of the Student Board's representatives in the Study Methodical Commission's work and the Academic Council activities.

During the interview, students said they were unable to influence on the content and parameters of a discipline (modules, practical training) of the Educational Programme.

Students' opinion on the degree of their influence on the educational process (based on a questionnaire):

- can influence decision-making - 71 %;
- can't influence decision-making - 9 %;
- find it difficult to answer – 5.9%.

Quality assessment of cooperation between students and the faculty is based on students' survey results, which along with the co-survey provided by the University demonstrated that students were generally satisfied with the quality of communication with the faculty:

The share of students who believe that:

- meetings with the scientific advisor are held regularly – 73%;
- it is difficult to arrange a meeting with the scientific advisor – 9%;
- a list of literature required for the study is provided – 100 %;
- the scientific research trajectory takes into account the wishes of the student – 82%;
- the scientific research helps to systematize the data, contributes to their collection – 73%.

In the Self-evaluation report, the difficulty of making an appointment with a supervisor is associated with the peculiarities of the organization of the educational process during the pandemic.

Collecting feedback

The survey of students is conducted by The Education Quality Monitoring Center (<https://spbu.ru/nauka/laboratorii-i-centry/centr-monitoringa-kachestva-obrazovaniya-spbgu>) 1-2 times a year. Based on the questionnaire, various data on student satisfaction are collected, for example:

Compliance with students' expectations

The percentage of students who evaluate the quality of education in this academic year when performing educational tasks as:

- very high level – 27 %;
- high level – 75.1%;
- average level – 27%.

The percentage of students who evaluate the content of the program to the expectations of students in this academic year as:

- very high level – 18 %;
- high level – 27 %;
- average level – 46 %;
- low level – 9%

Strengths:

1. Students' ability to influence on the educational process, since representatives of the Student Board take part in the Study Methodical Commission's work and the Academic Council's activities.

2. Most students (based on the survey results) evaluate education quality in this academic year in the course of fulfillment of study tasks as high (27%) and very high (46%).

Recommendations:

1. It is recommended to improve students' feedback mechanisms in order to increase students' involvement with the Educational Programme management. To do this, regular (at the end of each semester) meetings not only with the Student Board's representatives, but all students, where they will be able to evaluate (via survey or interviews) the Educational Programme quality and disciplines studied and to suggest how same can be improved, should be held.

Criterion 6. Teaching staff

Criterion assessment: *excellent*

Main characteristics of the programme:

General characteristics and involvement mechanisms

Based on the self-evaluation report, experts conclude that the faculty is highly qualified, in particular, it was noted that the degree of conformance of teachers' basic education to the nature of disciplines taught was 100%.

- are Ph.D. – 47 %;
- have an academic degree of Ph.D. from Russian university in the specialty profile – 44 %;
- are academicians/corresponding members of the Russian Academy of Education, the Russian Academy of Sciences, etc. – 7 %;
- have an academic degree of Ph.D. from foreign university in the specialty profile – 2 %.

Besides, based on the self-evaluation report, experts conclude that teachers with current practical experience teach disciplines under the Programme. The share of teachers involved in teaching field-specific disciplines and having work experience for last 3 years consistent with the specific character of the Educational Programme is 55%.

84% of teachers combine teaching with professional activities.

For example, Petrov Yu.V, the associate member of RAS, is a Chief Scientific Officer at the Institute for Machine Science of RAS, Professor Freidin A.B. is the head of the department at the Institute for Machine Science of RAS. All associate professors and professors carry out R&D work based on grants and contracts.

Also, based on the self-evaluation report, the experts draw a conclusion about the acceptable level of awareness of teachers about the goals of the program:

- the share of teachers who clearly formulate the goals of the program - 33%;

- the share of teachers who formulate the goals of the program vaguely, but know where to read about the program's objectives - 52%;

- the share of teachers who are not aware of the goals of the program - 15%.

Research work

Based on the self-evaluation results and distant visit results, experts conclude that the faculty is highly involved with scientific activities.

High publication activity of the higher education teaching personnel. 97% of teachers have published their scientific works in Russian magazines (323 articles) and foreign magazines (235 articles) through 2019–2022. Of them, 288 publications are included in databases' magazines (Scopus, WoS).

For example:

- Shakurova, L., & Kustova, E. (2022). State-specific boundary conditions for nonequilibrium gas flows in slip regime. *Physical Review E*, 105(3) doi:10.1103/PhysRevE.105.034126

- Selyutina, N., & Petrov, Y. (2022). Structural-temporal peculiarities of dynamic deformation of layered materials. *Materials*, 15(12) doi:10.3390/ma15124271

- Belyaev, F. S., Evard, M. E., & Volkov, A. E. (2022). Effect of plastic deformation on the martensitic transformations in TiNi alloy. *Smart Structures and Systems*, 29(2), 311-319. doi:10.12989/sss.2022.29.2.311

The share of teachers, who took part in scientific conferences in Russian and abroad as invited lecturers (for 3 last years) was 22%. Examples of events:

Freidin A.B. Kinetics and stability of chemical reaction fronts in solids within a chemical affinity tensor framework. Публикация: Book of abstracts L International Conference "Advanced Problems in Mechanics", June 20-24, 2022, St. Petersburg, Russia. St. Petersburg, 2022. – 91с.

Bauer S.M. Corneal Eye Shell Deformation Following Intravitreal Injections. Publication: XVth All-Russian School "Mathematic Simulation and Biomechanics in the Modern University", May 26-31, 2021, Divnomorskoe, the Russian Federation. Rostov-na-Donu: South Federal University PH, 2021 – 128 p.

Kustova E.V. Relaxation processes in CO₂ and bulk viscosity. Публикация: 63rd Course of the International School of Quantum Electronics COLD PLASMAS: FUNDAMENTALS AND APPLICATIONS, September 08-14, 2019. *Physics of Fluids*, 2019. V. 31, N 4.

Tikhonov A.A., Chebyshev P.L. and Russian mathematic school as a phenomenally successful project following reforms in science and education. Publication: Professor Forum 2021 "Science and Technologies in the 21st Century: Trends and Perspectives", September 27-30, 2021, Moscow, the Russian Federation.

Freidin A.B. PROPAGATION AND STABILITY OF STRESS-AFFECTED CHEMICAL REACTIONFRONTS IN SOLIDS. Публикация: Book of abstracts of 25th International Congress of Theoretical and Applied Mechanics (ICTAM 2021), August 22- 27, 2021, Milan.

Three international and all-Russian scientific conferences were arranged by teachers at University's facilities in 2019-2022:

– All-Russian Scientific Conference for Informatics Problems. List 2019, April 23-26, Saint Petersburg;

– All-Russian Scientific Conference for Informatics Problems. List 2022, April 27-29, Saint Petersburg;

– International Scientific Conference on Mechanics “IX Polyakhovskiy Readings), March 9-12, 2021, Saint Petersburg.

The share of teachers taking part in the Educational Programme students' scientific work (as a supervisor of term papers, graduate qualification works) is 13%. For example, RAS Professor Petrov Yu.V., Professor Kustova E.V., Professor Filippov S.B., who are supervisors under research projects and GQWs.

Students are attracted to research projects based on the Study [Rules](#) for educational programmes implemented at Saint Petersburg State University by means of comprehensive notification of contemporary problems for study, involvement in research work at the Division of Mathematics and Mechanics and the possibility to apply competences acquired in practice.

Besides, many grant applications for research work funding require participation of young members of the scientific community in implementation of scientific projects. In this regard, students are actively involved in the work under research projects.

10% of teachers, who take part in the Educational Programme implementation, are supervisors of scientific workshops and groups actively visited by students (65% of the total number of Educational Programme students). For example, Associate Professor Kuteeva G.A. is the head of a group for theoretical mechanics Olympiad training. Educational Programme students actively participate in conferences. The share of students, who participated in the Programme-specific conferences (for last 3 years) supervised by the teacher involved in the Programme implementation, was 56%. Examples of events:

Ganrielyan A.Kh. Isothermic Thermoelastic Martensite Transformation in TiNi-based Alloys: Mechanisms and Effects of Martensite Nonelasticity. Publication: The Fourth International Conference “Shape Memory Alloys”. Moscow. September, 13-17, 2021. Thesis Collection. – M: National Research Technological University Moscow Institute of Steel and Alloys, 2021, - 100 p.

Karachaeva N.V. H.B. Variable Area Rod Vibrations. Publication: Works, IX Polyakhovskie Readings. Saint Petersburg. March 9-12, 2021. SpB: BBM PH, 2021. – 471 p.

Krylova A.S. A.C. Deformation of Cribriform Area of Retinal Papilla under Unclassical Shell Theories. Publication: Works, IX Polyakhovskie Readings. Saint Petersburg. March 9-12, 2021. SpB: BBM PH, 2021. – 471 p.

Educational Programme students, who under the mentorship of the University's teachers received grants/scholarship from employers (including representatives of large organizations) and executive power bodies in Russian and abroad, accounted for 18 people (55%). For example, Bondarenko S.O., personal scholarship of the UniChance Fund, Kuvyrchenko D.V., scholarship from AE GROUP LLC.

List of students received personal scholarships is given in Annex 25 of the self-evaluation Report.

Faculty's scientific project funding sources are external projects of scientific funds (RSF, RFBR), Presidential grants, grants of the Government of Saint Petersburg, as well as research internally funded.

Internally funded research is performed by way of participating in competition. Information on competitions is posted in open access at [Saint Petersburg State University's portal](#). Main criteria and requirements are follows: inter-disciplinary character of research, publication of research project results in leading scientific editions (indexed in Web of Science Core Collection or Scopus).

Three international and all-Russian scientific conferences were arranged by teachers University's facilities in 2019-2022:

- All-Russian Scientific Conference for Informatics Problems. List 2019, April 23-26, Saint Petersburg;
- All-Russian Scientific Conference for Informatics Problems. List 2022, April 27-29, Saint Petersburg;
- International Scientific Conference on Mechanics “IX Polyakhovskiy Readings), March 9-12, 2021, Saint Petersburg.

12% of “Engineering and Mathematic Simulation” Educational Programme's students took part in these conferences.

Strengths:

1. High publication activity of the teaching staff. 97% of teachers have published their scientific works in Russian magazines (323 articles) and foreign magazines (235 articles) through 2019–2022. Of them, 288 publications are included in databases' magazines (Scopus, WoS).

2. Students take active part in the scientific activity. Eighteen students (55% of the total number of students under the Programme) mentored by the higher educational institution's teachers received grants/scholarships from employers (including representatives of large organizations) and executive power bodies of Russia and other countries.

3. The group of teachers and scientific staff who are involved in study programme realization have knowledge in all fields of the modern engineering, as well as in interdisciplinary fields at the border of chemistry, physics, biology, computation mathematics and other sciences.

4. The teaching staff of the Programme is involved in implementation of crucial innovative projects related to thin-walled design engineering, space craft dynamics, rotor dynamics, bioengineering, experimental aerodynamics, physical and chemical gas dynamics, multi-layer nanotube research, characteristics of shape memory materials, strongly nonequilibrium processes in non-homogenous and structured media engineering, etc.

5. Availability of operating scientific schools let students be actively involved in the research work. The School of Mechanics of Saint Petersburg – Leningrad – Saint Petersburg University was founded in the XVIIIth century, among other thanks to works of L.Euler (he worked in Saint Petersburg at the Abstract Mathematics Division in 1727 – 1741 and 1766 – 1783) and D. Bernoulli (he worked in Saint Petersburg at the Abstract Mathematics Division in

1725 – 1733). The first chair of analytical and practical mechanics was established at the University in 1863. Laboratories and scientific schools: <https://www.math.spbu.ru/rus/science.html>.

6. The main attention is paid to creative research work and in-depth study of the material in accordance with the chosen profile. In accordance with the curriculum, a significant part of the scientific research is assigned to practice, research and disciplines corresponding to the direction of study and chosen profile.

Recommendations:

1. It is recommended to increase the involvement of the teaching staff in the design and updating of the programme as a whole in order to fully understand the goals, objectives and strategy of the programme.

Criterion 7. Programme's Material, Technical and Information Resources

Criterion assessment: *excellent*

Main characteristics of the programme:

Material and technical resources

To implement educational programmes, all necessary facilities and equipment are available (library, including electronic educational resources, computers, equipment, including sports equipment and facilities, tools, hardware and software and audiovisual demonstration aids and other technical equipment and facilities); this makes it possible to provide all type of education for practical and R&D activities of students.

Classrooms and laboratories

Students have access to specially-equipped laboratories and specialized class rooms, equipped with technical educational means: displays, projectors, laptops. Personal unlimited access to electronic library system resources and other materials is provided for all students making it possible to implement educational programmes via electronic informational resources. Students and teachers are also provided with access to hardware and software resource centers of Saint Petersburg State University.

The WiFi network with Internet access is available in all class rooms of the University's Division of Mathematics and Mechanics, there are class rooms with Ethernet connection and with Ethernet sockets. Besides, e-resources are available in the local network if subscribed to at the Saint Petersburg State University's library. Internet access at the University is also provided in student hostels, where necessary VPN access to the university network may be arranged.

The Educational Programme is being implemented via, among other:

- Saint Petersburg State University's Science Park;
- Scientific Library named after M.Gorky (informational and library complex of Saint Petersburg State University's);
- Resources of Saint Petersburg State University's clinic;
- Saint Petersburg State University's collections;

- Access to the electronic informational and educational environment of Saint Petersburg State University's via informational and communication technologies;
- Necessary software licenses;
- Practice bases, including based on contracts with organizations;
- Educational labs;
- Class rooms and other facilities;
- Equipment and technical educational means;
- Other resources.

8 computer classes per 10-20 seats each have been arranged to implement the Educational Programme, the software is standard (Windows, MS Office, Acrobat Reader, antivirus, browser) and specialized: ANSYS, COMSOL, development environments, etc. There is a common file server, access to the library system of the University, Internet resources. The reading room in the library is equipped with Internet free access work places, where information can be loaded for students to get prepared for their classes.

Saint Petersburg State University's resource centers, including the Computation Center, can be used during practical trainings and working on graduate qualification works.

Informational resources

There is a branch of the Scientific Library named after M. Gorky (<https://library.spbu.ru/ru/o-biblioteke/otdely-sotrudniki.html#mat>) in the building of the Division of Mathematics and Mechanics; students also may access literature from any other branch. Access to all electronic licensed resources is open from all IP addresses of the Saint Petersburg State University's network (including Wi-Fi areas and hostel of Saint Petersburg State University). Access is also granted from any PC with Internet access (including home computers) using individual account, which all employees and students have.

Platforms and electronic educational resources

Saint Petersburg State University has specialized software for conferences, exams, tests to be held remotely, etc.: Blackboard, MSTeams, and specialized software (ANSYS, Comsol and др.).

Blackboard (<https://bb.spbu.ru/>) service, student's account (<https://my.spbu.ru>) provide students with necessary tools to make an individual study plan, to choose the subject of graduate qualification works and to control study performance.

Blackboard and MS Teams systems make it possible to carry out an exam in the form of a computer test, including for people with disabilities.

Delo e-system is used to support electronic document flow.

Blackboard and Microsoft Teams service allow teachers making teaching and learning materials, giving classes in remote mode.

Pure system is used to create electronic portfolios of faculty members and students.

Studying under the Educational Programme provides free access to the Saint Petersburg State University 's library system, i.e. to the Scientific Library named after M. Gorky – Main Scientific Library named after M. Gorky (<https://library.spbu.ru/ru/>).

Under the Open University concept implementation, almost all library resources are available in the online form. Here, work opportunities are listed on the corresponding section at the university's website, with electronic databases containing full-text documents, publications and funds of external library systems "Lan", "YouWrite", etc.

The following services are used in implementation of the Educational Programme:

- Student's personal account (<https://my.spbu.ru>);
- Electronic schedule displaying event dates, beginning, end time and durations, study locations and other navigational information;
- Teacher's personal account;
- [Sign up for disciplines \(spbu.ru\)](#).

In addition to computer classes with Internet access, there are 3 terminals with free access, where students may visit organization's official website, to look up class schedules, read the study plan and use resources of the Scientific Library named after M.Gorky, on the territory of the Division of Mathematics and Mechanics.

There is access to a Wi-Fi network throughout the territory of the University.

Strengths:

1. The sufficiency of the material and technical base for the implementation of the program. Students master application programs for solving problems of theoretical mechanics, hydroaeromechanics and elasticity theory (ANSYS, FLUENT, etc.) and create their own algorithms and programs for specific tasks of modern mechanics on the most modern computer technology.

2. Working at experimental facilities in their own laboratories, the combination of theoretical and experimental approaches allow students to comprehensively explore the most complex problems of mechanics, which allows them to plunge more deeply into scientific activity.

3. Open access to electronic informational resources for teachers and students allowing them to develop teaching materials and to study at any time at any place.

4. Availability and openness of current information on the university's structure, ongoing programmes, faculty, etc. This increases competitiveness of the programme making it more attractive for other universities' graduates.

Recommendations:

1. Development of the equipment and facilities for comprehensive implementation on e-learning into the education process must be continued; this includes individual work with electronic materials, the unified electronic educational environment, formation of the distributed user society, where common virtual academic and scientific activities are performed, technical and methodological support, and assurance of communication between remote learning participants.

Criterion 8. Management of Human Resources, Material, Technical, Information and Financial Resources of the Programme

Criterion assessment: *excellent*

Main characteristics of the programme:

Management of Human Resources

HR, equipment and facilities, informational and financial resources are controlled according to common university's rules and procedures adopted at Saint Petersburg State University. Main tool in making decisions concerning resource management is faculty's activities control that is based on student university surveys and reports containing information on most significant scientific study results.

Faculty's activities monitoring is carried out via general university student surveys, and reports containing information on most significant scientific study results. Employment contracts with faculty members involved in R&D work provide for an obligation to submit reports to subdivisions' supervisors (chair heads), which re-stated every year. In addition to general university student surveys, faculty members may obtain immediate feedbacks during individual consultations with students.

The system of financial and non-financial motivation is practically not related to monitoring the activities of the teaching staff, but is based on the ability of teaching staff to participate in internal and external competitions. This approach leads to the fact that only 5% of teaching staff are completely satisfied with the motivation system. And in general, less than half (48%) are completely satisfied with the personnel policy.

The level of qualification of teaching staff and opportunities for professional development

According to employment contracts, faculty members must regularly take up advanced training. Saint Petersburg State University provides the faculty with a possibility to take part in secondary education programmes. Strict requirements are set to employees planning to substitute positions related to scientific and pedagogical work, this ensures high qualification level of the faculty members of the Educational Programme.

Management of material and technical resources

98% of the teaching staff and 78% of the Management and administrative staff are fully satisfied with the quality of the conditions for the implementation of the program. While only 27% of students are fully satisfied. Class rooms and chair facilities are main material and technical resources of the programme.

Management of financial resources

The Programme is funded with Saint Petersburg State University's financial resources, which extent depends on student populations, faculty members and availability of necessary equipment and facilities. Scientific studies related to the field of the Programme under review are funded both via holding internal competitive procedures and external funding of R&D activities.

Faculty members initiate themselves participation in internal competitive procedures and external funding. Students take no part in formation of the Programme's budget.

Strengths:

1. High demands to qualification of teachers, involved in the Programme implementation.
2. Obtaining regular feedback from students via general university student surveys and meetings with active students.
3. Research project effective support system.

Recommendations:

1. It is necessary to build a systematic work on the formation and development of the personnel reserve. Over the past 5 years, only 3 employees from scientific and pedagogical workers have moved to higher positions. It is necessary to develop individual trajectories of competence development for employees from the personnel reserve.
2. To increase the level of teachers' satisfaction with the motivation system, it is necessary to develop an open system that takes into account the results of various types of teaching staff activities.
3. Since many packages of physical and mathematical modeling and computer-aided design systems require payment, and their usage is necessary for students to master commercial software packages, it is recommended to increase funding in this area in order for departments to purchase the necessary type of licenses for software products (ANSYS, Comsol, SolidWorks Compass, Logos, Fidesys, etc.).

Criterion 9. Student services

Criterion assessment: *excellent*

Main characteristics of the programme:

Student services

The employment center provides for a large number of career development both in state and private companies. Information on various types of internships, practical training, etc, is posted at the special website of Saint Petersburg State University (<http://edu.spbu.ru/stazhirovki-i-konkursy.html>). Students may fill in a CV, based on which employees from the practice and employment support department will offer a suitable vacancy

The digital environment is available at the university:

- unified university user accounts at enrollment to or employment with Saint Petersburg State University allow to have access to centralized informational systems.
- access based on unified user accounts to all digital resources of Saint Petersburg State University (e-mail, Blackboard, Delo document flow e-system, 1S, SAP, MS Teams to licensed electronic resources, etc.).

- informational and technical user support system, including registration of applications and incidents, setting up IT equipment in class rooms, labs, work places and remote access to the IT infrastructure.
- student's personal account at Saint Petersburg State University, i.e. the informational service that combines all information related to events, activity results, possibilities (e.g. applications for personal scholarship, etc.);
- electronic schedule displaying event dates, beginning, end time and durations, study locations and other navigational information;
- Saint Petersburg State University's Blackboard educational process support system, in which e-courses are created for all disciplines taught under all educational programmes with enrollment to e-courses of corresponding students, teachers and assistants.

Social and personal development

Creative skills may be fulfilled in theater unions, chorus, vocal practice rooms and groups. There are over 15 artistic clubs and practice rooms, including the Career Club, English Club, Theater Practice Room of Saint Petersburg State University, Chorus of Students of Saint Petersburg State University, Folklore Workshop, Jazz Vocal Group, Pop Vocal Workshop, Sport Dancing Club, Art Workshop, etc. (<https://students.spbu.ru/mmen-meroprijatija/tvorcheskie-kollektivny.html>)

There are also various educational events arranged outside the study plan: debates, additional classes, introductory lectures, etc.

Collective forms of education (group work on projects) are also used, leading to increased number of social and inter-personal relationships among students, improved closeness, common understanding and mutual aid, development of teamwork skills, teaching how to explain, listen and understand your dialogue partner, consider other persons' opinion, which in turn make communication skills of students better and increases their responsibility for formation of interpersonal relationships in a group.

Adaption events

The Head of the Field-Specific Educational Division, the supervisor of the educational programme and chairs' representatives giving field-specific classes hold a meeting for first-year students aimed at consulting them on educational issues and aspects concerning choosing electives, a scientific coordinator, GQW subject, etc.

At the beginning of the study year, a various events are arranged for first-year student in the Division of Mathematics and Mechanics: Division Quest; First-Year Student's Day; Field-Visit of First-Year Students, which is a global complex of events held on one of the University's sites.

Volunteer Express Quest is arranged for first-year students in September by the Volunteer Center of Saint Petersburg State University (<https://students.spbu.ru/mmen-meroprijatija/6098-kvest-volonter-ekspress-dlya-pervokursnikov.html>).

Besides, students are offered to enroll to online courses "Adaptation and Learning at the University", "University Life. Corporate Ethics Fundamentals" (included in the study plan).

The University also has a psychological help center and the mentorship system is created for first-year students.

Equal rights

Saint Petersburg State University's students are provided with financial aid according to the [By-Law](#) on provision of financial aid to Saint Petersburg State University's students and the [By-Law](#) on scholarship procurement. Financial aid rendered to students covers:

- provision of meals at University's canteens at lower prices;
- payment for health resort treatment;
- targeted payments to students, who are orphans;
- targeted payments to students with disabilities and lower income students;
- trips to sports and recreation facilities (<https://spbu.ru/studentam/otdyh>);
- Vice-chancellor's, employer's scholarship and other bonuses (<https://students.spbu.ru/mmen-stipendii/stipendii.html>);
- travel privileges.

Saint Petersburg State University's students may receive education credits to pay for education, including state-funded education credit (with reduced credit interest rate) (<https://abiturient.spbu.ru/priem/bakalavriat/116>) and use the maternity (family) capital (<https://abiturient.spbu.ru/priem/bakalavriat/platnaya-osnova-obucheniya-4/ispolzovanie-materinskogo-semejnogo-kapitala-dlya-oplaty-stoimosti-obucheniya.html>).

Individual study plans and programmes may be developed for students with disabilities where necessary.

Strengths:

1. The presence of a large number of creative, entertaining and other extracurricular activities, which allows students to develop comprehensively, adapt socially and realize their creative potential.
2. Assistance to first-year students in adapting to study and interacting with other students, which contributes to a comfortable entry into the educational process, as well as accelerated adaptation of students to the programme.
3. Assistance to students who find themselves in a difficult financial and living situation, thanks to which students receive timely and full support from the University, and, in case of a difficult life situation, they can continue their studies at the programme.
4. The presence of a voluminous infrastructure that makes the learning process comfortable and convenient.
5. The presence of a psychological assistance center that provides comprehensive psychological assistance to students, including those studying in the programme, further maintaining a healthy atmosphere in groups.
6. Assistance in finding employment through the offer of various vacancies from employers

Recommendations:

1. It is recommended to group information on the page with vacancies, internships, competitions, etc., by the proposal type (vacancy, internship, career fair, team retreat, webinar, competition, etc.) and by various qualifications and education fields (groups of qualifications and education fields).

Criterion 10. Interaction with Applicants

Criterion assessment: *excellent*

Main characteristics of the programme:

Attracting Russian applicants

Applicants with best knowledge, scientific articles, presentations at conferences, etc., receive extra scores at enrollment to the Educational Programme (https://abiturient.spbu.ru/files/2022/mag/admission/01.04.03_Mechanika_i_matematicheskoye_modelirovaniye.pdf).

Saint Petersburg State University holds the following career events aimed at applicant attraction:

- Doors Open Day and online presentations of the educational programme (<https://abiturient.spbu.ru/priem/magistratura/2150#p1>);
- Applicant’s days (<https://spbu.ru/news-events/calendar/den-abiturienta-6>);
- a series of meetings “Digest of Enrollment to Saint Petersburg State University” (<https://abiturient.spbu.ru/digest>);
- Career test “Interest Identification” (<https://abiturient.spbu.ru/priem/bakalavriat/2163>).

Admission

Enrollment to Saint Petersburg State University in 2022 is regulated with Enrollment Regulations (abiturient.spbu.ru/files/2022/pravila_priema_2022.pdf). The procedure of recognition of individual accomplishments under the Master’s Educational Programme is provided in Annex 3 to Enrollment Regulations.

Medal winners, awardees of the following Olympiads receive extra scores upon enrollment: Open International Olympiad among students and young specialists “Petropolitan Science (Re)Search”; All-Russian Student Olympiad “I am Professional”; Olympiad of students and graduates “Higher League” (https://abiturient.spbu.ru/files/2022/mag/mag_ID_2022.pdf).

Students applying for the Master’s Educational Programme may submit electronic documents via the Personal Account of an applicant with scanned documents attached

<https://abiturient.spbu.ru/priem/magistratura/2905-podacha-dokumentov-cherez-epgu-posredstvom-superservisa-postuplenie-v-vuz-onlajn.html>).

No entrance tests are required per the Educational Programme.

Interaction with foreign students

The Commission for Admission of Foreign Citizens of the Admission Arrangement Office of Saint Petersburg State University is involved in rendering aid to foreign applicants.

A series of career online events “Information Meetings with Foreign Applicants of Saint Petersburg State University” is arranged in different languages at the University. University’s representatives tell about educational capabilities, specific nature of educational programmes and the procedure of enrollment of foreign citizens, stateless citizens and Russian citizens, who permanently reside abroad (<https://abiturient.spbu.ru/russkij/informatsiya-dlya-inostrannykh-grazhdan/protsedura-podachi-dokumentov/2645-informatsionnye-vstrechi-s-inostrannymi-abiturientami-spbgu.html>)

There are detailed video instructions at the admission commission’s page for foreign citizens, who enroll to openings funded with the budget of the Russian Federation (<https://abiturient.spbu.ru/russkij/informatsiya-dlya-inostrannykh-grazhdan/1736-byudzhetskaya-osnova-obucheniya.html>), as well as regarding agreements on paid education services (<https://abiturient.spbu.ru/russkij/informatsiya-dlya-inostrannykh-grazhdan/1737-dogovornaya-osnova-obucheniya.html>).

Foreign citizens may be also admitted to exchange programmes at Saint Petersburg State University for 1 semester / academic year under free exchange programmes based on the agreement between Saint Petersburg State University and a forwarding higher educational institution.

Saint Petersburg State University has:

- pre-study training division for foreign citizens (<https://www.precourses.spbu.ru/>).
- Russian language courses (<https://russian4foreigners.spbu.ru/ru/>) and the summer school of Russian as a foreign language (<https://russian4foreigners.spbu.ru/ru/education/summerschool.html>).

Saint Petersburg State University has the Club of Foreign Students; this is a community of students from all over the world, who will be happy to help you to adapt faster in Russia. A mentor is assigned to first-year foreign students and he/she must not only help them to adapt to the student life environment (study process and internal regulations), but also to new life conditions, different culture, traditions, climate, etc.

Strengths:

1. A large number of career guidance events and Open Days, which increase the awareness of University and programme attracting a large number of applicants.

2. The possibility of submitting documents online, students have the opportunity to apply for a programme without being in St. Petersburg, which allows them to attract students not only from St. Petersburg, but also from other cities of Russia, thereby developing internal academic mobility.

3. Attracting the most prepared students with the help of an incentive system, which increases the general level of knowledge.

4. Various assistance to foreign applicants for admission and training. The foreign applicants are assisted by the Commission for the Admission of Foreign Citizens of the St. Petersburg State University Admission Administration.

Recommendations:

1. It is recommended to update information at the page of online presentations (<https://abiturient.spbu.ru/priem/magistratura/2150#p1>) related to the Educational Programme. There is no field-specific presentation.

Curriculum Vitae

Name: Andrey Kirsankin

Place of employment, position	senior Researcher, direction of technology for obtaining powder materials from refractory/rare metals and their alloys, Laboratory of Physico-Chemical Bases of Metallurgy of Non-ferrous and Rare Metals (No. 5), Institute of Metallurgy and Materials Science.
Academic degree, title	Ph.D. in Physical and Mathematical Sciences
Honors, ranks	
Education	
Professional achievements	3 monographs, 32 articles
Research interests	
Practical experience in the field of the programme	Engineer-physicist (MEPhI, 2010)Economist-Manager (MEPhI, 2010)

Name: Veronika Bednova

Place of employment, position	Associate Professor of the Department of Mechanics of Composites, Deputy Dean of the Faculty of Mechanics and Mathematics, Head of the Department of Management of Educational and Methodological Activities and Additional Education of Moscow State University
Academic degree, title	Ph.D. in Physical and Mathematical Sciences
Honors, ranks	Associate Professor
Education	
Professional achievements	
Research interests	
Practical experience in the field of the programme	

Name: Mikhail Kotov

Place of employment, position	Scientific Secretary of the Institute of Problems of Mechanics named after A.Yu. Ishlinsky of the Russian Academy of
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	Sciences, Senior Researcher at the Laboratory of Laser Discharges
Academic degree, title	Ph.D. in Physical and Mathematical Sciences
Honors, ranks	
Education	
Professional achievements	Number of monographs and scientific articles: more than 100
Research interests	
Practical experience in the field of the programme	Fundamental and applied scientific research in the fields of gas dynamics, aerothermodynamics, plasma physics, laser technologies, generation and absorption of UV radiation. Planning and control of the research work of the Institute, scientific events, preparation of summary reports, documentation of the Academic Council. Cooperation with the Ministry of Education and Science of Russia, the Russian Academy of Sciences, higher education organizations, government agencies and other departments on a wide range of scientific, administrative and organizational tasks of the Institute.

Name: Tatiana Lapochkina

Place of employment, position	Deputy Head of the Department of Educational Process Organization and Interdepartmental Cooperation, Kyrgyz-Russian Slavic University; Certificate of expert of the Ministry of Education and Science of the Kyrgyz Republic on licensing and accreditation of educational activities; Certificate of a Member of the Guild of Experts in the field of vocational education
Academic degree, title	Ph.D. in Physical and Mathematical Sciences
Honors, ranks	
Education	
Professional achievements	
Research interests	
Practical experience in the field of the	

programme	
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Name: Alexander Litvin

Place of employment, position	Specialty "Fundamental Mathematics and Mechanics", specialization "Fundamental Mechanics", 5th year, Moscow State University
Academic degree, title	
Honors, ranks	
Education	
Professional achievements	
Research interests	
Practical experience in the field of the programme	