

Abstract
of Master's Degree Program
in Field of Education 19.04.01 Biotechnology,
Discipline (Specialization) "Industrial Biotechnology and Bioengineering"
(Internal Study Mode)

Terms, Workload of the Degree Program and Qualification of Graduates

Name	Qualification	Term of education including the holidays provided after the completion of the State Final Certification	Workload (in credits)
Master's degree program	Master	2 years	120

Purpose (Mission) of the Degree Program

The purpose of the master's degree program is developing student personal qualities and forming general cultural, general professional and professional competences in accordance with the requirements to mandatory minimum of the degree program content in field of education 19.04.01 Biotechnology (qualification (degree) – master), as well as the student acquisition of additional professionally specialized competences in the field of research and production and engineering and manufacturing activities.

Demand for Graduates

Graduates of the master's degree program in "Industrial Biotechnology and Bioengineering" are in demand with organizations that carry out works having the following as their object: microorganisms, animal cell cultures, viruses, enzymes, biologically active chemical substances; instruments and equipment for studying of properties of used microorganisms, cell cultures obtained by biosynthesis of substances obtained in laboratory and industrial conditions; biomasses, installations and equipment for biotechnological processes; means of quality control of raw materials, semi-finished and finished products; regulations for production of biotechnology products, international standards; accounts and records of enterprises in the field of biotechnological production.

Requirements for Enrollment in the Degree Program

The persons with appropriate education confirmed by the document of higher education and qualification who have passed entrance examinations in accordance with the approved Regulations for Admission to Higher Education Programs, namely bachelor's degree programs, specialist's and master's degree programs, are allowed for enrollment.

Graduate's Qualification Characteristic
Areas of Professional Activity

The area of the professional activity of graduates of the master's degree program in "Industrial Biotechnology and Bioengineering" includes:

- research, generation and application of enzymes, viruses, microorganisms, animal and plant cell cultures, products of their biosynthesis and biotransformation;
- creation of technologies to produce new types of products, including products obtained with the use of microbiological synthesis, biocatalysis, genetic engineering and nanobiotechnologies;
- development of scientific and technical documentation, and process regulations for production of biotechnological products;
- implementation of biotechnological processes and production operations in accordance with the compliance of legislative and regulatory national and international acts;
- arrangement and performance of quality control of raw materials, intermediate products and finished products.

The master undertakes professional activities at enterprises and scientific research institutions in the field of pharmaceutical manufacturing and biotechnological production, educational institutions of secondary and higher vocational education that train personnel in the field of production of medicines and biotechnological products.

According to the register of professional standards (the list of types of professional activity approved by Order No. 667n of the Ministry of Labor of Russia dated 29.09.2014), the areas of professional activity and fields of professional activity which the graduates who have completed the master's degree program (hereinafter referred to as graduates) can be engaged in include:

02 Healthcare

26 Chemical, chemical engineering productions

40 Cross-cutting types of professional activity in industry

Graduates can be engaged in professional activity in other areas and (or) fields of professional activity if their education level and acquired competences correspond to the employee's qualification.

Objects of Professional Activity

In accordance with the types of professional activity, the objects of professional activity of graduates in the degree program in 19.04.01 Biotechnology, master's degree program in "Industrial Biotechnology and Bioengineering", are:

- microorganisms, animal and plant cell cultures, viruses, enzymes, biologically active chemical substances;
- instruments and equipment for studying of properties of used microorganisms, cell cultures obtained by biosynthesis of substances obtained in laboratory and industrial conditions;
- biomasses, installations and equipment for biotechnological processes;
- means of quality control of raw materials, semi-finished and finished products;
- regulations for production of biotechnology products, international standards

Types of Professional Activity

Types of professional activity which graduates of the master's degree program are prepared for:

- scientific research activities;
- engineering and manufacturing activities

Tasks of Professional Activity

The graduate who has completed the master's degree program according to the types of professional activity which the master's degree program is aimed at, is ready to solve the following job tasks:

Scientific Research Activity:

- selection, processing and analysis of scientific and technical, and patent information according to the area of research using specialized databases by means of IT solutions;
- analysis of engineering process performance for the compliance with scientific developments;
- development of research programs, assessment and analysis of obtained results;
- search and development of new effective ways to produce biotechnological products, creation of modern biotechnologies, including nanobiotechnologies, technologies of recombinant DNA, cell technologies;
- recovery, identification and analysis of biosynthesis and biotransformation products, deriving of new producer strains of biological preparations;
- creation of composite forms and optimal ways of biological preparations use;
- validation of engineering processes and analytical procedures;
- study of biochemical and biological regularities of biosynthesis processes, micro- and macrostoichiometry, micro- and macrokinetics of micropopulation and cell culture growth, interaction of microorganisms, virus-cell interaction, metabolic fates and specifics of substrate disposal and synthesis of metabolism products;
- creation of theoretical models that allow predicting the nature of change in properties of raw materials in the process of their biotransformation and producing of products with the set qualitative characteristics;

- experimental research of biological and physical and chemical kinetics at every stage of engineering process and their mathematical description;
- preparation of scientific and technical reporting documentation, analytical reviews and reports, documentation for participation in competitions of scientific projects, projects of pharmacopoeial monographs (state standards), publication of scientific results, protection of intellectual property.

Engineering and Manufacturing Activity:

- organization, planning and control of existing biotechnological processes and production;
- ensuring of stability of production performance and quality of manufactured products in accordance with local acts of the enterprise (process regulations, job descriptions, analysis techniques);
- provision of effective operation of means of control, automation and automated management of biotechnological production;
- organization and performance of energy-efficiency and resource-saving measures, measures on assurance of environmental safety of biotechnological processes;
- provision of chemical and technical, biochemical and microbiological control;
- development of measures for improving economic and production performance of the process, provision of production efficiency and obtaining of the product of needed quality;
- organization of production operations metrology support;
- organization of external and internal audit system;
- coordination of operations on implementation of results of scientific researches into production;
- operation of experimental and industrial installations;
- operation of instruments and equipment, means of analytical control and production control in accordance with technical data sheets and instructions for instruments and equipment.

List of Professional Standards Corresponding to the Professional Activity of Graduates Who Have Completed the Degree Program

Item No.	Code of professional standard	Name of professional standard
02 Healthcare		
1	02.010	Specialist in industrial pharmacy in the field of research of medicinal products
2	02.011	Specialist in validation (qualification) of pharmaceutical manufacturing
3	02.013	Specialist in industrial pharmacy in the field of quality control of medicinal products
4	02.014	Specialist in industrial pharmacy in the field of quality assurance of medicinal products
5	02.016	Specialist in industrial pharmacy in the field of production of medicinal products
26 Chemical, chemical engineering productions		
6	26.013	Specialist in quality control of biotechnological production of agents for plant industry
40 Cross-cutting types of professional activity in industry		
7	40.010	Products quality control specialist
8	40.062	Product quality specialist

General Characteristic of the Degree Program

Planned results of completing of the degree program (competences) and indicators of their achievement

In accordance with the aims of the degree program and tasks of the professional activity, the graduate of the master's degree program in "Industrial Biotechnology and Bioengineering" shall have the following competences characterized by the indicators of their achievement:

Codes	Competences, indicators of competence achievement
GCC-1	Ability to think abstractly, analyze, synthesize
GCC-1.1	Analyzes the available information and synthesizes their own judgments regarding professional activity
GCC-1.2	Analyzes the results of works performed, synthesizes conclusions and new ideas on their basis
GCC-2	Readiness to take actions in abnormal situations, to bear social and ethical responsibility for the decisions made
GCC-2.1	Takes social responsibility for the decisions made
GCC-2.2	Takes ethical responsibility for the decisions made
GCC-3	Ability to enhance and develop their intellectual and general cultural level, to acquire knowledge in the field of modern problems of science, engineering and technology, human, social and economic sciences
GCC-3.1	Develops their intellectual and general cultural level, performs a search, critically analyzes and synthesizes information
GCC-3.2	Finds solutions to the worldview and methodological problems in public field and professional activity
GCC-3.3	Generates new ideas when solving research and practical problems
GCC-4	Ability for professional growth, individual study of new research methods, change of scientific and scientific production profile of their professional activity
GCC-4.1	Works out individual techniques for practical solving of training and job tasks, including with the use of creative potential
GCC-4.2	Outlines the path of their professional growth and personal development
GCC-5	Ability to use skills in the organization of research and project works, in team management on a practical level
GCC-5.1	Able to be involved in interpersonal collaboration with due regard to the knowledge of their rights and obligations, as well as regulatory legal acts regulating the relations between individuals in the practical implementation of research and project works
GCC-5.2	Applies skills for effective performance of works
GCC-6	Readiness to use legal and ethical standards in the assessment of consequences of their professional activity, in the development and implementation of socially important projects
GCC-6.1	Considers ethical requirements in the course of scientific research practice, development and implementation of socially important projects
GCC-6.2	Applies normative legal documents in their professional activity
GPC-1	Ability to skillfully operate modern biotechnological equipment and scientific instruments
GPC-1.1	Takes into account the requirements for biotechnological process safety when selecting biotechnological equipment and scientific instruments
GPC-1.2	Operates modern biotechnological equipment used in production and laboratories.

GPC-2	Readiness to communicate in oral and written form using the official language of the Russian Federation and a foreign language to solve job tasks
GPC-2.1	Presents the results of their activities in a foreign language
GPC-2.2	Produces and edits scientific, business and professional texts in a foreign language
GPC-3	Readiness to manage the team in the field of their professional activity, perceive social, ethnic, religious and cultural differences in a non-judgmental manner
GPC-3.1	Plans and organizes the work of the team taking into account the peculiarities of behavior, interests and opinions of its members, appropriately distributes authority and responsibility based on the basic principles of delegation
GPC-3.2	Delegates the team considering peculiarities of behavior and interests of individual employees
GPC-4	Readiness to use methods of mathematical modeling of materials and engineering processes, readiness for theoretic analysis and experimental test of theoretical hypothesis
GPC-4.1	Uses mathematical methods for analysis and modeling of processes and materials
GPC-4.2	Performs theoretical analysis and experimental check of theoretical hypothesis
GPC-5	Ability to use state-of-the-art IT solutions for collection, processing and distribution of scientific information in the field of biotechnology and linked industries, ability to use databases, software programs and resources of information and telecommunications network “Internet”
GPC-5.1	Uses databases and resources of information and telecommunications network “Internet” in scientific activities
GPC-5.2	Uses databases, software programs and resources of information and telecommunications network “Internet” to solve job tasks
GPC-6	Readiness to protect intellectual property objects and commercialize intellectual property rights
GPC-6.1	Assesses potential patentability of new developments and determines the possibility of their commercial use
GPC-6.2	Determines the possibility of commercial use of new developments
PC-1	Readiness to plan, organize and conduct scientific research works in the field of biotechnology, ability to correctly handle the results of experiments and make reasonable deductions and conclusions
PC-1.1	Searches scientific information and develops plans to conduct scientific researches within the selected scientific direction
PC-1.2	Set goals of the experiment, draws up plans of the experiment with due regard to set goals, develops plans for performers
PC-1.3	Takes into account the interests of all participants of the process when playing their role in a teamwork and social interaction
PC-2	Ability to analyze scientific and technical information in the field of biotechnology and linked disciplines with the purpose of scientific, patent and marketing support of conducted fundamental researches and engineering developments
PC-2.1	Conducts a critical analysis and assessment of modern scientific achievements
PC-2.2	Searches scientific and technical information in today’s databases

PC-2.3	Draws up reports and abstracts containing scientific, business and professional information required for organizing and conducting scientific researches in the field of biotechnology, in a foreign language
PC-3	Ability to present the results of the work performed in the form of scientific and technical reports, reviews, scientific presentations and publications using state-of-the-art capabilities of IT solutions and taking into account the requirements of intellectual property protection
PC-3.1	Uses information and communication technologies when handling experimental results
PC-3.2	Handles the results of experiments and tests, analyzes obtained results, presents the results in the form comprehensible for others
PC-3.3	Executes analysis reports, draws conclusions
PC-13	Readiness to organize, plan and control the existing biotechnological processes and production
PC-13.1	Develops measures to improve and intensify the existing production using achievements of science and technology
PC-13.2	Organizes project works for biopharmaceutical manufacturing
PC-13.3	Designs process flow diagrams of biotechnological stages in accordance with the rules of production organization as per GMP
PC-14	Ability to use type methods and develop new methods of engineering calculations of process parameters and equipment for biotechnological production
PC-14.1	Makes calculations of process parameters and equipment for biotechnological production
PC-14.2	Uses type methods and develops new ones in the course of engineering calculations of process parameters in production
PC-14.3	Assesses and takes into account hazards in calculations of the equipment and modes of its operation
PC-15	Readiness to provide the stability of production performance and quality of manufactured products
PC-15.1	Conducts reviews of quality of biotechnological products using tools and methods of risk analysis
PC-15.2	Provides the stability of production process performance with the aim to produce products of appropriate quality
PC-15.3	Ensures the stability of production performance in the course of practical and scientific activities upon the receipt of biopharmaceutical substances
PC-16	Ability to perform effective operation of means of control, automation and automated management of production, chemical and technical, biochemical and microbiological control
PC-16.1	Justifies the selection of methods of microbiological, chemical and technical, biochemical control of production items and finished products
PC-16.2	Uses current regulatory documents to analyze the results of microbiological control, draws conclusions
PC-17	Readiness to carry out experimental industrial elaboration of the technology and simulation of processes
PC-17.1	Knows the approaches for carrying out the experimental industrial elaboration of the technology
PC-17.2	Carries out the experimental-industrial elaboration of the technology and simulation of processes in practice
PC-18	Ability to develop and scientifically justify schemes for optimal integrated certification of biotechnological products
PC-18.1	Develops scientifically grounded programs for integrated certification of biotechnological products taking into account the risk analysis
PC-18.2	Takes into account safety requirements in the risk analysis

PC-19	Ability to analyze engineering process performance for the compliance with initial scientific developments
PC-19.1	Analyzes engineering process performance in practice considering the compliance with safety requirements
PC-19.2	Assesses technology efficiency and suggests measures aimed at improvement of production and quality of finished products

Curriculum of Master's Degree Program "Industrial Biotechnology and Bioengineering"
Mandatory part (name, workload, final discipline assessment)

1. Foreign Language – 3 credits (108 hours), in-class work – 32 hours, examination
2. Philosophical Problems of Science and Technology – 3 credits (108 hours), in-class work – 26 hours, examination
3. Management of Human Resources – 3 credits (108 hours), in-class work – 32 hours, pass-fail test
4. Information Technology in Professional Activity – 3 credits (108 hours), in-class work – 32 hours, pass-fail test
5. Economics and Innovation – 3 credits (108 hours), in-class work – 32 hours, examination, course work
6. Modern Problems of Biotechnology – 3 credits (108 hours), in-class work – 32 hours, examination

The part formed by participants of educational relations (name, workload, final discipline assessment)

7. Design and Organization of Pharmaceutical Manufacturing according to GMP – 3 credits (108 hours), in-class work – 26 hours, pass-fail test, course project
8. Engineering Implementation of Biotechnological Processes – 3 credits (108 hours), in-class work – 26 hours, graded test
9. Quality Assurance of Biotechnological Medicinal Products – 3 credits (108 hours), in-class work – 26 hours, examination
10. Raw Material Base of Biotechnology – 3 credits (108 hours), in-class work – 26 hours, pass-fail test
11. Molecular and Cell Technologies – 3 credits (108 hours), in-class work – 26 hours, pass-fail test
12. Modern Technologies of Biopharmaceutical Substances – 6 credits (216 hours), in-class work – 52 hours, examination, pass-fail test
13. Design of New Microorganism Strains – 3 credits (108 hours), in-class work – 26 hours, pass-fail test
14. Safety of Engineering Processes in Pharmaceutical Manufacturing – 3 credits (108 hours), in-class work – 24 hours, pass-fail test

Elective disciplines (name, workload, final discipline assessment)

15. Psychology of Professional Activity and Management – 3 credits (108 hours), in-class work – 16 hours, pass-fail test
16. Team Conflict Resolution – 3 credits (108 hours), in-class work – 16 hours, pass-fail test
17. Physical and Chemical Methods of Analysis – 3 credits (108 hours), in-class work – 16 hours, pass-fail test
18. Microbiological Control in Biotechnological Production – 3 credits (108 hours), in-class work – 16 hours, pass-fail test
19. Immunobiological Products Based on Microorganisms – 3 credits (108 hours), in-class work – 16 hours, pass-fail test
20. Molecular Biology – 3 credits (108 hours), in-class work – 16 hours, pass-fail test
21. Recombinant Protein Biotechnology – 3 credits (108 hours), in-class work – 16 hours, pass-fail test
22. Foreign Language for Scientific Work – 3 credits (108 hours), in-class work – 14 hours, pass-fail test
23. Foreign Language for Business Contacts – 3 credits (108 hours), in-class work – 14 hours, pass-fail test
24. Processes of Equipment Cleaning – 3 credits (108 hours), in-class work – 14 hours, pass-fail test
25. Validation of Purification – 3 credits (108 hours), in-class work – 14 hours, pass-fail test

Optional subjects (name, workload, final discipline assessment)

26. Latin Language – 2 credits (72 hours), in-class work – 12 hours, pass-fail test
27. Bioethics – 2 credits (72 hours), in-class work – 12 hours, pass-fail test
28. Digital Literacy – 2 credits (72 hours), in-class work – 10 hours, pass-fail test
29. Digital Culture – 2 credits (72 hours), in-class work – 10 hours, pass-fail test
30. Cognitive Management Systems – 2 credits (72 hours), in-class work – 10 hours, pass-fail test

Practices (name, workload, final assessment)

31. Academic Practical Training: Practice in Obtaining Primary Professional Abilities and Skills – 6 credits (216 hours), in-class work – 24 hours, pass-fail test
32. Practice in Obtaining Professional Abilities and Experience of Professional Activities (Including Production Practice) – 6 credits (216 hours), in-class work – 24 hours, graded test
33. SRW 1 (Scientific Research Work) – 21 credits (756 hours), in-class work – 45 hours, pass-fail test
34. SRW 2 (Scientific Research Work) – 15 credits (540 hours), in-class work – 15 hours, pass-fail test
35. Pre-graduation Practice – 6 credits (216 hours), in-class work – 30 hours, graded test

State final certification

36. Presentation of Graduate Qualification Work – 6 credits (216 hours), in-class work – 2 hours, GQW presentation

Resources Provision of the Degree Program

The master's degree program in "Industrial Biotechnology and Bioengineering" is provided with learning and teaching documentation, as well as materials in all disciplines (modules) and practices, including electronic educational-methodical complexes posted in electronic information and educational environment of the University.

The University has facilities and resources that are in compliance with applicable fire safety rules and regulations and ensure all types of the disciplinary and interdisciplinary preparation, practical and scientific research works of students, provided for by the curriculum.

The list of facilities and resources, learning and teaching support, required for implementation of the degree program, includes the following: special rooms in the form of classrooms for conducting lecture-type activities, seminar-type activities, course work development (course work execution), group and individual tutorials, current control and midterm assessment. There are also rooms for independent work and rooms for storage and preventative maintenance of training equipment. Special rooms are equipped with designated furniture and teaching aids intended for presentation of teaching information to a large audience. Laboratories are equipped with laboratory equipment depending on the degree of complexity. Sets of demonstration equipment and illustrative study guides providing for topic-based illustrations and corresponding to discipline (module) programs, working educational programs of disciplines (modules), are offered for lecture-type activities.

Rooms for students' independent work are equipped with computer hardware with the possibility of connecting to the Internet network and access to electronic information and educational environment of the organization. Furthermore, students' independent work is arranged with the use of electronic resources of the University.

The library fund is provided with the required number of printed publications, moreover, there is an access to electronic library systems.

The University has the necessary licensed software package the composition of which is given in working programs of disciplines (modules) and is subject to annual update.

The students are provided with an access (remote access), including in the event of doing electronic learning, applying distance learning technology, to today's professional databases and inquiry and communications systems the composition of which is determined in working programs of disciplines (modules) and is subject to annual update.

During the whole period of studying every student and a teacher are provided for with an unlimited access (including the remote one) to electronic library systems and to electronic information and educational environment of the University from any place with the available Internet connection.

Electronic information and educational environment of the University provides for:

- the access to curricula, working programs of disciplines (modules), practices, editions of electronic library systems and electronic learning resources specified in working programs;
- recording of progress of the educational process, results of midterm assessment and results of the degree program completion;
- the formation of electronic portfolio of the student, including the preservation of student's works and grades for these works by any participants of the educational process;
- interaction between participants of the educational process, as well as synchronous and (or) asynchronous communication via Internet.

Functioning of electronic information and educational environment complies with the requirements of the legislation of the Russian Federation in the field of education and is provided for with the relevant means of information and communication technologies and qualification of the University employees who use and maintain it.

Staffing of the Degree Program

Implementation of the master's degree program in "Industrial Biotechnology and Bioengineering" is ensured by the senior academic staff of the organization, as well as by persons engaged in the implementation of the master's degree program under the terms of the civil contract in accordance with the requirements of the Federal State Educational Standard for this field of education.

The percentage of the employed academic staff (reduced to integer rates) is at least 60 % of the total number of the University academic staff. The percentage of the academic staff (reduced to integer rates) having education and (or) a degree that correspond to the profile of the discipline (module) taught in the total number of the academic staff implementing the master's degree program is at least 80 %. The percentage of the academic staff (reduced to integer rates) having a degree and (or) an academic rank in the total number of the academic staff implementing the master's degree program is at least 70 %. The percentage of staff (reduced to integer rates) among the heads and employees of organizations whose activities are related to the specialization (profile) of the master's degree program (having at least 3 years of work experience in this professional field) in the total number of staff implementing the master's degree program is at least 10%.

General management of the science based content of the master's degree program is responsibility of an employed academic of the University having the Doctor of Sciences degree, carrying out independent scientific research projects (involved in implementation of such projects) in the field of education, having annual publications of the results of the scientific research activities in leading domestic and (or) foreign peer reviewed scientific journals and editions, as well as taking part in annual evaluation of the results of the scientific research activities at national (departmental, industrial) and international conferences.

The list of the academic staff engaged in the implementation of the master's degree program is included in the certificate of staffing of the educational process.

Uniqueness and Competitive Advantages of the Master's Degree Program in "Industrial Biotechnology and Bioengineering"

This degree program has a relevant focus as Biotechnology is one of the most important modern scientific disciplines today. Biotechnology is a fundamental base for many studies not only in medicine and pharmacy, but also in chemical and food industry, agricultural and ecological activities.

The content of the program represents the needs of today's labor market. Graduates of the master's degree program in "Industrial Biotechnology and Bioengineering" are in demand with organizations that carry out works having the following as their object: microorganisms, animal and plant cell cultures, viruses, ferments, biologically active chemical substances. Implementation of the master's degree program in the field of biotechnologies contributes to solving the personnel problem of biopharmaceutical enterprises, scientific research centers and laboratories.

Mastering of the degree program ensures forming of the competences that allow carrying out professional activities in the field of innovative technologies of biosynthesis, recovery and purification of biotechnological active pharmaceutical substances. Educational trajectories allowing for operative considering the modern requirements for creation of modern medicinal products using the nanostructuring of active pharmaceutical ingredients.

The area of the professional activity of masters in field of education 19.04.01 Biotechnology, master's degree program "Industrial Biotechnology and Bioengineering", includes:

- research, generation and application of enzymes, viruses, microorganisms, animal and plant cell cultures, products of their biosynthesis and biotransformation;
- creation of technologies to produce new types of products, including products obtained with the use of microbiological synthesis, biocatalysis, genetic engineering and nanobiotechnologies;
- development of scientific and technical documentation, and process regulations for production of biotechnological products;
- implementation of biotechnological processes and production operations in accordance with the compliance of legislative and regulatory national and international acts;
- arrangement and quality control of raw materials, intermediate products and finished products.

The master undertakes professional activities at enterprises and scientific research centers in the field of pharmaceutical manufacturing and biotechnological production, educational institutions of secondary and higher vocational education that train personnel in the field of production of medicines and biotechnological products.

Active career guidance counseling involving employers is carried out with students within the educational process, this allows graduates to get involved in the work processes of organizations more quickly. Introductory tours and visits to the leading pharmaceutical companies, where SPCPU graduates work, are held within the master's program disciplines. During the academic studies, potential employers introduce graduate students to their future jobs and the specifics of enterprises. Within the academic studies of graduate students, such educational formats as round table, conference, speeches by representatives of companies as invited teachers were used in various disciplines of the program.