САТБАЕВ УНИВЕРСИТЕТІ SATBAYEV UNIVERSITY

Mining and Metallurgical Institute named after O.A. Baikonurov
Department of Materials Science, Nanotechnology and Engineering Physics

APPROVED by
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Educational development plan

8D05301 – "Applied and Engineering Physics"
(PhD degree)

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The department plans to train specialists within the educational program 8D05301 – Applied and Engineering Physics. This program is designed to prepare highly qualified professionals with strong theoretical knowledge and practical skills in modern physics and engineering technologies. Due to the interdisciplinary and versatile nature of applied and engineering physics, graduates of this program can successfully work in advanced and high-technology sectors of the national economy. Their expertise allows them to address complex scientific and technological problems, participate in innovative research, and contribute to the development of modern industrial processes.

The training provided within the program focuses on developing competencies in fundamental and applied physics, materials science, modern experimental methods, and advanced engineering technologies. Graduates gain the ability to analyze physical processes, design and optimize technological systems, and apply modern research methods in both scientific and industrial environments.

The objects of professional activity of graduates include a wide range of scientific, engineering, and industrial organizations, such as:

- Research institutes and scientific centers, as well as technology parks, where specialists conduct fundamental and applied research, develop innovative technologies, and participate in scientific and technological projects.
- Machine-building plants producing various types of equipment, machine parts, and engineering products, where graduates are involved in improving production technologies, analyzing material properties, and ensuring the reliability and efficiency of engineering systems.
- Design, engineering, and technological organizations, where specialists participate in the development, design, and optimization of new devices, equipment, and technological processes.
- Engineering physics enrichment enterprises, where graduates apply physical principles and modern analytical methods to improve technological processes related to the extraction and processing of raw materials.

Graduates of this specialty are currently employed in leading research institutes, industrial enterprises, and government organizations. Many of them are also involved in teaching and scientific activities at universities, contributing to the training of new specialists and the development of scientific research. Having obtained a master's degree and strong research competencies, they successfully apply their knowledge in both academic and industrial sectors.

Main activities planned for the educational program

The educational program 8D05301 – Applied and Engineering Physics has a set of strategic activities aimed at enhancing the quality of education, strengthening research

capabilities, and developing highly qualified specialists. The main planned activities include:

1. Development of Research Directions and Scientific Schools

Within the framework of the research work conducted by the Department of Materials Science and Engineering Physics, the program aims to establish and strengthen scientific schools that focus on cutting-edge topics in engineering physics. This includes the creation of research teams, development of thematic scientific programs, and implementation of projects in areas such as advanced materials, nanostructures, applied physical methods, and engineering technologies. The goal is to promote innovative research and create a sustainable environment for the continuous development of the Institute's scientific capabilities in engineering physics.

2. Expansion of International Cooperation

The program places strong emphasis on the development of international partnerships with universities and research institutions both near and far abroad. This includes signing formal agreements and contracts in the fields of research, academic collaboration, and student and staff exchange programs. By participating in international academic mobility programs, students and faculty will have opportunities to gain global experience, exchange knowledge, adopt advanced teaching methodologies, and stay updated with modern trends in physics, materials science, and engineering. This will contribute to raising the international competitiveness of both students and faculty members.

3. Strengthening Educational, Methodological, and Scientific Mobility

The department aims to enhance the educational and methodological process by integrating interactive and digital technologies into teaching and research. This includes the use of virtual laboratories, online platforms, simulation software, and other modern educational tools to support independent learning, project-based work, and research activities. By increasing the mobility of education, both teachers and students can access resources anytime and anywhere, conduct experiments virtually, and participate in interactive learning sessions. This approach ensures the development of critical thinking, problem-solving skills, and practical competencies in applied and engineering physics.

4. Expansion and Modernization of the Educational and Laboratory Base

A key activity is the continuous improvement of the department's infrastructure. This includes:

- Equipping laboratories with modern experimental and analytical instruments for research in materials science, nanotechnology, and applied physics.
- Creating specialized laboratories, such as the Engineering Physics Laboratory, to provide hands-on training and research opportunities for students.
- Updating educational resources, including textbooks, digital teaching materials, and interactive modules, to reflect the latest scientific advances.

- Developing collaborative laboratory projects with industry partners to provide students with real-world experience and practical problem-solving skills.

These activities are designed to ensure that graduates of the Applied and engineering physics program are well-prepared for professional careers in research institutes, industry, and academia. They will also be capable of contributing to the development of innovative technologies, conducting high-level research, and participating in international scientific and engineering projects.

- concluding a cooperation agreement and opening a branch of the department with leading research institutes for conducting some types of practical and laboratory classes based on this research institute, which uses modern technology in the production of nanomaterials and is equipped with advanced research equipment, conducting joint research work, preparing and conducting scientific projects;

- conclusion of cooperation agreements between Satbaev University and leading research institutes to open training and production centers in the future for introducing innovative forms of achievements in the field of new materials and technologies into the educational process, practical acquaintance with new technologies and types of research equipment, conducting lectures, practical and laboratory classes, etc.

- creation of the laboratory "Engineering physics", which will be organized based on the Laboratory for Engineering. The creation of this laboratory is aimed at strengthening the scientific, educational, and research infrastructure of the department and providing modern experimental facilities for training highly qualified specialists in applied and Engineering Physics. The laboratory will allow us to carry out work on obtaining materials and coatings with nanosized particles for use in the production of solar panel elements.

- the opening of the Competence Center will be an important step in the development of advanced analysis technologies and will contribute to the training of qualified specialists who meet the requirements of modern high-tech research institutes and industry.

5. Attracting doctoral students to participate in scientific conferences organized by the Department of material science and Engineering physics department, leading departments of the institute, publishing their articles in collections of reports.

6. Strengthening the work on monitoring the research and innovation activities of the department, analyzing the implementation of research and development by the faculty of the department.

7. Further strengthening of work on the preparation of projects for participation in various competitions for grant, program-targeted financing and other competitions held within the framework of scientific research.

8. Creation of a program to attract and recruit strong bachelors for master's studies. Development of a program to attract strong graduates of specialized specialties and industry employees to the university for a master's degree in the specialties of the department.

9. Coordination of supply and demand for graduates. Creation of sectoral working groups to determine sectoral needs by specialty at the regional level. Development of an action plan to collect data according to needs.

10. Development of an education program on the example of the world's leading practices. Development of curricula for doctoral studies on the example of the best world practices. Implementation of enhanced research practice. Drawing up an internship program together with employers. Implementation of an annual process of approving the topic and writing a master's thesis together with research institutes and enterprises on topics related to the narrow problems of new materials for their further solution.

11. Professional development of teaching staff. If necessary, attract the target number of teaching staff. Conclusion of agreements with partner universities for conducting advanced training courses for teaching staff. Sending teachers to advanced training courses in foreign partner universities. Conclusion of contracts with companies for internships of the teaching staff of the university. Strengthening the practical qualifications of teaching staff. Development of an internship program together with research institutes and enterprises, taking into account the requirements of teaching staff and the specifics of research institutes and enterprises. Involvement of employees of specialized research institutes in teaching. Improving the qualifications of teaching staff in the study of English for teaching specialized disciplines in the master's program.

12. Development of the material and technical base of the department. Approval of the list of necessary equipment for the training of scientific personnel for various industries.

13. Development of a program for quality employment. Development of a system for informing graduates and employers about vacancies and candidates. Development of a system for informing employers about possible candidates, their achievements and skills.