

Matrices of goals and modules of the specialty 8D05301 "Applied and engineering physics", based on professionally significant competencies of skills and abilities

Guidance for developing the Objectives and Modules Matrix

The goal matrix allows you to build a specialty in two directions:

1. A simple "Matrix of Objectives and Modules" maps the expected learning outcomes (competency profile) of the program to the modules through which these competencies can be acquired.

2. The "Matrix of goals and modules" based on professionally significant skills and abilities is also a tool for building expected competencies with models of established learning outcomes (as close as possible) similar to ASIIN professionally significant skills and abilities (PSS) from the point of view of the university. They are available for engineering and natural sciences, as well as for typical interdisciplinary programs.

First of all, this method of "matching" helps to determine how the learning outcomes of the specialty are similar to the models of the established learning outcomes of the PSS, or complement them or deviate from them.

Thus, the established learning outcomes of the PSS represent the ideal goals and objectives of the program in the relevant subject area. In case of rejection of program orientation or interdisciplinary educational programs, it would be useful to include additional learning outcomes. Deviations from the PSS depending on the profile and orientation of the program are possible and can be explained by the university.

Secondly, the university must present to what extent each module of the program contributes to the achievement of one or more goals and objectives of the specialty. The stated expected learning outcomes should be reflected in the relevant module descriptions according to the program level. Thus, it is possible to evaluate performance horizontally in two directions. This can be analyzed when all learning objectives are covered by the modules. In addition, it is possible to assess whether the main task of learning at the program level is reflected appropriately in the objectives of the module at the module level.

The matrix of goals and models can also be used by the university as a tool in the development and further development of goals and learning outcomes.

Table 1: Goal Matrix

PSS ASIIN	Expected learning outcomes of the specialty	Relevant Modules
Knowledge and understanding		
graduates, in particular:		
possess advanced and systematic knowledge in applied and engineering physics	The doctoral program 8D05301 "Applied and Engineering Physics" is aimed at developing profound theoretical and methodological knowledge in modern applied physics, physics of condensed matter systems, physical foundations of advanced materials, and interdisciplinary physical modeling. Doctoral students demonstrate deep understanding of physical principles governing structure,	Module of Basic Training

	properties, and functional behavior of materials and physical systems at micro-, nano-, and mesoscopic levels.	
possess a critical and comprehensive understanding of contemporary scientific research in applied and engineering physics	Doctoral students are familiar with current global research trends in applied physics, advanced functional systems, nanostructures, and high-precision physical diagnostics. They critically evaluate scientific theories, analyze experimental data using modern computational tools, and assess the scientific validity and innovation potential of research results.	Module of Professional Activity
Engineering analysis		
Graduates are able to analyze complex interdisciplinary scientific and engineering problems	Doctoral students apply advanced theoretical models, numerical simulations, and modern experimental techniques to investigate physical phenomena and material behavior. They perform comprehensive analysis of physical processes, interpret multi-parameter datasets, and integrate analytical and computational methods to solve high-level scientific problems.	Module of Professional Activity
Graduates are able to formulate and solve scientific problems of global significance	Doctoral students independently define research objectives, develop original scientific hypotheses, design research strategies, and conduct systematic evaluation of theoretical and experimental results in accordance with international research standards.	Experimental Research Module
Engineering Design and Innovation		
Graduates have special competencies in:		
in developing innovative physical and engineering solutions	Doctoral students must master modern methods of materials design, be able to develop new materials with specified functional characteristics, and implement innovative technologies in the field of materials science.	Practice-Oriented Module
Scientific Research and Evaluation		
Graduates have special competencies to:		
conduct independent and original scientific research	Doctoral students master advanced research methodology, plan and conduct complex experimental investigations, validate scientific hypotheses, and produce original scientific contributions. They demonstrate the ability to publish research results in peer-reviewed international journals.	Experimental Research Module

critically evaluate scientific results and technological applications	Doctoral students conduct rigorous scientific analysis, apply advanced data processing and statistical methods, assess reproducibility and reliability of results, and evaluate technological feasibility and innovation impact.	Practice-Oriented Module
Pedagogical and Professional Activity		
Graduates are able to transfer knowledge and participate in academic and professional training	Doctoral students demonstrate pedagogical competence, conduct lectures and seminars in applied physics, supervise research projects, and contribute to the development of highly qualified specialists in engineering and physical sciences.	Practice-Oriented Module
Practical Activity		
Graduates are able to apply research results in scientific institutions and high-technology industries	Doctoral students implement advanced physical methods and technologies in industrial and research environments, contribute to innovation-driven projects, and integrate scientific results into applied engineering practice.	Module of Professional Activity
Communication and Scientific Cooperation		
Graduates are able to present research results at the international level	Doctoral students participate in international scientific collaborations, publish in indexed high-impact journals, present research at international conferences, and demonstrate professional recognition in the global scientific community.	Experimental Research Module
Completion of the Educational Program		
Graduates demonstrate the ability to conduct original scientific research	Doctoral students prepare and defend a doctoral dissertation containing original scientific results that contribute to the advancement of applied and engineering physics at national and international levels.	Module of Final Attestation