

Matrices of goals and modules of the specialty 7M05301 "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 knowledge of scientific and engineering principles in applied and engineering physics, materials science and materials processing technologies	The content of the educational program 7M05301 "Applied and engineering physics" at developing deep theoretical and applied knowledge in structure–property relationships of materials, physical foundations of materials behavior, and advanced processing technologies. Graduates understand mechanisms of structure formation at micro- and nano-levels, modern production technologies, and	Module of Basic Training Module of Theoretical Training Materials Science Module

	principles of controlling functional and operational characteristics of materials.	
possess a critical understanding of contemporary scientific research in materials science and applied physics	Graduates are familiar with modern research trends in advanced materials, functional systems, nanostructured materials and interdisciplinary physical approaches. They critically analyze scientific data, apply digital tools for modeling and simulation, and evaluate the technological feasibility and efficiency of materials processing methods.	Materials Science Module Nanotechnology Module
Engineering analysis		
Graduates possess competencies in analyzing and solving engineering problems using scientifically grounded methods	Graduates apply physical modeling, thermodynamic and kinetic analysis, and modern computational tools to predict material behavior. They evaluate phase transformations, mechanical reliability, and functional stability of materials under various operating conditions.	Materials Science Module Nanotechnology Module R&D Module
Graduates are able to formulate complex interdisciplinary scientific and engineering tasks	Graduates define research objectives, develop hypotheses, select analytical methods, and use modern diagnostic and measurement equipment. They apply simulation software and experimental data processing systems for solving applied engineering problems.	Experimental Research Module
Engineering design		
Graduates have special competencies in:		
developing engineering solutions for complex and partially non-standard interdisciplinary problems	Graduates design technological processes for advanced materials production, surface modification and nanostructuring. They integrate physical principles, economic efficiency and sustainability criteria into engineering decision-making.	Module of basic training
developing innovative materials and technologies	Graduates design next-generation functional and nanostructured materials, justify industrial implementation strategies, and assess scalability of innovative technologies.	Nanotechnology Module Practice-Oriented Module
Scientific research and evaluation		
Graduates have special competencies to:		
conduct independent scientific research	Graduates design experimental methodologies, perform laboratory and analytical investigations, interpret results, and prepare scientific publications in accordance with international standards.	R&D Module

critically evaluate scientific data and technological solutions	Graduates assess reliability and reproducibility of experimental data, apply advanced characterization techniques, and perform technical and economic evaluation of materials technologies.	Practice-oriented module
research and evaluate the application of new and emerging technologies in their discipline	Graduates demonstrate: <ul style="list-style-type: none"> • ability to identify перспективные research directions in nanotechnology and applied physics; • competence in preparing technical documentation and technological specifications; • skills in operating high-precision analytical and technological equipment; • ability to conduct techno-economic analysis using modern software tools. 	Research module Practice-oriented module
Engineering practice		
Graduates are able to		
systematically integrate interdisciplinary knowledge and solve complex engineering problems	Graduates optimize technological parameters, combine physical and engineering approaches, and determine rational technical and economic indicators in materials production.	Experimental research module
adapt efficiently to new technologies and scientific developments	Graduates apply information technologies, digital modeling tools and databases for materials selection and process optimization.	Module of Theoretical Training
evaluate applicability of methods and technological solutions	Graduates apply modern testing and quality control methods, operate advanced research equipment, assess cost-efficiency, and ensure compliance with international standards.	Nanotechnology Module
integrate environmental and social responsibility into engineering practice	Graduates evaluate environmental impact of materials technologies and implement sustainable engineering solutions.	Practice-oriented module
Broad application skills		
Graduates		
demonstrate advanced interdisciplinary and systemic thinking at Master's level	Graduates logically present knowledge, understand systemic scientific relationships, apply critical analysis methods, and contribute to academic and professional knowledge transfer.	Module of final attestation

function effectively as leaders in interdisciplinary teams	Graduates manage research teams, organize projects, demonstrate leadership and responsibility in achieving strategic objectives.	Module of final attestation
work and communicate effectively at national and international levels	Graduates participate in international research collaborations, publish in indexed journals, and demonstrate professional recognition in scientific and engineering communities.	Module of final attestation