Matrices of goals and modules of the specialty 7M07153 "Materials Science and Engineering", 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 the field of materials science, materials processing technologies, and their interdisciplinary integration	The content of the educational program 7M07153 “Materials Science and Engineering” is aimed at forming fundamental knowledge in the field of structure and properties of materials, modern methods of their production and modification. Graduates must possess knowledge of the regularities of structure formation at the micro- and nano-level, modern technologies for production	Basic Training Module

	and processing of materials, as well as principles of controlling their performance characteristics.	
possess a critical understanding of modern scientific research in materials science	Graduates must know modern scientific directions in the development of materials science, methods for creating functional materials, and scientific approaches to controlling the properties of metallic, ceramic, polymeric, and composite materials. Graduates must possess skills in analyzing scientific information, master modern information technologies, and be able to evaluate the efficiency of technological processes for materials production.	Module of professional activity in materials science
Engineering analysis		
Graduates possess competencies in analyzing and solving engineering problems using scientifically grounded methods	Graduates must know the main principles of controlling structure and properties of materials, methods for analyzing phase equilibria and predicting material properties. They must be able to analyze various materials for scientifically grounded selection of the optimal material for specific operating conditions, formulate research goals and objectives, and apply physico-chemical analysis methods and mathematical modeling.	Module of professional activity in materials science
Graduates are able to formulate complex scientific and engineering tasks	Graduates must know the main types of modern functional and structural materials, including composites, nanomaterials, and hybrid materials. They must be able to use modern methods of diagnostics and control of material properties, apply analytical equipment and software for processing research results.	Experimental research module
Engineering design		
Graduates have special competencies in:		
developing engineering solutions for fundamentally oriented and partially non-standard problems, considering them in relation to a wide coverage of other disciplines	Graduates must possess knowledge of traditional and modern methods of surface processing and modification of materials, be able to analyze coating production methods and select optimal technological solutions for obtaining materials with specified characteristics.	Module of basic training
developing new materials and technologies	Graduates must know modern scientific and technical problems and prospects for the development of nanotechnologies, the main types of nanomaterials and methods of their production. They must be able to navigate	Practice-oriented module

	a wide range of materials and justify the selection of the most effective materials for solving engineering problems.	
Scientific research and evaluation		
Graduates have special competencies to:		
conduct scientific research	Graduates must master research methods, be able to collect, analyze, and systematize scientific and technical information, interpret research results, and present them in the form of scientific publications and reports.	Experimental research module
critically evaluate scientific data and draw conclusions	Graduates must master methods of analyzing technological processes of materials production, conduct testing and diagnostics of materials, and apply modern methods of nanomaterial research.	Practice-oriented module
research and evaluate the application of new and emerging technologies in their discipline.	- the ability to identify new areas of research, new problems in the field of nanotechnology and diagnostics of nanomaterials, the possibilities of creating new functional materials with their subsequent use in practice; - the ability to formulate technical specifications, develop and use technical means in carrying out technological processes for obtaining and processing nanomaterials, and compose the necessary set of technical documentation; - skills in the development, commissioning and operation of science-intensive technological and analytical equipment; - the ability to solve applied engineering and technical and economic problems with the help of application software packages.	Research module Practice-oriented module
Engineering practice		
Graduates are able to		
Classify and systematically combine knowledge from different fields and solve complex problems;	- Have practical skills that are necessary when applying methods for solving problems, obtaining and processing materials for process analysis; - be able to determine a rational combination of the main technical and economic indicators for obtaining materials and equipment.	Experimental research module
Quickly, methodically and systematically familiarize yourself with the new and the unknown;	- use information technology to select the necessary materials and equipment in the manufacture of finished products.	Module of professional activity in materials science
evaluate applicable methods and their scope;	- ability to apply modern methods of research, testing and quality control of materials, films and coatings; -	Module of professional activity in materials science

	possession of experience with research equipment; - the ability to assess the economic efficiency of technological processes; - master the methods of studying nano-objects using scanning tunneling, atomic force and electron transmission microscopes.	
To be able to reflect the non-technical effects of engineering activities systematically and with full responsibility to integrate them into their actions	- be able to apply the methods of researching materials and developing technologies for obtaining new materials and introducing them into production.	Practice-oriented module
Broad application skills		
Graduates		
meet all the skills requirements for the broad application of the first cycle of the bachelor's program for the more demanding level of the second cycle of the master's degree;	The graduate must show: - the ability to logically present acquired knowledge and demonstrate an understanding of systemic relationships within the discipline, as well as interdisciplinary relationships in modern science; - the ability to build technologies for teaching new knowledge; - possession of approaches and methods of critical analysis, the ability to use them in practice in relation to various cultural forms and processes of modern society;	Module of final attestation
function effectively as the leader of a team that may be composed of different disciplines and levels;	Be able to build interpersonal relationships in a team and work in a team - have organizational skills, be able to create mobile working groups to achieve their goals and be able to manage such a group, be able to protect their rights and require them to fulfill their duties;	Module of final attestation
work and communicate effectively at the national and international level	have fundamental professional training, organize and conduct research and experimental research activities in the chosen direction, be recognized nationally or internationally. An indicator of recognition is publications in scientific journals with a high impact factor, carried out by international and domestic scientific projects together with foreign partners.	Module of final attestation