Materials Design and Engineering
(Master)

Higher Education Institution	National Research Nuclear University MEPhI (Moscow Engineering Physics Institute)
Country	Russia
City	Moscow
Web-site	https://eng.mephi.ru/
Name of the Programme	22.04.01 Materials Science and Technologies of Materials «Materials Design and Engineering»
Degree awarded	master
Qualification Level (first/ second cycle)	second cycle
Programme objectives; Profile	The program is aimed to prepare masters in the fields of computational condensed matter physics and advanced technologies of materials.
Programme Duration	2 years
Total number of ECTS Credits awarded	120
Curriculum analysis (% and credits): − **engineering fundamentals and advanced engineering subjects (including final thesis)** − **mathematics / natural sciences fundamentals** − **humanities and socioeconomics studies** - **other**	Total 120 credits 100%: - engineering fundamentals and advanced engineering subjects (including final thesis) 65,0%, 78 ECTS - mathematics / natural sciences fundamentals 20,0%, 24 ECTS - humanities and socioeconomics studies 10,8%, 13 ECTS - other 4,2%, 5 ECTS
Brief description of the programme	Many of today's problems that are solved by materials science cannot be investigated with the necessary completeness and accuracy by traditional theoretical and experimental methods. The direct full-scale experiments are too time-consuming, expensive, often dangerous or simply impossible. As a result of that, over the past 20 years, computational physics has acquired the status of an independent powerful methodological direction in the field of materials research along with

	experimental and theoretical physics. The simulation of an object or phenomenon by the methods of computational physics requires a clear statement of the problem followed by the development of a self-consistent plan of the computer experiment. This program is aimed at the development of these skills supported by an intensive introduction into the basics of computational methods of solid state physics and innovative technologies of the production and treatment of materials. The program involves a combination of disciplines in physics of materials and technological processes, programming languages, visualization methods and supercomputing technologies. The curriculum plan of the academic program provides an additional enhanced physical and mathematical training, the study of experimental methods for materials research, mastering of the modern computer technologies, and professional practical training. The program provides a choice of two learning trajectories: "Simulation in Materials Science" and "New Materials and Technologies". The disciplines of the professional module are taught by highly qualified associate professors and professors (including foreign ones in English). Basic professional disciplines (common for the two learning trajectories): Special Chapters of Theoretical Physics; Special Chapters of Higher Mathematics; Radiation Solid State Physics; Metrology, Standardization and Certification; Specialized Software Packages for Numerical Modeling and Analysis; Experimental Methods of Materials Science; Nuclear Fuel Materials; Functional and Structural Materials for Nuclear Power Facilities; Computer and Information Technologies in Science and Industry; Modern Problems of the Sciences of

	Materials and Processes (Selected Sections of the Modern Materials Science). Basic professional disciplines (the trajectory "Modeling in Materials Science"): Radiation-Induced Processes in Solids; Computer Simulation Methods in Condensed Matter Physics (Part 1); Phase Field Theory; Methods and Principals of Visualization; Computer Simulation Methods in Condensed Matter Physics (Part 2); First Principle Calculations in Condensed State Physics; Physical Foundations of the Computer Design of Materials; Selected Problems of the Computer Simulation in Condensed Matter Physics; Neural Network Techniques of the Development of New Materials; Introduction to Phase Transformation Kinetics; Parallel Programming. Basic professional disciplines (the trajectory "New Materials and Technologies"): Technologies of Modern and Advanced materials; Modeling of Technological Processes; Nanomaterials and Nanotechnologies; Modern Ideas of the Structure of Materials; Modern Research Methods of the State of Materials; Theory and Technology of Powder Consolidation; Laser and Micro Technologies; Materials for Alternative Power Engineering; Materials Science Problems of Ecology.