Learning outcomes verification sheet for candidates applying for admission to the Additive Manufacturing program

Appendix No. 2

Symbol of Learning Outcomes	Required Learning Outcomes	Achieved Learning Outcomes	Compliance %
1	2	3	4
KNOWLEDGE: THE GRADUATE KNOWS AND UNDERSTANDS			
K1_W01	The applications of mathematical models to describe the structure of materials and the structural phenomena occurring during the design, manufacturing, processing, and operation of engineering materials in constructions. Knows mathematical and numerical methods used to solve basic problems in mechanics, strength of materials, fundamentals of machine design, fluid mechanics, and thermodynamics at the engineering level. In particular, the graduate knows: a) arithmetic and algebra, including matrix calculus, analytical geometry in the plane and in space, b) essential elements of mathematical analysis, including differential and integral calculus, linear ordinary differential equations, trigonometric series, and elements of variational calculus, c) complex numbers.		

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K1_W02	Issues in physics related to the structure of materials and structural phenomena occurring during the manufacturing, processing, and operation of engineering materials. Knows mathematical models of physical phenomena and can apply them. Understands the description of physical phenomena occurring in engineering problems related to mechanics and machine construction. Possesses fundamental knowledge of physics covering mechanics of a material point, optics, electricity and magnetism, solid-state physics, and atomic structure. Holds organized and theoretically grounded knowledge in statics, kinematics, and dynamics of a point and system of points, dynamics of a rigid body and systems of rigid bodies, and spherical motion dynamics. Has knowledge of the basics of thermodynamics and fluid mechanics.		
K1_W03	Principles of design and strength analysis of machine elements and solving technical problems based on the laws of mechanics. Has knowledge of statistical mathematical analysis useful for analyzing both measurement data and economic data.		
K2_W04	Principles of operation of computer systems, programming languages, Internet tools, technical software, and the use of computer-aided systems in materials engineering and technology. Has knowledge of the fundamentals of automation, robotics, and control theory necessary for solving engineering problems in mechanics and machine construction.		
K1_W05	Application of thermodynamics to the description of physical phenomena and mathematical modeling of heat exchange in material technological processes.		

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K1_W08	Basic structural phenomena occurring in engineering materials under the influence of energy interactions.		
K1_W09	Basic technological processes of manufacturing engineering materials and understands the principles of their selection.		
K1_W10	Principles for selecting manufacturing techniques depending on the technological properties of engineering materials and their operating conditions.		
K1_W11	Structural composition of engineering materials, including atomic bonding, fundamentals of crystallography, structural defects, and polymer structure.		
K1_W12	Basic groups of engineering materials, taking into account their chemical composition, structural structure, physicochemical properties, and principles of classification and application.		
K1_W14	Material characteristics and material databases.		
K1_W18	Basic research methods and equipment used for measuring the properties of engineering materials; also knows and understands the principles of conducting scientific research.		
K1_W20	Economic and ecological conditions for the use of basic groups of engineering materials.		
K1_W21	Non-technical conditions of engineering activities, including basic occupational health and safety principles applicable in engineering practice.		
K1_W22	Legal and economic aspects of running a business and management, including quality management in engineering.		
K1_W23	Principles of intellectual property protection and patent law.		
K1_W24	Basic issues in technical drawing and engineering graphics.		
K1_W25	Issues in surface engineering techniques and technologies for shaping the structure and properties of material surfaces.		

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K1_W26	Basic issues in biomedical engineering and biomaterials.		
K1_W27	Issues related to joining techniques and material bonding technologies.		
K1_W30	Basic technological processes for manufacturing materials used in additive manufacturing and understanding the principles of their selection.		
K1_W31	Basic methods and equipment used in additive manufacturing of products and understanding the principles of their application.		
SKILLS: THE GRADUATE IS ABLE TO			
K1_U01	Obtain information from literature, computer databases, and other sources; integrate, interpret, and draw conclusions from the gathered information as well as formulate opinions on the selection and technological application of engineering materials.		
K1_U02	Work individually and in a team; estimate the time required to complete an assigned task; develop and implement a work schedule ensuring timely completion.		
K1_U03	Prepare documentation related to the execution of an engineering task and compose a text discussing the obtained results in the field of materials engineering.		
K1_U06	Use a foreign language at the B2 level.		
K1_U07	Use computer-based materials science techniques in engineering design, materials research, and data processing.		
K1_U08	Plan and conduct basic testing methods for engineering materials, operate specialized scientific and research equipment, collect and process test results, and assess measurement errors.		
K1_U09	Apply knowledge of structural phenomena in the manufacturing, processing, and operation of engineering materials.		
K1_U10	Analyze structural phenomena and measure physicochemical quantities, applying them to solve technical problems based on the laws of physics and chemistry.		

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K1_U11	Apply analytical, simulation, and experimental methods to formulate and solve materials-related engineering problems.		
K1_U14	Evaluate the economic conditions of applying different engineering materials and manufacturing techniques in machine and equipment construction.		
K1_U15	Analyze existing technical solutions regarding the selection of processes and equipment for manufacturing and processing engineering materials.		
K1_U16	Compare basic physicochemical, technological, and operational properties of various groups of engineering materials.		
K1_U17	Design materials with a predetermined structure and functional properties.		
K1_U18	Select engineering materials for technical applications depending on their structure, properties, and operating conditions.		
K1_U19	Design simple processes for manufacturing and processing engineering materials and select appropriate tools and technical devices for their implementation.		
K1_U20	Design and implement recycling techniques for engineering materials.		
SOCIAL COMPETENCES: THE GRADUATE IS READY TO			
K1_K01	Engage in lifelong learning – enhancing professional and social competences. Can inspire their team to seek up-to-date technical, technological, and organizational solutions in professional literature.		
K1_K02	Act as a conscious engineer making decisions that consider the impact of technology on the environment, human relations, safety, and quality of social life.		
K1_K03	Collaborate within a team as a member, group leader, or person inspiring innovative solutions.		
K1_K04	Define tactical and operational goals and priorities concerning both employer interests and the social impact of undertaken decisions.		

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K1_K05	Identify and resolve ethical dilemmas arising in relations with colleagues and subordinates, as well as external dilemmas related to the effects and impact of one's actions on other people's lives.		
K1_K06	Define economic goals and undertake new challenges in an entrepreneurial manner.		
K1_K07	Recognize the role of an educated engineer in society, particularly in promoting modern technical solutions and their impact on improving the quality of life of citizens without technical education.		