Verification Sheet of Achieved Learning Outcomes			
	REQUIRED LEARNING OUTCOMES	**ACHIEVED LEARNING OUTCOMES**	**Compliance %**
	KNOWLEDGE – THE GRADUATE KNOWS AND UNDERSTANDS		
K_W01	Mathematical topics including mathematical analysis, algebra, and elements of applied mathematics, including mathematical methods of physics and numerical methods necessary to use mathematical apparatus and methods in describing and modelling physical phenomena and processes.		
K_W02	Topics in technical physics and chemistry necessary to understand and describe basic physical and chemical phenomena and the role of physics in various areas of engineering and technology.		
K_W03	Basic topics in electrical engineering and electronics sufficient for formulating and solving basic technical problems.		
K_W04	Basic computer techniques, including programming methodologies and techniques, engineering graphics, and the operation and maintenance of IT tools necessary in physics and technology.		
K_W05	Topics in modern physics required for understanding fundamental physical mechanisms and for applying physical knowledge in engineering and technology.		
K_W06	The structure of matter at the atomic and molecular levels; mechanisms of chemical processes and their applications in the manufacturing technologies of modern materials.		
K_W07	Development trends and contemporary applications of physics in selected engineering and technological problems.		
K_K08b	Fundamental principles of operation and maintenance of apparatus, instruments, and systems employing methods of technical physics.		
K_W09b	Basic methods, techniques, tools, and materials for designing, modelling, simulating, and manufacturing technical instruments and devices, and for solving technical and research problems with their use.		
K_W10	Principles of professional and ethical responsibility related to the quality and operation of technical devices; knowledge necessary to understand social, environmental, and other non-technical determinants of engineering activities.		
K_W11	Fundamentals of economics, management, quality management, business activity, and entrepreneurship.		
K_W12	Copyright and patent law and principles of intellectual property protection.		

KW_13	English (or another foreign language) at an intermediate (B2) level sufficient to read literature in general and applied physics.		
K_W14b	Selected areas of technical sciences in electronics and computer-aided measurement and technological processes.		
K_W15	Fundamentals of classical and quantum physics, in particular: (a) systematic knowledge of mechanics of a material point and rigid body, oscillatory and wave motion, fluid mechanics, electromagnetic field, statistical physics and thermodynamics, and basic quantum mechanics; (b) basic knowledge of atomic physics and condensed matter physics.		
K_W16b	Principles of conducting and processing results of physical measurements, measurement uncertainties, and methods for their determination.		
K_W17b	Methods of computer modelling of physical, economic, biological, and sociological problems.		
K_W18	Physics of nanomaterials and modern materials used in contemporary technologies.		
K_W19b	Topics in condensed matter physics, including semiconductor physics, magnetic materials, and mesoscopic systems; knowledge and understanding of fundamental research methods in solid-state physics.		
K_W20	Structural composition of engineering materials, including atomic bonding, basics of crystallography, and structural defects. Knowledge of main groups of engineering materials with regard to their chemical composition, structure, physico-chemical properties, classification principles, and applications. Understanding of basic structural phenomena occurring in engineering materials under the influence of energy interactions.		
K_W21	Basic research methods and tools for studying the structure of engineering materials. Knowledge of research methods and apparatus used to measure properties of engineering materials; understanding the principles of scientific research. Knowledge of methods for analysing chemical composition and structure of materials using spectroscopy, optical and scanning electron microscopy, and X-ray diffraction.		
K_W22	Basic technological processes for manufacturing materials used in additive techniques; understanding of principles of their selection, and knowledge of methods and devices used in additive manufacturing and their applications.		
	SKILLS – THE GRADUATE IS ABLE TO		

K_U01	Use verbal and graphical forms of scientific communication characterized by mathematical and logical rigour; acquire, select, interpret, and integrate information with prior knowledge.		
K_U02	Work effectively in a team and communicate using various information and communication technics in a professional community.		
K_U03	Use English (or another foreign language) at an intermediate (B2) level sufficient for reading and understanding technical manuals, documentation, articles, and textbooks.		
K_U04 b	Prepare documented written reports and papers in Polish and English concerning the results of engineering tasks.		
K_U05	Prepare and deliver oral presentations in Polish and English on specific topics in physics and engineering.		
K_U06b	Identify physical aspects of natural phenomena and technological processes and apply experimental and theoretical research methods to solve engineering problems.		
K_U07b	Use experimental methods, computer simulations, and theoretical models to analyse and solve engineering problems.		
K_U08b	Select appropriate methods, techniques, and instruments for performing measurements and experiments in physics and materials engineering.		
K_U09b	Analyse experimental data, interpret results, estimate measurement uncertainties, and draw conclusions.		
K_U10	Apply physical principles, methods, and mathematical tools to analyse and solve typical problems and models in classical and quantum physics.		
K_U11	Use standard IT tools for designing, modelling, and simulating selected engineering problems.		
K_U12	Recognize systemic and non-technical —including environmental, economic, and legal—consequences of implementing specific technical solutions.		
K_U13	Apply the principles of health and safety at work.		
K_U14	Make preliminary estimates of the costs of a planned engineering task.		
K_U15	Apply knowledge of structural phenomena in the manufacturing and processing of engineering materials and during their operation.		
K_U16	Select engineering materials for technical applications depending on their structure, properties, and operating conditions; design simple processes of manufacturing and processing engineering materials and select appropriate tools and devices for their implementation.		
	SOCIAL COMPETENCES – THE GRADUATE IS READY TO		

K_K01	Continuously improve qualifications and understand the need for constant adaptation of knowledge and skills to technological progress.		
K_K02	Anticipate non-technical consequences of applying methods of technical physics (including environmental impact) and take responsibility for decisions made.		
K_K03	Work as part of a team and understand responsibility for own and group actions.		
K_K04	Set priorities appropriately for the execution of a task defined by oneself or by others.		
K_K05	Apply professional ethics and correctly evaluate the contribution of team members to achieved results; be aware of and value the importance of intellectual honesty in professional practice.		
K_K06	Plan, analyse, and act in an entrepreneurial manner.		
K_K07	Disseminate technical achievements and modern technologies.		
K_K08	Overcome conceptual and linguistic barriers in communicating research results and technical solutions.		
K_K09	Understand the role of a qualified engineer in society, particularly in promoting modern technical solutions in materials engineering, their impact on improving the quality of life as well as the quality and competitiveness of work, and be able to communicate such opinions clearly to non-technical audiences.		