Learning outcomes of the programme:

1.	**Field of study**	**Biomedical Engineering**
2.	Academic year of entry	2018/2019 (summer term)
3.	Level of qualifications/degree	second-cycle studies (in engineering)
4.	Degree profile	general academic

Code of the learning outcome of the programme	**Learning outcomes** The graduate:	Codes of the learning outcomes of the areas of education to which the learning outcome of the programme is related
	KNOWLEDGE	
W01	has extended knowledge of physical and chemical phenomena and their mathematical and numerical models in the field of applications of mechanics, signal analysis, computer science and biomechanical system modeling in biomedical engineering	T2A_W01
W02	has extended knowledge of mathematical methods used for solving and modelling engineering problems in the field of biomedical engineering, including matrix, differential, integral and algorithmic descriptions	T2A_W01
W03	has in-depth knowledge of computer science, materials science, biology and medicine in terms of their application in biomedical engineering and medical diagnostics	T2A_W01
W04	has detailed knowledge of modelling in biomedical engineering in the field of experimental methods, simulations and numerical calculations as well as information systems in medicine	T2A_W02
W05	has detailed knowledge of manufacturing systems in biomedical engineering regarding innovative production techniques and technologies, metrology and reconstruction engineering issues	T2A_W02
W06	has structured and theoretically founded knowledge of modeling supporting the design of technical devices, both in the area of modeling structural elements and the theory of constitutive equations of hard and soft tissues and biological fluids	T2A_W03
W07	has well-organized knowledge of modern information and telemetry systems in medicine, integration of medical systems and networks, remote medical data acquisition systems and methods of automatic diagnostics	T2A_W03
W08	knows standard and modern statistical methods used in medicine, issues of creating and managing databases in health care	T2A_W04
W16	knows and understands the basic concepts and principles in the field of protection of industrial property and copyright as well as the need to manage intellectual property resources; can use patent information resources	T2A_W10
W17	knows the general principles of creating and developing forms of individual entrepreneurship using knowledge in the field of biomedical engineering	T2A_W11
	SKILLS	
U01	is able to acquire information from the subject literature to solve complex engineering problems in the field of biomedical engineering and related sciences, both in Polish and English; can draw conclusions from the resources of information gathered in various sources, compare it and formulate critical and reasoned opinions in both speech and writing	T2A_U01
U02	can use the basic forms of engineering communication in biomedical engineering in both Polish and English; can use a mathematical description with symbols appropriate to the subject matter; knows how to prepare the technical specification of the structure with the use of CAD and numerical methods, in particular FEM	T2A_U02
U03	is able to prepare, both in Polish and English, information on the problem being solved, prepare a report presenting the results of his/her own scientific research, documented with appropriate literature footnotes, in both written and oral form	T2A_U03
U04	can prepare and make an oral presentation in Polish and English in the field of biomedical engineering	T2A_U04
U05	can determine the direction of engineering and scientific research, find the relevant literature and use it, as well as acquire knowledge in the field set by the teacher as part of self-study	T2A_U05
U06	is able to interact in technical English language using specialized vocabulary in the field of biomedical engineering to present a brief and simple justification or explanation of a given engineering problem	T2A_U06
U07	skilfully and in an advanced way: uses a computer connected to the Internet; efficiently uses it in everyday life and in the process of education and self-study, uses application software, prepares materials and multimedia presentations; creatively uses information technology to search, gather and process information and to communicate; uses the systems of: computer graphics, digital image processing, modelling of vector computer graphics objects	T2A_U07

U08	is able to map, measure structural elements and select technological processes using computer-aided design and production methods; knows how to use CAD, CAM and FEM programs	T2A_U07
U09	can use data, charts, tables, other sources of technical information, and ready-made engineering programs for data analysis, measurement and design	T2A_U07
U14	is able to apply knowledge acquired or taken from various sources when analysing a technical problem, not only in the field of biomedical engineering, but also related sciences, i.e. materials engineering, computer science, biology and medicine, taking into account non-technical aspects	T2A_U10
U16	can put forward a hypothesis related to the construction of a technical device or a technological process in medical engineering, and then can develop and implement a simple research program to verify it	T2A_U11
U17	is able to evaluate the possibilities of experimental or theoretical verification of research hypotheses put forward in the field of biomedical engineering	T2A_U11
U18	has the ability to assess the possibility of using new achievements of technology in biomedical engineering and their usefulness in solving a given technical problem	T2A_U12
U19	is prepared to work in the broadly understood health care industry, applying the principles of work safety, ergonomics and health management	T2A_U13
U22	can propose improvements to existing technical solutions	T2A_U16
SOCIAL COMPETENCES		
K01	is aware of the very rapid development of technology as a field of knowledge both in terms of theoretical methods and new solutions, inventions and can inspire his/her team to search for the latest solutions in the literature of the subject indicating the sources of information	T2A_K01
K03	is able to work in a team as a team member, group leader, person inspiring others to search for new solutions and is aware of responsibility for his/her own work and ready to comply with the principles of working in a team and to take responsibility for jointly realized tasks	T2A_K03
K04	can set strategic and operational goals, and related priorities for the implementation of tasks, both formulated by others and identified by himself/herself, adequately determining priorities for the implementation of defined tasks, behaving in a professional manner, observing the rules of professional ethics, respecting the dignity of patients during medical procedures, respecting the diversity of views and cultures as well as legal provisions in medicine and biomedical engineering	T2A_K04
K05	is able to identify and adequately solve ethical dilemmas related to contact with employees, team-mates and subordinates, as well as external dilemmas related to the effects that his/her professional activity can have on the lives of other people	T2A_K05
K07	is aware of the role of a master of science in society, in particular, related to promoting modern technical solutions, their impact on the improvement of people's quality of life and the quality and competitiveness of their work; can formulate and present opinions in a manner understandable to technically uneducated people; is able to translate his/her knowledge into the language of electronic media as well as other mass media, presenting important engineering problems, paying attention to all important elements, arguing for and against the analysed solutions	T2A_K07

Code of the learning outcome of the programme	**Learning outcomes leading to the acquisition of engineering competences** The graduate:	Codes of the learning outcomes of the areas of education to which the learning outcome of the programme is related
KNOWLEDGE		
W09	has detailed theoretical knowledge of the most important problems of biomedical materials engineering in the field of biomaterials and tissue research methods and the basics of tissue and genetic engineering	InzA_W05, T2A_W04
W10	has knowledge of the perspectives and trends in the field of computer modelling and simulation in engineering and clinical biomechanics, testing methods for biomaterials and tissues, basics of biotechnology and genetic engineering, design of IT and telemetry system applications in medicine, applications of electronics in medicine and modern manufacturing technologies and systems	InzA_W05, T2A_W05
W11	has basic knowledge of telecommunication, telecommunication systems and networks as well as devices included in ICT networks, including wireless networks, and configuration parameters necessary for the operation and maintenance of local area network infrastructure	InzA_W01, T2A_W06
W12	knows basic design methods, graphic recording methods and methods of engineering calculations and simulations of phenomena in the field of modeling biological structures and implants cooperating with them	InzA_W02, T2A_W07
W13	knows modern simulation and computational programs in the field of biomedical engineering	InzA_W02, T2A_W07
W14	has the knowledge necessary to understand social, economic, legal, ethical and other non-technical conditions of engineering activities	InzA_W03, T2A_W08
W15	has basic knowledge of management, including quality management and running a business	InzA_W04, T2A_W09
SKILLS		

U10	is able to plan a program of experimental research and conduct an experiment in the field of biomedical engineering and draw conclusions based on the results of his/her own research and the results of research available in the literature	InzA_U01, T2A_U08
U11	is able to develop a simple program or use an available computer simulation program to implement issues in the field of biomedical engineering and to interpret data obtained through computer simulation	InzA_U01, T2A_U08
U12	is able to develop a mathematical model of physical phenomena occurring in basic engineering problems of biomechanics and human dynamics, biological fluid mechanics, heat and mass exchange in bioengineering and can solve the related engineering problems in these fields using analytical computational tools and computer simulations of real processes	InzA_U02, T2A_U09
U13	can apply experimental methods to solve problems in the field of biomedical engineering, perform measurements, carry out statistical analysis and significance analysis in the field of engineering measurements, carry out load analysis of anatomical elements of the human musculoskeletal system, design models of medical devices, including implants and artificial organs, as well as carry out their biomechanical testing in terms of functionality	InzA_U02, T2A_U09
U15	is able to assess a wider technical problem and its implications, not only in relation to technology, but also, to a certain extent, in relation to basic medical sciences concerning the protection of health, work environment or natural environment	InzA_U03, T2A_U10
U20	is able to make initial economic analysis of the developed technical project in the field of biomedical engineering	InzA_U04, T2A_U14
U21	can make critical analysis of the way technical solutions (devices, objects, systems, processes and services of biomedical engineering) work and evaluate them	InzA_U05, T2A_U15
U23	can specify project assumptions and then formulate the specification of complex biomedical engineering tasks, including the unusual ones, taking into account their non-technical aspects	InzA_U06, T2A_U17
U24	can assess the usefulness of methods and tools for solving engineering tasks typical of biomedical engineering, as well as creatively solve complex engineering tasks, including unusual ones and those containing a research component	InzA_U07, T2A_U18
U25	can - according to a given specification - design and implement a complex device, object, system or process used in biomedical engineering using the appropriate and available methods, techniques and tools, and developing new tools	InzA_U08, T2A_U19
SOCIAL COMPETENCES		
K02	is aware of the impact of technology on the surrounding world, including the environment, human relations and security, and the related responsibility for the decisions made	InzA_K01, T2A_K02
K06	is capable of creating new ideas and concepts in the scope of his/her profession, and able to perceive the needs of innovation and improvement of ideas	InzA_K02, T2A_K06