ATTACHMENT NO. 3
to resolution no. 26/2023 of the Senate
of the Silesian University of Technology
of 22 May 2023
(ATTACHMENT No. 24.1
to resolution no. 71/2019 of the Senate
of the Silesian University of Technology
of 15 July 2019)

Study plan

Field/Course of study:	biomedical engineering
Cycle of study:	First cycle studies
Study profile:	General academic
Form of study:	Full-time studies Part-time studies
Number of semesters	7 semesters
Number of ECTS credits required for graduation:	210 ECTS
Professional title awarded to graduates:	engineer
The field of study is assigned to disciplines:	biomedical engineering (100%) – leading discipline
Total number of teaching hours	Full-time studies: 2625 Part-time studies: 1575
Total number of ECTS credits to be obtained by the student in classes with direct participation of academic teachers or other instructors:	Full-time studies: 108 ECTS Part-time studies: 70 ECTS
Number of ECTS credits a student must obtain from courses in humanities or social sciences – for fields of study assigned to disciplines within fields other than, respectively, humanities or social sciences:	5 ECTS
The scope and number of ECTS credits a student must obtain in the course of professional practice /internship:	4 weeks / 40 hours a week 4 ECTS
Principles and form of professional practice/internship:	The internship takes place in a workplace (company, health care institution, scientific and research institution, domestic or foreign), indicated or approved by the faculty student internship supervisor. The student placement must be completed and passed before the end of the semester in which it is scheduled to be completed in accordance with the study plan. Student practical placements should take place in a period free from classes or during their duration, provided that this does not affect the proper course of studies. In order to obtain credit for practical placement, the student must complete the placement within the established timeframe, submit a confirmation of the placement, submit a placement report in the form of a professional placement logbook signed and stamped by a representative of the employer which is to be accepted by the faculty supervisor for student internships.

Learning outcomes

Symbol	Assumed learning outcomes	Reference to the second-level characteristics of learning outcomes of the Polish Qualifications Framework
Knowledge: student knows and understands		
K1A_W01	issues in mathematics, physics, chemistry and other areas of science including biomedical engineering which form the basis for formulating and solving engineering tasks	P6S_WG P6S_WG inż.
K1A_W02	basic principles for the creation and development of various forms of individual entrepreneurship; the basic social, economic, legal, ethical and other non-technical conditions of engineering activity, including the basic notions and principles concerning the protection of industrial property and copyright	P6S_WK P6S_WK inż.
K1A_W03	basic problems of contemporary civilisation specific to the curriculum of biomedical engineering studies	P6S_WK
K1A_W04	issues concerning the principles of conducting and processing the results of physical measurements, the types of measurement uncertainty and methods of their determination	P6S_WG
K1A_W05	Construction and operation of electronic systems and devices, in particular computer systems and medical apparatus	P6S_WG
K1A_W06	issues of acquisition, processing and analysis of signals and biomedical images	P6S_WG

K1A_W07	principles of algorithmic presentation of engineering problems, as well as their implementation conditions	P6S_WG
K1A_W08	state-of-the-art materials solutions and techniques and technologies for the manufacturing and structuring as well as testing of medical materials and devices, including implantable ones, and ways of modifying surfaces to improve their functionality, inter alia in the tissue environment	P6S_WG
K1A_W09	issues in the field of designing medical products and preparing technical documentation, as well as evaluation and certification methods for medical devices	P6S_WG
K1A_W10	basic issues in the field of engineering design for the medical industry and issues in modelling of biological systems	P6S_WG
Skills: student is able to		
K1A_U01	identify, formulate and solve complex and unusual engineering problems related to the field of biomedical engineering by applying knowledge of basic sciences, as well as perform tasks under conditions that are not fully predictable	P6S_UW
K1A_U02	plan and carry out experiments, including measurements and computer simulations, interpret the obtained results and draw conclusions	P6S_UW inż.
K1A_U03	in the identification and formulation of specifications of engineering tasks and their solution: - use analytical, simulation and experimental methods, - perceive their system and non-technical aspects, including ethical aspects, - make a preliminary economic assessment of the proposed solutions and engineering actions taken; make a critical analysis of how existing technical solutions function and evaluate these solutions	P6S_UW inż.
K1A_U04	design to a given specification, analyse and manufacture a device, object, system or process typical of biomedical engineering, using appropriate methods, techniques, tools or materials	P6S_UW inż.
K1A_U05	work individually and as part of a team, taking on a variety of roles; plan and organise this work and cooperate with others in teamwork (including interdisciplinary work).	P6S_UO
K1A_U06	select relevant sources and source information, evaluate, critically analyse and synthesise such information; communicate using specialist terminology and modern information and communication technology, take part in debate and use a foreign language at B2 level of the Common European Framework of Reference for Languages	P6S_UW P6S_UK
K1A_U07	select and use appropriate techniques, skills and modern engineering tools	P6S_UW inż.
K1A_U08	continuously update and extend their knowledge and improve their professional, personal and social competences	P6S_UU
K1A_U09	solve practical engineering tasks requiring the use of engineering standards and norms and select and use tools and technologies appropriate for the field of biomedical engineering	P6S_UW inż.
Social competences: student is ready to:		
K1A_K01	critically appraise their knowledge and perceived content	P6S_KK
K1A_K02	perform professional roles responsibly, including compliance with professional ethics, honesty and respect for diversity of views and cultures, be responsible for one's own work and submit to the rules of teamwork and responsibility for jointly undertaken tasks	P6S_KR
K1A_K03	think and act in an entrepreneurial manner	P6S_KO

Classes

Name of class or group of classes	Number of ECTS	Learning outcomes (symbol) assigned to a class or group of classes	Program content ensuring the achievement of learning outcomes
Physical education	-	-	-
Foreign language	8	K1A_U06	Grammatical constructions and vocabulary, including vocabulary based on specialist/professional language - at proficiency level B2 of the Common European Framework of Reference for Languages.
HES	5	K1A_W02 K1A_U06 K1A_K03	Communication techniques and tools. Introduction to entrepreneurship. Intellectual property protection.
Mathematics	14	K1A_W01 K1A_U01	Introduction to mathematics. Algebra and mathematical analysis, in particular: probability calculus, Fourier series, differential calculus, finite difference calculus, integral calculus, complex numbers, study of the properties of functions, transforms, trigonometric functions, elements of statistics. Geometry.
Physics	10	K1A_W01 K1A_U01	Introduction to physics. Fundamentals of kinematics and material point dynamics, oscillatory motion, wave motion, electrodynamics, elements of solid-state physics, physical measurements, electromagnetic waves, ionising radiation, electricity and magnetism.
Core subjects, including elective courses, defining the scope of the diploma and conducted in the	144	K1A_W01 K1A_W03 K1A_W04 K1A_W05 K1A_W06 K1A_W07	Engineering graphics, computer aided design of medical devices, modelling and engineering calculations and experimental testing of medical devices. Modelling and experimental studies as applied to the diagnosis and assessment of the functioning of biological systems. Interpretation and application of measurement results in medical device design. Issues in medical components, systems, devices and apparatus. Biomedical data,

form of PBL (63 ECTS)		K1A_W08 K1A_W09 K1A_W10 K1A_U01 K1A_U02 K1A_U03 K1A_U04 K1A_U05 K1A_U06 K1A_U07 K1A_U08 K1A_U09 K1A_K01 K1A_K02	their acquisition and processing. Computer science, including hardware, algorithmic and implementation issues in general and biomedical applications. Artificial intelligence and its application in biomedical engineering. Structure and properties of engineering materials, including biomaterials and their practical applications. Modern technologies of manufacturing, processing and evaluation of materials for medicine. Design and certification of medical devices. Theoretical and experimental foundations in mechanics, strength of materials and engineering biomechanics. Implementation of individual and group projects in the form of PBL in thematic areas in accordance with the course of study and the selected diploma scope. As part of the block of classes, students are also taught knowledge of biomedical engineering in English.
Engineering project	15	K1A_W01 K1A_U01 K1A_U02 K1A_U03 K1A_U04 K1A_U05 K1A_U06 K1A_U07 K1A_U09	Integration of the knowledge and skills acquired in the education process at engineering level, in order to develop independently, under the guidance of a supervisor, a selected project from the field of biomedical engineering with the preparation of full documentation of the completed project.
Classes from the University database of elective classes	10	K1A_W01 K1A_U08 K1A_K01	Interdisciplinary lectures covering the latest achievements of science and technology regarding modern engineering in the field of various scientific disciplines and humanistic-economic-social issues.
Professional practice/internship	4	K1A_U01 K1A_U03 K1A_U05 K1A_U09 K1A_K02	Learning and acquiring practical skills in engineering technologies applied in industry companies in the field of biomedical engineering.

Means of verification and assessment of the learning outcomes achieved by the student throughout the entire learning cycle

Name of the means of verification and assessment of learning outcomes	Description of how learning outcomes are verified and assessed
Written examination	The examination tests the student's knowledge by requiring them to be able to combine facts, answer cross-sectional questions and/or solve specific engineering problems e.g. calculus tasks, create computer programs. The examination may be conducted in the form of a single-choice or multiple-choice test or be in the form of open questions.
Oral examination	The oral examination is aimed at checking the student's knowledge, level of understanding of the issues constituting the course content, ability to combine and analyse facts, ability to solve engineering problems indicated by the examiner.
Diploma examination	The oral examination which includes answering questions concerning the curricular content of the course and in the scope of graduation.
Final written test	The final written test verifies the student's knowledge of the material realised in the course. It may be conducted in the form of cross-sectional questions, as well as engineering / calculation tasks, as well as in the form of a single or multiple-choice test or may be in the form of a set of open questions.
Oral test in class	An oral test consists in oral answers to questions on topics covering the content of the course. It is used to check the level of mastery of part or all of the course content.
Project	Evaluation of a completed project task performed independently (or possibly in cooperation with other students, upon the consent of the teacher) under the guidance of the teacher.
Report	Evaluation of the knowledge and ability to analyse the results and formulate conclusions from the research/experiments carried out independently (or possibly in cooperation with other students, upon the consent of the teacher) under the guidance of the teacher.
Presentation	Oral, audiovisual or electronic presentations of end-of-term assignment.
Computer programme	A computer programme prepared in a selected programming language, constituting the implementation of an algorithm or required functionality, possibly with a graphical user interface, or source codes of developed programmes or libraries, or their fragments.
Observation of activity	Observation and assessment of the student's practical skills based on the way in which the research/experiments are carried out, as well as on the basis of oral/written statements during the course.
Professional practice report	Completion of the “Professional Practice Logbook which includes information on the number of hours of practical training, the topics covered, as well as comments, observations and conclusions drawn from the work carried out by the student.