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Study programme "Medical Engineering and Medical Physics"

Main attributes

Title	Medical Engineering and Medical Physics
Identification code	MCF0
Education classification code	42527
Level and type	First-Cycle Higher Education (Professional Bachelor) Studies
Higher education study field	Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering
Head of the study field	Olga Kononova
Department responsible	Faculty of Civil and Mechanical Engineering
Head of the study programme	Jurijs Dehtjars
Professional classification code	2144 37
The type of study programme	Full time
Language	Latvian, English
Accreditation	16.11.2022 - 17.11.2028; Accreditation certificate No 2022/30-A
Volume (credit points)	270.0
Duration of studies (years)	Full time studies - 4.5
Degree or/and qualification to be obtained	Professional bachelor's degree in medical physics and qualification of medical physical technology engineer
Qualification level to be obtained	The 6th level of European Qualifications Framework (EQF) and Latvian Qualifications Framework (LQF); the 6th level of professional qualification
Programme prerequisites	Secondary education

Description

Abstract	<p>The study programme prepares medical physical technology engineers who work in healthcare institutions as equipment operators and managers; in medical equipment distribution and service representative offices; in certification and monitoring institutions; in production, design and research institutions.</p> <p>Medical physical technology engineers know how to design and improve medical equipment, are familiar with physical and technical principles of equipment operation, production and construction technologies, can participate in the selection and installation of equipment and systems used in medicine, can organize their regulation, repair, monitoring and testing.</p> <p>Medical physicists working in health care institutions, monitoring and radiation safety institutions are able to plan and monitor radiation technologies, perform patient and staff dosimetry, organize service, monitoring and testing of equipment and systems, provide radiation safety measures.</p> <p>During studies, students learn fundamental engineering study courses, industry theoretical, information technology and professional specialization study courses, as well as humanitarian and social, economic and management study courses. A 25-week internship is planned during the studies. The specialized study courses are grouped into modules, providing students with the opportunity to specialize in the following areas: medical equipment, medical physics and nanomedicine, e-medicine, medical electronics, biomechanics and auxiliary technologies, medical materials, medical engineering business.</p> <p>At the end of the studies, students develop a bachelor thesis and an engineering project, obtaining professional bachelor's degree in medical physics and qualification of medical physical technology engineer.</p>
Aim	<p>To educate and train highly qualified specialists in medical physics and medical engineering (in accordance with the professional standard) for professional activities in the fields of medical engineering and medical physics possessing professional knowledge of the design of medical equipment, apparatuses and tools, their physical and technical operation principles, their manufacturing technology, application procedures and safety; possessing the practical skills for working with medical equipment – its purchase, installation, use, calibration and quality management, as well as the ability to plan and monitor application of radiation technology, patient and personnel dosimetry; to equip graduates for experimental research work; to prepare for studies at master level.</p>

Tasks	<p>The tasks of the study programme:</p> <ul style="list-style-type: none"> - to provide students with the knowledge and skills necessary for the completion of professional tasks in accordance with the requirements of the higher technical engineering education, medical physical technology engineer and medical physicist; - to ensure the acquisition of the skills relevant to the field of medical engineering and medical physics that would allow developing skills in designing of new and improvement of the existing systems, products and technologies, to use the newest achievements of physics in medicine, as well as to train students for creative research and pedagogical activity in medical engineering and medical physics. - to provide internship opportunities to the students with an aim to apply the acquired knowledge in medical engineering and medical physics; - to motivate students to analyse the obtained knowledge and experience, and to obtain knowledge in self-study; - to improve students' foreign language skills; - to educate students on professional ethics issues, promote observation of ethical principles; - to develop students' oral and written professional communication skills in medical engineering and medical physics; - to develop team-working skills.
Learning outcomes	<p>Graduates of the study programme are able:</p> <ul style="list-style-type: none"> - to apply the acquired theoretical knowledge and practical skills in the development and improvement of innovative medical equipment, devices and technologies; - to analyse the development trends of medical equipment and technologies, as well as to evaluate functional, economic and other preconditions justifying the necessity of designing new medical equipment, devices and technologies or redesigning existing equipment, devices and technologies; - to use traditional and modern computer-aided systems, design, manufacturing and processing technologies in the design process, taking into account environmental and civil protection, fire safety and hygiene requirements; - to construct, design and service modern medical equipment; - to analyse, evaluate, systematize and use the results of applied and scientific research, and in joint work with medical practitioners, biologists and other specialists is able to participate in teamwork, implement creative and research work, is able to justify and present its conceptual solution; - to evaluate the conditions for the acquisition of medical engineering equipment and technologies, manage the installation, use, adjustment of medical engineering equipment, develop appropriate inspection methodologies; - to evaluate the safety and security of modern medical equipment and technologies, analyse the causes of damage to the equipment or system and organise their prevention, if necessary, perform supervision, servicing, repair, testing and calibration of medical equipment and technologies; - to apply radiation source protection engineering calculation methodologies, develop and apply mathematical modelling models in radiation physics, biophysics and medical physics; - to perform dosimetric, radiometric and radiation spectrometric measurements and document them; - to provide measures for the supply of radioactive radiation to the patient, as well as to carry out the necessary activities to ensure radiation safety.
Final/state examination procedure, assessment	<p>In order to obtain a professional bachelor degree in medical physics and the professional qualification of a medical physical technology engineer, all the requirements of the study programme must be met - the study courses of the compulsory part of the study programme must be completed, the limited elective and free elective study courses must also be completed, an internship must be completed, and a bachelor thesis and engineering project must be developed and defended.</p> <p>Reviewers are appointed to evaluate the bachelor thesis and engineering project. The requirements for the bachelor thesis and engineering project have been published in the e-study environment (https://ortus.rtu.lv). For the public defence of bachelor theses and engineering projects, a State Examinations Commission is established, the composition of which is not less than 50% representatives of employers' organizations. The commission's work is led by the chairman, who represents one of the employers' organizations.</p>
Description of the future employment	<p>A medical physical technology engineer:</p> <ul style="list-style-type: none"> - designs and improves medical equipment, apparatus and instruments; - knows the physical and technical operating principles of equipment, their manufacturing and construction technologies; - knows how to apply knowledge about the effect of physical fields on biological objects, organize radiation safety measures; - participates in the selection, installation, adjustment, repair and use of medical equipment and systems; - manages and organizes production, promotes the introduction of new technologies; - performs technical, physical and economic calculations in the field of medical physical technologies; - optimizes and harmonizes medical physics methods for diagnosis and treatment in cooperation with medical professionals; - participates in international projects; - evaluates the impact of the implementation of industry projects on the environment and society; observes professional ethics. <p>A medical physicist:</p> <ul style="list-style-type: none"> - is able to plan and monitor radiation technologies; - is able to perform patient and staff dosimetry, as well as participate in other engineering activities related to radiological procedures and ionizing radiation; - participates in the development of the radiation safety and nuclear safety quality assurance program in the medical institution; - organizes service, monitoring, control and testing of medical equipment and systems; - manages and organizes production, promotes the introduction of new technologies; performs technical, physical and economic calculations in the field of medical physical technologies; - optimizes and harmonizes medical physics methods for diagnosis and treatment in cooperation with medical professionals; participates in international projects; - evaluates the impact of the implementation of industry projects on the environment and society; observes professional ethics.
Special enrollment requirements	English language proficiency equivalent to at least CEFR B2 level.
Opportunity to continue studies	It is possible to continue studies in the master study programme "Medical Engineering and Physics" and in other, also academic master study programmes.

Courses

No	Code	Name	Credit points
A		Compulsory Study Courses	177.0
A.1		General Education Study Courses	26.0
1	BM0425	Basics of Occupational Safety and Civil Protection	3.0
2	BM0409	Health Economics	3.0
3	BM0221	Fundamentals of Quality Control and Monitoring	5.0
4	BM0432	Introduction to Medical Engineering	3.0
5	DA0211	Chemistry for Engineers	3.0
6	BM0194	Medical Physics	5.0
7	BM0101	Radiation and Environmental Safety in Medicine	4.0
A.2		Field-Specific Theoretical Basic and IT Study Courses	63.0
1	DE0002	Mathematics	14.0
2	DA0212	Physics	12.0
3	BM0411	Methods of Medical Statistics	3.0
4	BM0298	Descriptive Geometry and Engineering Graphics	3.0
5	BM0201	Measurements for Medical Equipment and Technologies	5.0
6	DE0341	Electrical Engineering and Electronics	3.0
7	BM0410	Anatomy and Physiology	6.0
8	BM0423	Fundamentals of Physical and Mathematical Simulation	3.0
9	BM0404	Mechatronics	3.0
10	BM0098	Physical Materials Science	7.0
11	BM0106	Medical Informatics	4.0
A.3		Field-Specific Professional Study Courses	88.0
1	BM0431	Physics of Medical Imaging	5.0
2	BM0407	Medical Instrumentation	12.0
3	BM0415	Medical Equipment Design	6.0
4	BM0424	Methods of Medical Equipment Manufacturing	6.0
5	BM0299	Reliability of Medical Equipment	3.0
6	BM0179	Radiation Therapy Technologies	5.0
7	BM0208	Introduction to Biochemistry and Biophysics	5.0
8	BM0416	Cell and Tissue Microstructure	3.0
9	BM0074	Basics of Biomaterials and Biomechanics	4.0
10	BM0219	Spectroscopy Methods in Medicine	8.0
11	BM0071	Computer Systems in Medicine	7.0
12	DE0340	Electronics in Medicine	3.0
13	BM0059	Micro- and Nanotechnologies	4.0
14	BM0210	Basics of Nanomedicine	5.0
15	BM0426	Medical Instruments, Equipment and Systems, Their Use	3.0
16	BM0412	Simulation of Physical Processes (Study Project)	3.0
17	BM0430	Medical Equipment Design (Study Project)	3.0
18	BM0406	Medical Equipment Manufacturing Technology (Study Project)	3.0
B		Compulsory Elective Study Courses	29.0
B1		Field-Specific Study Courses	17.0
		<i>Medical facilities</i>	<i>17.0</i>
1	BM0417	Theoretical Mechanics	4.0
2	BM0394	Resistance of Materials	3.0
3	BM0294	Heat Study	3.0
4	BM1035	Analysis of Biological Signals	7.0
		<i>Medicine physics and nanomedicine</i>	<i>17.0</i>
1	BM0427	Technical Mechanics	6.0
2	BM0403	Nanotechnologies in Medicine	4.0
3	BM1035	Analysis of Biological Signals	7.0
		<i>E-medicine</i>	<i>17.0</i>
1	BM0433	Technical Mechanics	3.0
2	DE0129	Pattern Recognition and Image Processing Methods in Medicine	4.0
3	DE0426	Computerized Decision-Making in Medicine	3.0
4	DE0424	The Basics of Artificial Intelligence in Medicine	4.0
5	DE0427	Fundamentals of Computer Graphics	3.0
		<i>Medicinal electronics</i>	<i>17.0</i>

1	BM1035	Analysis of Biological Signals	7.0
2	BM0433	Technical Mechanics	3.0
3	DE0428	Electronic Elements and the Design of Electronic Equipment	7.0
		<i>Biomechanics and assistant technologies</i>	<i>17.0</i>
1	BM1035	Analysis of Biological Signals	7.0
2	BM0433	Technical Mechanics	3.0
3	BM0414	Assistive Technologies	3.0
4	BM0428	Design of Prostheses	4.0
		<i>Medicinal materials</i>	<i>17.0</i>
1	BM0433	Technical Mechanics	3.0
2	BM0413	Biomaterials	3.0
3	DA0033	Basis of Biomaterial Technology	4.0
4	BM0429	Medical Textile Materials	4.0
5	DA0210	Functional Medical Implants	3.0
		<i>Medical engineering business activities</i>	<i>17.0</i>
1	BM0433	Technical Mechanics	3.0
2	BM0408	Health Care Organisation and Economics	3.0
3	BM0077	Business Risks	4.0
4	BM0402	Project Management	3.0
5	BM0421	Business Economics and Fundamentals of Marketing	4.0
B2		Humanities and Social Sciences Study Courses	6.0
1	DE0425	Business Sociology	3.0
2	BM0422	Medical Ethics	3.0
3	BM0419	Fundamentals of Law in Medicine	3.0
B6		Languages	6.0
1	DE0429	The English Language	3.0
2	BM0405	Medical Terminology in English	3.0
3	DE0430	The Latvian Language	3.0
C		Free Elective Study Courses	9.0
D		Practical Placement	37.0
1	BM0073	Practical Placement	37.0
E		Final Examination	18.0
1	BM0420	Bachelor Thesis	9.0
2	BM0418	Engineering Design Project	9.0