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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	Professional Bachelor Study
Higher education study field	Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering
Head of the study field	Aldis Balodis
Department responsible	Faculty of Mechanical Engineering, Transport and Aeronautics
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)	180.0
Duration of studies (years)	Full time studies - 4,5
Degree or/and qualification to be obtained	Professional bachelor degree in medical physics / 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 distributors and service representative offices; in certification and monitoring institutions; in production, design and research institutions. Medical physical technology engineers know how to design and improve medical equipment, are familiar with their physical and technical principles of operation, production and construction technologies, participate in the selection and installation of equipment and systems used in medicine, organize their regulation, repair, monitoring and testing. 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. 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 structure of the study programme consists of: compulsory study courses, limited optional study courses, which include professional specialization study courses, humanitarian and social study courses, languages. 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. At the end of the studies, students develop a bachelor thesis and an engineering project, obtaining a professional bachelor degree in medical physics and the engineer qualification of a medical physical technologies.</p>
Aim	<p>To educate and train highly qualified specialists - bachelors in medical physics and medical engineering (in accordance with the professional standard for a medical physical technology engineer) 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 train students so that they can continue studies at the 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 engineering education and professional standard for medical physical technology engineer; - 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 continue gaining them; - to improve students' foreign language skills; - to educate students on professional ethics issues, promote observation of ethical principles; - to develop student's 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:</p> <ul style="list-style-type: none"> - is able to apply the acquired theoretical knowledge and practical skills in the development and improvement of innovative medical equipment, devices and technologies; - is able 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; - is able to use traditional and modern computerised calculation systems, design, manufacture and processing technologies in the design process, taking into account environmental and civil protection, fire safety and hygiene requirements; - is able to construct, design and service modern medical equipment; - is able to analyse, evaluate, systematize and use the results of applied and scientific research, 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; - is able 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; - is able 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; - is able to apply radiation source protection engineering calculation methodologies, develop and apply mathematical modelling models in radiation physics, biophysics and medical physics, are able to perform dosimetric, radiometric and radiation spectrometric measurements and document them; - is able 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>Engineer of medical physical technologies:</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>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, in addition, also in academic master study programmes.

Courses

No	Code	Name	Credit points
A		Compulsory Study Courses	118.0
A.1		General Education Study Courses	17.0
1	SFI701	Basics of Occupational Safety and Civil Protection	2.0
2	SFI702	Health Economics	2.0
3	MMK227	Fundamentals of Quality Control and Monitoring	3.0
4	MEE711	Introduction to Medical Engineering	2.0
5	ÇVK115	Chemistry for Engineers	2.0
6	MEE332	Medical Physics	3.0
7	MEE226	Radiation and Environmental Safety in Medicine	3.0
A.2		Field-Specific Theoretical Basic and IT Study Courses	42.0
1	DMF101	Mathematics	9.0
2	MFB107	Physics	8.0
3	MEE307	Methods of Medical Statistics	2.0
4	BTG131	Descriptive Geometry and Engineering Graphics	2.0
5	MEE666	Measurements for Medical Equipment and Technologies	3.0
6	EEE226	Electrical Engineering and Electronics	2.0
7	SFI705	Anatomy and Physiology	4.0
8	MEE712	Fundamentals of Physical and Mathematical Simulation	2.0
9	MMK443	Mechatronics	2.0
10	MEE404	Physical Materials Science	5.0
11	MEE514	Medical Informatics	3.0
A.3		Field-Specific Professional Study Courses	59.0
1	MEE413	Physics of Medical Imaging	4.0
2	MEE999	Medical Instrumentation	8.0
3	MEE998	Medical Equipment Design	4.0
4	MEE707	Methods of Medical Equipment Manufacturing	4.0
5	MEE320	Reliability of medical equipment	2.0
6	MEE508	Radiation Therapy Technologies	3.0
7	MEE411	Introduction to Biochemistry and Biophysics	3.0
8	SFI703	Cell and Tissue Microstructure	2.0
9	BBB102	Basics of Biomaterials and Biomechanics	3.0
10	MEE406	Spectroscopy Methods in Medicine	5.0
11	MEE403	Computer Systems in Medicine	5.0
12	RRI311	Electronics in Medicine	2.0
13	MMK371	Micro- and Nanotechnologies	3.0
14	MMK789	Basics of nanomedicine	3.0
15	SFI704	Medical Instruments, Equipment and Systems, Their Use	2.0
16	MEE710	Simulation of Physical Processes (Study Project)	2.0
17	MEE708	Medical Equipment Design (Study Project)	2.0
18	MEE706	Medical Equipment Manufacturing Technology (Study Project)	2.0
B		Compulsory Elective Study Courses	19.0
B1		Field-Specific Study Courses	11.0
		<i>Medical facilities</i>	<i>11.0</i>
1	MTM118	Theoretical Mechanics	2.0
2	MMP108	Resistance of Materials	2.0
3	MSE201	Heat Study	2.0
4	RRI598	Analysis of Biological Signals	5.0
		<i>Medicine physics and nanomedicine</i>	<i>11.0</i>
1	MTH701	Technical Mechanics	4.0
2	MMK795	Nanotechnologies in Medicine	2.0
3	RRI598	Analysis of Biological Signals	5.0
		<i>E-medicine</i>	<i>11.0</i>
1	MTH202	Technical Mechanics	2.0
2	DAA304	Pattern Recognition and Image Processing Methods in Medicine	3.0
3	DDI709	Computerized Decision-Making in Medicine	2.0
4	DDI708	The Basics of Artificial Intelligence in Medicine	2.0
5	DAA305	Fundamentals of Computer Graphics	2.0
		<i>Medicinal electronics</i>	<i>11.0</i>

1	RRI598	Analysis of Biological Signals	5.0
2	MTH202	Technical Mechanics	2.0
3	RRI709	Electronic Elements and the Design of Electronic Equipment	4.0
		<i>Biomechanics and assistant technologies</i>	<i>11.0</i>
1	RRI598	Analysis of Biological Signals	5.0
2	MTH202	Technical Mechanics	2.0
3	MEE713	Assistive Technologies	2.0
4	MMK900	Design of Prostheses	2.0
		<i>Medicinal materials</i>	<i>11.0</i>
1	MTH202	Technical Mechanics	2.0
2	MEE997	Biomaterials	2.0
3	ᲠST561	Basis of Biomaterial Technology	3.0
4	BTM100	Medical Textile Materials	2.0
5	ᲠVT727	Functional Medical Implants	2.0
		<i>Medical engineering business activities</i>	<i>11.0</i>
1	MTH202	Technical Mechanics	2.0
2	MEE203	Health Care Organisation and Economics	2.0
3	SFI711	Business Risks	3.0
4	SFI713	Project Management	2.0
5	SFI712	Business Economics and Fundamentals of Marketing	2.0
B2		Humanities and Social Sciences Study Courses	4.0
1	HSP488	Business Sociology	2.0
2	SFI706	Medical Ethics	2.0
3	MEE302	Fundamentals of Law in Medicine	2.0
B6		Languages	4.0
1	HVD212	The English Language	2.0
2	SFI700	Medical Terminology in English	2.0
3	VIL169	The Latvian Language	2.0
C		Free Elective Study Courses	6.0
D		Practical Placement	25.0
1	MEE222	Practical Placement	25.0
E		Final Examination	12.0
1	MEE996	Bachelor Thesis	6.0
2	MEE995	Engineering Design Project	6.0