

Programme specification (Bachelor) <i>163 «Biomedical engineering»</i>	
Higher education program level	FQ-EHEA – the first cycle, EQF LLL – level 6, HPK – level 6 / Bachelor
Full name of qualification	Expert in Biomedical engineering
Programme official name	Specialty educational program 163 «Biomedical engineering» field of knowledge 16 «Chemical and bioengineering»
Diploma type and number of credits according to the program	Bachelor’s Diploma (Single Honors) , 240 credits ЄKTC
Higher educational establishment	Ternopil I.Pulu’y national technical university
Licence	AE №636492 of 19.06.2015
Accreditation institution	National agency of higher education quality assurance
<b>A.</b>	<b>Programme purpose</b>
	To educate an expert who is able to solve difficult specific tasks and practical problems of biomedical engineering which are characterized by complex and uncertain conditions.
<b>B.</b>	<b>Programme characteristics</b>
1	Subject-matter discipline Chemical and biomedical engineering
2	Subject-matter discipline description <p><b>Study and (or) activity objects:</b></p> <ul style="list-style-type: none"> <li>- medical industry enterprises;</li> <li>- medical establishments;</li> <li>- rehabilitation, sport and recreational complexes, laboratories, departments of life-sustaining treatment, intensive therapy, anesthesiology and surgical departments;</li> <li>-diagnostic-healthcare laboratories and medical institutions departments dealing with medical laboratory equipment use, medical imaging equipment and isotropic materials;</li> <li>- structural subdivisions of medical, scientific, educational establishments.</li> </ul> <p><b>Study goals:</b> be competent in the field of:</p> <ul style="list-style-type: none"> <li>- development, design, production, maintenance and service of biological and medical instruments and systems, design-engineering documentation, estimation of correspondence to technical regulations, standards of biosecurity and biosafety: biological and medical engineering, biomedical products and biomaterials of medical use, biological and medical technologies, and also the proper software and IT for biology, medicine and</li> </ul>

		<p>medical instrument-making;</p> <ul style="list-style-type: none"> <li>- engineering support of diagnostic-healthcare (medical) technologies whilst work in medical institutions;</li> <li>- engineering support of medical-biological instruments and systems production;</li> <li>- certification and standardization of medical and biological instruments and systems.</li> </ul> <p><b>Theoretical content:</b> modern medical technologies, modern techniques, methods and facilities of development, design, maintenance, certification and standardization of medical and biological instruments and systems.</p> <p><b>Methods and techniques:</b> medical and biological research methods, methods of biomedical signals and images processing, biomedical instruments and systems design; methods of biomedical instruments and systems maintenance, certification and standardization; software and IT for biology, medicine and medical instrument-making; biological and medical technologies</p> <p><b>Instruments and equipment:</b> biological and medical equipment, biomedical products and biomaterials of medical use.</p>
3	Programme status	Educational-professional
4	Peculiar and distinctive features	Regular renewal that allows taking into consideration the tendencies of medical, engineering and information technologies development. It is mobile according to the program of academic mobility « Double Diploma»
<b>C.</b>	<b>Graduate rights</b>	
1	Graduate academic rights	Possibility of study on the program of second cycle FQ-EHEA, of level 7 EQF-LLL and of level 7 HPK
2	Employment	<p><b>Main positions of ДК 003:2010:</b></p> <p>3439 – expert</p> <p>3111 – expert in medical physics,</p> <p>3115 – engineer on equipment maintenance,</p> <p>3119 –engineer on technical documentation preparing,</p> <p>3119 – engineer on adjustment and testing,</p> <p>3121– IT expert (biology and medicine)</p> <p><b>International Standard Classification of Occupations 2008 (ISCO-08):</b></p> <p>2149 – Engineer, biomedical</p> <p>5329 – Assistant, medical imaging</p> <p>2240 – Assistant, medical: diagnosing and treating patients</p> <p>1342 – Administrator, medical</p> <p>3255 – Assistant, allied health: physiotherapy</p>

		3255 – Assistant, technical: physiotherapy
<b>D.</b>	<b>Teaching techniques and rating system</b>	
1	Teaching techniques and methods	Teaching process involves both traditional techniques and new technologies. Traditional methods: lectures, tutorials, practical and laboratory classes; new technologies: student-focused study, self-study, distance study using other modern teaching techniques etc.
2	Rating system	Tests, presentations, reports of laboratory works and internship programs, course (projects) papers, control papers, oral and written exams, diploma thesis.
<b>E.</b>	<b>Programme competence</b>	
1	Integral	Ability to solve complex specific tasks and practical problems in the field of professional activity 16 Chemical and bioengineering or in the study process aimed at use of some theories and methods of certain science and is characterized by complex and uncertain conditions
2	General	<b>System competence</b>
		3K1. Ability to apply knowledge in practical activity
		3K2. Ability to conduct research at proper level
		3K3. Ability to adapt and work under unfamiliar conditions
		3K4. Ability to work either independently or in team
		3K5. Ability to motivate people and move to the common goal
		3K6. Ability to evaluate and provide quality of work
		<b>Tools competence</b>
		3K7. Ability of analysis and synthesis
		3K8. Ability to speak and write mother tongue
		3K9. Ability to speak foreign language
		3K10. Skills of information and communication technologies use
		3K13. Ability of information from different sources search, processing and analysis
		3K12. Ability to find, set and solve problems
3K13. Ability to make reasonable decisions		
3K14. Know main conceptions of philosophy, psychology, pedagogics assisting general culture development and personal socialization, inclination to ethic valuables, knowledge of national history, economy and law, comprehension of causal-consequential links of society development and a skill of their use in		

			professional and social activity
		3K15.	Basic knowledge of fundamental sciences enough to necessary mastering general-professional disciplines
		<b>Interpersonal competence</b>	
		3K16.	Ability to be critical and self-critical
		3K17.	Ability to work in interdisciplinary team
		3K18.	Ability to work in international context
		3K19.	Ability to act on the ethics position (reasons)
		3K20.	Be eager to protect environment
		3K21.	Skills in safety activity
3	<b>Professional competence</b>	CK1.	Ability to carry out, edit and write engineering drawings at modern medical complexes and systems designing both by hand and using computer software
		CK2.	Ability to design parts and mechanisms of medical complexes and systems structures using knowledge of applied mechanics
		CK3.	Ability to set concrete medical-biological tasks and find ways of their solving whilst biomechanics study
		CK4.	Ability to describe the essence and importance of physical and chemical notions and laws, use physical and chemical terms, understand basic physical and physical-chemical regularities which are in basis of bio objects functioning, be aware of main problems and tasks of biology, physical-chemical biology, bioengineering and apply this knowledge in medical practice
		CK5.	Ability to find fundamental problems and set tasks dealing with professional functions executing in biomedical engineering and suggest possible methods of their solving using medical complexes and systems
		CK6.	Ability to develop diseases diagnostics algorithms and make conclusions on reasons and mechanisms of functional, metabolic, structural disorder of human body aimed at to find the most efficient methods of treatment, preventive measures and rehabilitation in different branches of medicine
		CK7.	Ability to use modern programming techniques taking into account hardware configuration of modern computers at solving professional tasks in biomedical engineering

	CK8.	Ability to foresee, analyze and estimate the physical fields effect on human body at medical complexes and systems development and operation
	CK9.	Ability of designing, development, using laboratory-analytical devices, medical diagnostics and therapeutic complexes and systems, in diagnostic information processing, in servicing and writing typical documents on kinds of work taking into account European directives on medical equipment and authorization framework of Ministry of healthcare of Ukraine
	CK10.	Ability to apply knowledge of fundamentals of circuits and signals theory, analogue and digital circuit engineering, principles of construction, operation and programming of medical microprocessors and modern element base for medical complexes and systems construction
	CK11.	Ability to evaluate the medical complexes and systems correspondence to metrology requirements at their calibration and certification
	CK12.	Ability to take into consideration structural materials properties according to their nature, composition, physical-chemical features at medical complexes and systems design, bio materials use and their bio compatibility taking into consideration at artificial parts and systems design and development
	CK13.	Ability to organize and carry out design and technology work taking into account requirements of engineering task, existing standards, specific operation and production, modern technologies and methods of design, providing high quality and economic efficiency and safety taking into account ergonomics requirements and medical complexes and systems design
	CK14.	Ability to organize work according to life security requirements and to know work organization fundamentals based on knowledge of labor laws and labor protection rules
	CK15.	Ability to make proximate-economic analysis of production organization indices of medical complexes and systems

		CK16.	Ability to substantiate the choice, to analyze accuracy, to determine parameters by making experiments and to develop structural materials of biophysical quantities and electrodes transducers taking into account medical complexes and systems operational conditions
		CK17.	Ability to investigate and carry out optimization of complex bio objects and medical complexes and systems based on mathematical and computer modeling methods
		CK18.	Ability to introduce methods of biomedical signals and images processing in the form of algorithms and computer programs as medical complexes and systems constituents
		CK19.	Ability to choose, organize and conduct medical-biological investigation of human body depending on the medical task, hardware, staff qualification in the field of biomedical engineering
		CK20.	Ability to develop diseases diagnostics algorithms and make conclusions on reasons and mechanisms of functional, metabolic, structural disorder of human body aimed at to find the most efficient methods of treatment, preventive measures and rehabilitation in different branches of medicine
		CK21.	Ability of functional, structural and circuit engineering construction and medical complexes and systems efficiency estimation to solve problems of biomedical engineering
		CK22.	Ability to design and use local and global computer networks to solve tasks of biomedical information transfer
		CK23.	Ability of medical complexes and systems synthesis and optimization based on system approach and decision-making theory in medicine
		CK24.	Ability to build functional networks of telemedicine systems and estimate their maximum capabilities whilst medical information exchange in telecommunication networks
<b>F</b>	<b>Programme learning outcomes</b>		
PH1.	Skill to apply knowledge in practice		
PH2.	Ability to carry out experimental research and use research skills on professional theme.		

PH3.	Skill to adapt to new situations
PH4.	Skill to work both in team and by himself/herself
PH5.	Skill to be responsible in work and to gain his/her end
PH6.	Skill to apply knowledge and comprehension to solve problems of analysis and synthesis in the systems specific for chosen field
PH7.	Skill to speak and write Ukrainian and a foreign (English, French, German) language
PH8.	Skill to apply information and communication technologies to solve different research and professional tasks
PH9.	Skill of information search in different sources for professional problems solving
PH10.	Skill to make reasonable decisions and estimate their results
PH11.	Skill to use basic knowledge of philosophy, psychology, pedagogics in professional and social activity
PH12.	Skill to apply basic knowledge of fundamental and applied mathematics in scientific-research and professional activity
PH13.	Skill of criticism perception, self-criticism, be self-critical to his/her actions, and criticize the results of work
PH14.	Skill of public, business and scientific communication
PH15.	Skill to follow the code of professional ethics, moral norms and valuables in behavior, keep to etiquette rules
PH16.	Skill to use administrative, legal, economic and educational levers of influence on natural resources users
PH17.	Skill to demonstrate knowledge of life security and labor protection fundamentals in professional activity
PH18.	Skill in using elements of engineering design, descriptive geometry, modern software for imaging and drawing at design-engineering documents preparation for modern medical complexes and systems design
PH19.	Mastering the techniques of design, engineering calculations and choice, usage of classical and modern structures of machine parts, joints and mechanisms in biotechnical and medical apparatuses and systems
PH20.	Knowledge of biomechanics basis of motor apparatus, hemodynamics, digestive system, supporting-motor apparatus and analyzers at design and research
PH21.	Skill in using basic knowledge in chemistry, biochemistry, physical-chemical basis of human living organisms functioning on sub molecular, molecular, cell, tissue levels in the field of biomedical engineering at experimental and theoretical activity in medical practice
PH22.	Be aware of biomedical engineering problems and capabilities of medical complexes and systems in medical practice
PH23.	Skill in analyzing information of human body, estimating and explaining general principles of main functional systems activity and value, interpreting the reasons, mechanisms of development and symptoms of typical pathological processes and the most spread diseases, developing diagnostics algorithms

PH24.	Knowledge of logic and arithmetic basis of modern computers construction, programming, algorithms and programming techniques in different algorithmic languages at professional tasks solving on biomedical engineering
PH25.	Knowledge of research and analysis methods and aids of physical fields effect on human body at medical complexes and systems development and use
PH26.	Skill in designing, development, using laboratory-analytical devices, medical diagnostics and therapeutic complexes and systems, in diagnostic information processing, in servicing and writing typical documents on kinds of work taking into account European directives on medical equipment and authorization framework of Ministry of healthcare of Ukraine
PH27.	Knowledge of fundamentals of circuits and signals theory, analogue and digital circuit engineering, principles of construction, operation and programming of medical microprocessors and modern element base for medical complexes and systems construction
PH28.	Knowledge of methods and techniques of measurement organization of electric, magnetic and non-electric quantities and their accurateness evaluation at medical complexes and systems certification and quality control

PH29.	Knowledge of structural materials properties and taking into account them at medical complexes and systems design, bio materials use and their bio compatibility taking into consideration at artificial parts and systems design and development
PH30.	Skill in organizing and carrying out design and technology work at medical complexes and systems designing
PH31.	Skill to demonstrate knowledge of life security and labor protection fundamentals in professional activity
PH32.	Knowledge of economics fundamentals and medical complexes and systems production organization
PH33.	Knowledge of general principles of operation, functional and structural construction of bio physical quantities and electrodes transducer for medical complexes and systems
PH34.	Skill in investigating and optimization of complex bio objects and medical complexes and systems based on mathematical and computer modeling methods
PH35.	Knowledge of methods of analogue and digital processing of biomedical signals and images and means of their introduction as algorithms and computer programs for medical complexes and systems
PH36.	Knowledge of general medical principles of medical-biological experiments organization and making, basic research methods of vital activity, methods of human body study by bio probes, medical aids of examination, quality and quantity analysis of their results in biomedical engineering
PH37.	Knowledge of main therapeutic and surgical pathology, criteria of diagnostics and use of hardware physiotherapeutic methods of treatment and preventive measures in different medicine branches
PH38.	Knowledge of operation principles, methods of functional, structural and circuit engineering construction and safe use of medical complexes and

	systems, their basic engineering characteristics and specific use under different conditions
PH39.	Knowledge of computer networks construction principles, peculiarities of traditional and advanced technologies of local and global networks, ways of complex networks development, ways of computer networks control, and ways of biomedical information transfer in computer networks
PH40.	Knowledge of theory of systems, system analysis, theory of decision-making and their use in medicine whilst doing medical-biological research
PH41.	Knowledge of fundamentals of telemedicine, telemedicine systems and methods of medical information processing in telemedicine systems

