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Developed in the frame of project "Erasmus+ (CBHE) BioArt "Innovative Multidisciplinary Curriculum in Artificial Implants for Bio-Engineering BSc / MSc Degrees" (586114-EPP- 1-2017- 1-ES- EPPKA2-CBHE- JP).

DESCRIPTION/Syllabi of Curricula/Module

Short Name of the University/Country code Date (Month / Year)	VNTU / UA Sep 2019
TITLE OF THE DISCIPLINE	Code
Biochemistry	
TITLE OF THE MODULE	Code
Biomaterials	

Teacher(s)	Department
Coordinating: As. Prof. Dmytro Shtofel, Ph.D. Others:	Dep. for Biomedical Engineering

Study cycle (BA/MA)	Level of the module (Semester number)	Type of the module (compulsary/elective)
Bachelor	3 rd (second year) for Bachelor	Compulsory

Form of delivery (theory/lab/exercises)	Duration (weeks/months)	Language(s)
Lectures, exercises, laboratory study	9 weeks / 2 months	Ukrainian, English

Prerequisites

Prerequisites: Knowledge: General chemistry, Human anatomy and physiology Skills: none Competences: none	Co-requisites (if necessary): none
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ECTS (Credits of the module)	Total student workload hours	Contact hours	Individual work hours
1,5	45	30	15
Aim of the module (course unit): competences foreseen by the study programme			
<p>Students should be able to:</p> <ul style="list-style-type: none"> - Use the knowledge in practice. - Control the quality and operating conditions of medical equipment and medical supplies, artificial organs and prostheses. - Carry out the feasibility study of the production of medical supplies. - Identify, formulate and solve engineering problems related to the interaction between living and non-living systems. 			
Learning outcomes of module (course unit)	Teaching/learning methods (theory, lab, exercises)	Assessment methods (written exam, oral exam, reports)	
<p>Knowledge: The students will obtain wide knowledge on the different types of biomaterials, their properties and principles of application in regenerative medicine.</p>	Slides, lecture notes, suggested books and literature, personal reports, written papers	Written/oral exam, essays	
<p>Skills: Efficient topic discussion. Studying the properties of biomaterials. Selection of the material for implants design.</p>	Lectures, working groups	Exercise and laboratory reports	
<p>Competences: Perform critical literature research on the subject, use the knowledge in practice, exchange notions, make conclusions and suggestions</p>	Working groups	Exercise and laboratory reports, presentations, essays	

Themes	Contact work hours							Time and tasks for individual work	
	Lectures	Consultations	Seminars	Practical work	Laboratory work	Placements	Total contact work	Individual work	Tasks
Concepts of biomaterials and their application in medicine	2						2	2	Learn the definition of biomaterials and their classification. Learn and understand the requirements for biomaterials. Learn the fundamentals of biotribology, prosthesis technology, implantology. Study the methods of exploring biomaterials and tissues. Learn mechanical, electrical, optical and other methods for determining the properties of biomaterials.
Biocompatibility of materials	4						4	4	Understand and learn the concept of biocompatibility, the mechanisms of biocompatibility, osteointegration and combination of biological tissues with implants. Learn the morpho-functional compatibility of metal materials in implantology. Learn the properties of different metals and their alloys. Understand the process of corrosion and resistance of metals, biocompatible coatings.
Bioceramics	4						4	3	Learn and study the application of ceramic materials in medicine. Learn the properties of corundum bioceramics, bioglass, hydroxyapatite based materials. Understand the transformational strengthening of biomaterials, advantages and disadvantages of bioceramic materials. Study the technology of bioceramics obtaining.
Polymeric biomaterials	4						4	3	Learn the concept of natural polymers as biomaterials. Learn the medical application of synthetic polymers, biocomposites, carbon-carbon composites, carbon fibers, composites based on polymer matrix. Learn and understand the properties of biodegradation of polymers. Learn the concept and application of structural materials, stitch materials, insulating materials, polymeric prostheses and artificial fabrics. Learn the waste processing and utilization in the production and application of biomaterials.
Fundamentals of tissue engineering	4						4	3	Learnt the principles and scientific basis of tissue engineering and regenerative engineering. Learn the structure and use of bioactive gels,

									bioreactors and bioincubators. Learn the materials and technology of fabrication, methods for tissue assembly. Learn and understand the basis of biological 3D printing. Intelligent (intellectual) materials and technologies in prosthetics, biosensors.
Exercises				2 1 1				4	Microstructural analysis of biomaterials Design of biomaterials based on hydroxyapatite Study of shape-memory in structural biomaterials
Laboratory units					2 2 2 2			8	Unit on material hardnessmetry: study of the corrosion resistance of biomaterials Unit on desktop testing: determining of the contact angle between the surface of bioceramics material and biological fluid Unit on desktop testing: study of the polymeric biomaterials Unit on microscopy: study of the bioresorptive properties of materials
Final exam									
Total	18			4	8			32	15

Assessment strategy	Weight in %	Deadlines	Assessment criteria
Practical works attendance and exercise reports	15		Attendance and reports
Laboratory study and lab report	20		Attendance and reports
Colloquium (theory control)	20		Test
Individual tasks	20		Essays and presentations
Final exam	25		Written/oral exam

Author	Year of issue	Title	No of periodical or volume	Place of printing. Printing house or internet link
Compulsory literature				
Chen, Qizhi and George Thouas	2014	Biomaterials: a basic introduction	ISBN 978-1138749665	CRC Press
Ducheyne, Paul (ed.-in-chief)	2011	Comprehensive biomaterials. Vol. 1. Metallic, Ceramic and Polymeric Biomaterials	ISBN 978-0-08-055302-3	Elsevier
He, Nongyue and Zhiyang Li	2016	Biomaterials Science	Science. No 7.1. pp. 1-812.	American Association for the Advancement of Science
Murphy, William, Jonathan Black, and Garth W. Hastings	2016	Handbook of biomaterial properties	ISBN 978-1-4939-3305-1	Springer
Additional literature				
Bronzino, Joseph D. and Donald R. Peterson (eds.)	2014	Biomedical engineering fundamentals	ISBN 978-1138748071	CRC press
Paul, John P. (ed.)	2016	Biomaterials in artificial organs	ISBN 978-3527152346	Springer
Talwar, G. P.	2015	Textbook of biochemistry, biotechnology, allied and molecular medicine	ISBN 978-8120351257	PHI Learning Pvt. Ltd.
Bronzino, Joseph D. and Donald R. Peterson (eds.)	2015	Molecular, Cellular, and Tissue Engineering	ISBN 978-1138749078	CRC Press

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