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Short Name of the University/Country code Date (Month / Year)	PSTU January 2019
TITLE OF THE MODULE	Code
Bioceramics	

Teacher(s)	Department
Coordinating: Assoc. Prof. Oleinik I.M. Others: Prof. Iefremenko V.G.	Department of Material Science and Advanced Technologies

Study cycle	Level of the module	Type of the module
MA	9th semester	compulsary

Form of delivery	Duration	Language (s)
Lectures, seminars	18 weeks	Ukrainian/English

Prerequisites	
<p>Prerequisites:</p> <p>Knowledge: mathematics, physics, chemistry, materials engineering</p> <p>Skills: analysis, calculations, basic software for calculations.</p> <p>Competences: none.</p>	<p>Co-requisites (if necessary):</p> <p>Students should have skills to work in basic computer software (eg. MS Word, MS PowerPoint)</p>

ECTS (Credits of the module)	Total student workload hours	Contact hours	Individual work hours
3	90	54	36

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Aim of the module (course unit): competences foreseen by the study programmes		
Students should be able to: <ul style="list-style-type: none"> - Take part in a discussion on new trends in biomaterials; - Find, analyze and compare information of new biomaterials; - Make a presentation on a selected topic. 		
Learning outcomes of module (course unit)	Teaching/learning methods	Assessment methods
Knowledge: Knowledge of basic information of various materials, processing methods. Knowledge of bioceramic materials applications in biomedicine. Competences: Demonstrate innovation ideas in the field of bioceramic materials for biomedicine and their applications. Select an appropriate bioceramic material for specific biomedical applications.	Lectures	Test
Skills: Ability to analyze and compare physical and mechanical properties of different types of bioceramic materials. Explain the basic advantages and disadvantages of ceramic materials in biomedicine. Proper project presentation.	Seminar	Presentation

Themes	Contact work hours						Time and tasks for individual work		
	Lectures	Consultations	Seminars	Practical work	Laboratory work	Placements	Total contact work	Individual work	Tasks
1. Introduction, basic information, composition, structure, properties, processing, application. Traditional and advanced ceramics. Bioceramics as an advanced material. Topics of presentations for students.	4		2				6	4	Study of theoretical material, case study
2. Ceramics as a materials for bio-applications. Historical retrospective and current state. Implant areas – dental, orthopedic. Implant materials – bio polymers, bio metals, ceramic implants – porous ceramics, surface active ceramics, resorbable ceramics. Biological performance of the materials, body reaction to implant materials – corrosion, biodegradation and biocompatibility. In-vitro and in-vivo test methods of implant materials.	6		4				10	5	Study of theoretical material, case study

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3. Biominerals and mineralised tissues. Biological ceramics. Structure and properties of mineralised tissues. Bone, dentin and dental enamel. Bone bonding mechanism: bonding mechanism to living tissue – interfacial bonding.	4		2				6	5	Study of theoretical material, case study
4. Biostable ceramics. Different kinds of advanced ceramics: functionally graded, smart/intelligent, biomimetic, nanoceramics. Ceramic oxides: alumina and zirconia. Structure, properties and use in the biomedical field.	4		2				6	5	Study of theoretical material /case study/ presentations
5. Bioactive ceramics. Calcium phosphate-based ceramics. Bioactive glasses and glass ceramics. Bioactive glass ceramics: processing, structure, mechanical and biological properties. Surface active glasses: mechanism of surface apatite formation, compositional dependence.	6		2				8	5	Study of theoretical material/case study/ presentations
6. Composites: characteristic and basic parameters. Ceramics matrix composites: different types, their preparation and properties. Different types of ceramic fibres, composites, their properties and applications. Hydroxyapatite composites with zirconia, alumina and titania – preparation and properties. SiC whisker reinforced hydroxyapatite and bioactive glass ceramics, zirconia toughened and bioactive glass ceramics, bioglass-hydroxyapatite composites, carbon composites.	6		4				10	5	Study of theoretical material /case study/ presentations
7. Bioactive coatings, basic characteristics. Importance of bioactive coatings. Hydroxyapatite coated metal implants: coating methods, characterization and properties. Bioglass and bioactive glass ceramics coating over metals and alloys.	4		2				6	5	Study of theoretical material /case study/ presentations
8. Final open questions test	2						2	2	
Total	36		18				54	36	

Assessment strategy	Weight in %	Deadlines	Assessment criteria
Presentation	50	17 th week	Attendance, activity, presentation
Final test	50	17 th week	Open questions test

Author	Year of	Title	No of periodical or	Place of printing. Printing house or internet link
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	issue		volume	
Compulsory literature				
Narayan R.	2009	Biomedical Materials		Springer
Верещагин В.И.	2011	Керамические и стеклокристаллические материалы для медицины		Томск : НИПУ
Additional literature				
Баринов С.М.	2005	Биокерамика на основе фосфатов кальция		Москва : Наука
Фадеева И.В.	2016	Медицинская керамика		Москва : Университет
Поюровская И.Я.	2008	Стоматологическое материаловедение		Москва : Наука
Воложин А.И., Курдюмов С.Г., Орловский В.П., Баринов С.М. и др.	2004	Создание нового поколения биосовместимых материалов на основе фосфатов кальция для широкого применения в медицинской практике	Т.1, №1. Р. 41-56	«Технологии живых систем»
Комлев В.С., Баринов С.М.	2005	Костные ткани «ремонтирует» керамика	№ 1. Р. 27-30	«Наука в России»
Park J.	2007	Biomaterials Principles and Applications		CRC Press
Ramakrishna S., Ramalingam M., Kumar T.S.S., Soboyejo W.O.	2010	Biomaterials.		CRC Press
	2016	Материалы IV-й Международной научно-практической конференции «Новые технологии создания и применения биокерамики в восстановительной медицине».		Томск : «НИТПУ»