

DESCRIPTION/Syllabi of Curricula/Module

Short Name of the University/Country code	PSTU Ukraine
Date (Month / Year)	June 2021
TITLE OF THE MODULE	Code
Bioceramics	

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

Study cycle (BA/MA)	Level of the module (Semester number)	Type of the module (compulsary/elective)
MA	9th semester	Compulsary

Form of delivery (theory/lab/exercises)	Duration (weeks/months)	Language(s)
Lectures, Seminars	18 weeks	Ukrainian/English

Prerequisites	
Prerequisites: Knowledge: Mathematics, physics, chemistry, materials engineering. Skills: Analysis, calculations, basic software for calculations. Competences: None	Co-requisites (if necessary): Students should have skills to work in basic computer software (eg. MS Word, MS PowerPoint)

ECTS (Credits of the module)	Total student workload hours	Contact hours	Individual work hours
3	90	54	36
Aim of the module (course unit): competences foreseen by the study programme			
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 (theory, lab, exercises)	Assessment methods (written exam, oral exam, reports)	
Knowledge: Knowledge of basic information of various materials, processing methods. Knowledge of bioceramic materials applications in biomedicine.	Lectures	Test	
Skills: Ability to analyze and compare physical and mechanical properties of different types of bio-ceramic materials. Explain the basic advantages and disadvantages of ceramic materials in biomedicine. Proper project presentation.	Seminar	Presentation	
Competences: Demonstrate innovation ideas in the field of bio-ceramic materials for biomedicine and their applications. Select an appropriate bioceramic material for specific biomedical applications.	Lectures	Test	

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	12	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	15	Study of theoretical material, case study
3. Biomaterials 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	15	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	15	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.	4		2				6	14	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		2				8	14	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	13	Study of theoretical material /case study/ presentations
8. Final open questions test	2						2	4	
Total	32		16				48	102	

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 issue	Title	No of periodical or volume	Place of printing. Printing house or internet link
Compulsory literature				
Ed. by Iulian Vasile Antoniac	2016	Handbook of Bioceramics and Biocomposites		Springer. – 1410 p. ISBN: 978-3-319-09230-0
T. Sabu, B. Preetha, M.S. Sreekala	2018	Fundamental Biomaterials: Ceramics		Woodhead Publishing.– 498 p.

T.E. San, H. Jie, A. Mamoru	2016	Nanobioceramics for Healthcare Applications		World Scientific. – 316 p.
Additional literature				
K. Gurbinder	2017	Bioactive Glasses: Potential Biomaterials for Future Therapy		Springer. – 332 p.
G. Straffelini	2015	Friction and Wear. Methodologies for Design and Control		Springer, Cham. – 283 p.