Co-funded by the Erasmus+ Programme of the European Union

DESCRIPTION OF THE COURSE SYLLABI

NU ZAPORIZHZHIA POLYTECHNIC, UA	
TITLE OF THE COURSE	**Code**
CAD OF BIOMEDICAL DEVICES AND STRUCTURES	**IIIIB02**

Teacher(s)	Department
Coordinating: Anzhelika Parkhomenko **Others: Olga Gladkova**	**Software Tools**

Study cycle	Level of the curricula	Type of the curricula
MA	**2**	**elective**

Form of delivery	Duration	Language(s)
Lectures/lab	**15 weeks**	**Ukr/Eng**

Prerequisites	
Prerequisites: Basics of CAD	**Co-requisites (if necessary):** - Biomedical materials and structures - Embedded biomedical systems and wireless sensor networks

ECTS	Total student workload hours	Contact hours	Individual work hours
5	**150**	**60**	**90**

Aim of the course: competences foreseen by the study programme		
Research, development and practical application of modern computer-aided design technologies of biomedical devices and structures		
Learning outcomes of the course	**Teaching/learning methods**	**Assessment methods**
Students will gain general competencies defined in the Educational Professional Program	Lectures, preparation for laboratory classes, laboratory works execution, students self-study under the guidance of a teacher.	Separate assessment does not apply
Students will gain special competencies defined in the Professional Education Program	Lectures and consultations. Students self-study under the guidance of a teacher, preparation and execution of laboratory works.	Assessment during exam. Reports on laboratory and self-study works.
Students will be able to develop new and effectively use the existing technologies of prototyping and designing of biomedical devices and structures	Students self-study under the guidance of a teacher, preparation and execution of laboratory works.	Reports on laboratory and self-study works.

Themes	Contact work hours							Time and tasks for individual work	
	Lectures	Consultation	Seminars	Practical work	Laboratory work	Placements	Total contact work	Individual work	Tasks
Module 1. Methodology of biomedical devices and structures development	**12**						**12**	**18**	
1.1 Tasks and problems of software tools application for the implementation of life cycle stages of biomedical devices and structures	2						2	4	Analysis of literature sources
1.2 Current state and prospects of CAD/CAM/CAE system development. New directions in design.	4						4	6	Analysis of literature sources
1.3 Systems of geometric modeling. Solid modeling. Assembly modeling.	6						6	8	Analysis of literature sources
Module 2. Computer-aided design of biomedical devices on the basis of Mechanical CAD (MCAD)	**4**				**20**		**24**	**21**	
2.1 Structure and functionality of the Creo system	2				2		4	4	Preparation for laboratory work №1. Self-study work №1 (Part 1) execution.
2.2 Development and research of 3D virtual prototypes of biomedical structures	2				18		20	17	Preparation for laboratory works № 2-5. Self-study works №2-6 (Part 1) execution.
Module 3. Computer-aided design of biomedical devices on the basis of Electronic CAD (ECAD)	**4**						**4**	**26**	
3.1 Structure and functionality of ALTIUM DESIGNER	2						2	2	Self-study work №1 (Part 2) execution.
3.2 Development and investigation of electronic circuits and printed circuit boards design techniques for biomedical apparatus	2						2	24	Self-study works №2-6 (Part 1) execution.
Module 4. Advanced techniques of biomedical devices and structures rapid prototyping	**10**				**10**		**10**	**25**	
4.1 Classification of prototyping technologies. Virtual and physical prototyping	4						4	7	Analysis of literature sources
4.2 Technologies of 3D printing and 3D scanning. Software and hardware.	4				10		4	10	Preparation for laboratory works № 6-7.
4.3 The features of prototyping of robotic prostheses of human upper limb	2						2	8	Analysis of literature sources
Is viso	**30**				**30**		**60**	**90**	

Assessment strategy	Weight in %	Deadlines	Assessment criteria
Final exam	40	20	Grade A (excellent) - clarity of expression – excellent, confident delivery, practical tasks – full done. Grade B (good) – clarity of expression – good, thoughts and ideas clearly expressed, practical tasks - well done. Grade C (good) - clarity of expression – well-placed, delivery is fluctuating, practical tasks - well done. Grade D (passed) - clarity of expression – poor, delivery is fluctuating, practical tasks done with mistakes. Grade E (fail) - failure in theoretical or practical tasks.
Lab and self-study works assessments	60	40	All labs and self-study reports should be passed

Author	Year of issue	Title	No of periodical or volume	Place of printing. Printing house or internet link
Compulsory literature				
A.V. Parkhomenko, O. M. Gladkova, A. V. Parkhomenko	2021	PROTOTYPING OF BIOMEDICAL DEVICES AND STRUCTURES		Zhytomyr, PE "Euro-Volyn" http://eir.zp.edu.ua/handle/12345 6789/6801
A. Parkhomenko, O. Gladkova, A. Tulenkov	2021	Modern Technologies for Biomedical Systems Prototyping In: Teaching and subjects on bio-medical engineering. Approachwes and experiences from the BIOART- project		Acco cv, Leuven, Belgium
A. V. Parkhomenko, A. V. Pritula, V. M. Krishchuk	2020	Computer aided design of electronic devices in CREO and ALTIUM DESIGNER		Zhytomyr, Evenok http://eir.zp.edu.ua/handle/12345 6789/6801
A. V. Parkhomenko, O. M. Gladkova, Ya. I. Zalyubovskiy, A. V. Parkhomenko	2017	Engineering of Embedded Systems		Zaporizhzhia, Dyke pole http://eir.zntu.edu.ua/handle/1234 56789/1969
Additional literature				
I. Gibson, D. W. Rosen, B. Stucker	2017	Additive Manufacturing Technologies		Springer
L. J. Kumar, P. M. Pandey, D. I. Wimpenny	2019	3D Printing and Additive Manufacturing Technologies		Springer
S. N. Bernier, B. Luyt, T. Reinhard	2015	Design for 3D Printing: Scanning, Creating, Editing, Remixing, and Making in Three Dimensions		Maker Media, Inc .,