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DESCRIPTION/Syllabi of Curricula/Module

Short Name of the University/Country code	PSTU Ukraine
Date (Month / Year)	June 2021
TITLE OF THE MODULE	Code
3D Printing for Biomedical Applications	

Teacher(s)	Department
Coordinating: Assoc. Prof. Yefremenko Bohdan, PhD Others:	Department of Biomedical Engineering

Study cycle (BA/MA)	Level of the module (Semester number)	Type of the module (compulsory/elective)
MA	10th semester	Compulsary

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

Prerequisites	
Prerequisites: Knowledge: Basic knowledge in physics, mechanics, modeling. Skills: Basic skills in 3D modeling, ability to search information, analysis. Competences: None	Co-requisites (if necessary): Students should have skills to work in basic computer software.

ECTS (Credits of the module)	Total student workload hours	Contact hours	Individual work hours
4	120	64	56
Aim of the module (course unit): competences foreseen by the study programme			
Students should be able to: <ul style="list-style-type: none"> - Have knowledge about 3D prints in medical and biological; - Choose the appropriate additive technology to application in medicine and biotechnology; - Compare the advantages and disadvantages various 3D printing techniques for applications in medicine and biotechnology. 			
Learning outcomes of module (course unit)	Teaching/learning methods (theory, lab, exercises)	Assessment methods (written exam, oral exam, reports)	
<p>Knowledge:</p> <p>Knowledge of the design of parameters for additive manufacturing processes.</p> <p>Knowledge of basic additive technologies of metal products</p> <p>Knowledge of basic additive technologies of polymer products.</p>	Work with the lecture notes as well as on the available fundamental subject literature	Knowledge test	
<p>Skills:</p> <p>The ability to select methods and tools for printing with metallic and polymeric materials.</p> <p>Ability to design and select the technology of printing metal and polymer models.</p> <p>Ability to prepare 3D models for printing and select optimal printing modes.</p> <p>Ability to solve problems with analytical and simulation methods.</p>	Lectures, labs, project, consultation	Active attendance on lectures, individual/group project and presentation	
<p>Competences:</p> <p>Demonstrate innovation ideas in the field of additive technology in medicine.</p> <p>Collecting and transferring information about the achievements of technology in a comprehensible way.</p> <p>Basic 3D printing technologies, their advantages and drawbacks;</p> <p>Features of preparation of 3D models for printing;</p>	Lectures, project, consultation	Individual/group project and presentation	

<p>The main types of materials used for 3D printing, their properties, advantages and drawbacks;</p> <p>The directions of using 3D printing for biomedical purposes</p>		
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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 to 3d printing	2						2	2	Study of theoretical material/case study/ presentations
2. Additive manufacturing technologies and associated equipment	4			2			6	12	Study of theoretical material/case study/ presentations
3. Materials for 3D printing	4			4			8	6	Study of theoretical material/case study/ presentations
4. 3D models developing	8			6	4		18	12	Study of theoretical material/case study/ presentations
5. Preparation of 3D model for printing. Printing procedure	10			10	4		24	20	Study of theoretical material/case study/ presentations
6. Manufacturing the implants for biomedical application	4			2			6	4	Study of theoretical material/case study/ presentations
Total	32			24	8		64	56	

Assessment strategy	Weight in %	Deadlines	Assessment criteria
Individual or group final project referred during seminars	50	3 th - 16 th week	Project
Final exam	50	17 th week	Test

Author	Year of issue	Title	No of periodical or volume	Place of printing. Printing house or internet link
Compulsory literature				
A.Gebhardt, J.Kessler, L.Thurn	2018	3D Printing: Understanding Additive Manufacturing		Carl Hanser Verlag GmbH &Company KG. – 204 p.
D. Wimpenny, P.M. Pandey, L.J. Kumar	2016	Advanced 3D Printing & Additive Manufacturing Technologies		Springer. – 186 p.
I. Gibson, D. Rosen, B. Stucker, M. Khorasani	2020	Additive Manufacturing Technologies, 3rd ed.		Springer International Publishing. – 595 p. ISBN: 9783030561277
M. Dipaola, F.M. Wodajo	2018	3D Printing in Orthopaedic Surgery		Elsevier Health Sciences. – 228 p. ISBN: 9780323581196
Additional literature				
L.S. Osborn	2019	3D Printing and Intellectual Property		Cambridge University Press.– 234 p. ISBN: 9781108763059
J.O. Milewski	2017	Additive Manufacturing of Metals: From Fundamental Technology to Rocket Nozzles, Medical Implants, and Custom Jewelry		- Springer Series in Materials Science, vol. 258. – 343 p. ISBN-10: 3319582046