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EUROPEAN UNIVERSITY FOR CUSTOMISED EDUCATION

STUDY GUIDE

INNOVATIVE METHODS OF DESIGN AND FABRICATION OF PROSTHETIC DEVICES

Organised by

Poznan University of Technology [PUT]

Brandenburg University of Technology Cottbus - Senftenberg
Universidad de Cantabria
Università di Catania
Université Polytechnique Hauts-de-France
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1. IDENTIFYING DATA.	
· Course Name.	Innovative Methods of Design and Fabrication of Prosthetic Devices
· Coordinating University.	Poznan University of Technology
· Partner Universities Involved.	-
· Course Field(s).	Engineering
· Related Study Programme.	Biomedical Engineering / Implants and artificial organs
· ISCED Code.	0710 - Engineering and engineering trades, not further defined
· SDG.	Goal 3: Good health and well-being; Goal 4: Quality education; Goal 9: Industry, innovation and infrastructure; Goal 10: Reduced Inequalities; Goal 12: Responsible Consumption and Production
· Study Level.	Bachelor (B), Master (M)
· EUNICE Key Competencies	[Indicate the Key Competencies required for the course.] • Green – strongly • Orange- moderately • Red – partially • Blank cell - not at all

Problem solving	STRONGLY
Teamworking	PARTIALLY
Communication	PARTIALLY
Self-management	STRONGLY
Cognitive flexibility	STRONGLY

	Digital competence	STRONGLY
	Technical competence	STRONGLY
	Global intercultural competence	NOT AT ALL

· Number of ECTS credits allocated.	3
· Mode of Delivery.	Online live / online self-study
· Language of Instruction.	English
· Course Dates.	01.03.2026 – 31.05.2026
· Precise Schedule of the Lectures.	Will be provided at a later stage
· Key Words.	Anatomically Customized Medical Devices; Prosthetics; Orthotics; Implants; Surgical Guides; Medical Imaging Processing; 3D Scanning; CAD Design; Design Automation; Intelligent Modeling; Additive Manufacturing; 3D Printing; Virtual Reality (VR); Extended Reality (XR); Medical Engineering
· Catchy Phrase.	Bridging medicine and technology: this course empowers to smoothly create patient-specific medical devices.

· Prerequisites and co-requisites.	- Basic knowledge from biology and chemistry, especially related to functioning of a human body. - Basic knowledge about manufacturing technologies and engineering materials. - The ability of logical thinking, obtaining information from the library and the Internet. - Understanding the needs for learning and gaining interdisciplinary knowledge.

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· Number of EUNICE students /staff members that can attend the Course.	30
· Course inscription procedure(s).	Applications via EUNICE website

2. CONTACT DETAILS.	
· Department.	Faculty of Mechanical Engineering
· Name of Lecturer.	DSc. PhD. Eng. Filip Górski, Assoc. Prof.
· E-mail.	filip.gorski@put.poznan.pl
· Other Lecturers.	-

3. COURSE CONTENT.

Lecture

1. Introduction - basic notions, classification, state of the art, challenges (2 hours).
2. Designing anatomically customized prosthetic and orthotic devices. Medical imaging processing. Mesh processing. CAD design. CAD design automation: intelligent models, automated design systems (4 hours).
3. Manufacturing processes of prosthetic devices, including additive manufacturing: FDM/FFF, SLS, UV technologies; basic material division; bioprinting (4 hours).
4. Use of XR technologies in design of anatomically customized devices: basic notions, concepts and methodologies (3 hours).
5. Case study examples: customized prosthetic arm, lower jaw reconstruction, therapeutic hand orthotics (2 hours).

Project

Students realize own work on their computers, related to various aspects of modern design and fabrication of anatomically customized medical devices. The project are realized solo or in pairs (1-2 persons per project). The following tasks are to be realized:

1. Design – based on provided 3D data and basic CAD models, the students realize design of a part of a medical (prosthetic) device (e.g. a mechanical prosthesis or a hand orthosis – selection out of 2-3 choices offered by the instructor). Instructions and software provided.
2. Additive manufacturing – based on realized design, the students create a simulation of additive manufacturing and a program for a 3D printer, along with economic analysis (cost and time). Instructions and software provided.

3. XR – based on realized design, the students create a simple interactive visualization. Instructions and software provided.
Finally, the students prepare a report showing realization of all three tasks.

4. LEARNING OUTCOMES.

Knowledge

1. Student should differentiate between various types of anatomically customized devices: implants, prostheses, orthoses and artificial organs.
2. Student should have knowledge about the design of implants and artificial organs, using traditional and modern methods, including medical imaging, CAD and design automation.
3. Student should have knowledge of modern fabrication techniques of antomically customized devices, including additive manufacturing and 3D bio-printing.
4. Student should have knowledge of use of spatial computing (XR) technologies in the process of development and use of anatomically customized devices.

Skills

1. Student can acquire information regarding the interdisciplinary area of medical engineering.
2. Student is able to assess the need for a given anatomically customized device in a specific group of patient case.
3. Student is able to select the techniques of design and fabrication suitable for a given case of an anatomically customized medical device.
4. Student is able to integrate the obtained information, interpret and draw conclusions.

Social competences

1. Student is aware of the importance and understanding of non-technical aspects of engineering and connection between medicine, design and manufacturing.
2. Student is able to set priorities for the implementation of a specific project.
3. Student is able to interact in a group, taking on different roles.
4. Student appreciates the importance of mutual communication between doctors, patients and engineers in the development and implementation of modern medical products.

5. OBJECTIVES.

The main aims of the course are as following:

- to get the students acquainted with the basic notions of anatomically customized medical devices: prostheses, implants, artificial organs and orthoses

• to present the development and progress in the field – evolution from manual forming, to digital sculpting, towards automated, AI-driven design techniques • to get the students familiar with modern fabrication techniques of anatomically customized devices – 3D printing with polymers, composites and metals • to get the students familiar with modern methods of design aid, using Virtual and Mixed Reality

6. COURSE ORGANISATION.	
UNITS	
1.	Lecture 1. Introduction, main concepts
2.	Lecture 2a. Design of anatomically customized products, part 1: image processing, CAD design
3.	Lecture 2b. Design of anatomically customized products, part 2: design automation
4.	Project: Assignment 1. Design of a medical device using intelligent model (self study)
5.	Lecture 3a. Additive manufacturing of anatomically customized devices, part 1: basic concepts, processes and key features
6.	Lecture 3b. Additive manufacturing of anatomically customized devices, part 2: stereolithography, extrusion and sintering processes for medical devices
7.	Project: Assignment 2. Planning and simulation of additive manufacturing of anatomically customized devices (self study)
8.	Lecture 4. Use of XR technologies for medical devices design
9.	Project: Assignment 3. Building a simple interactive visualization of a selected medical device.
10.	Lecture 5: Case studies: real-life examples.
LEARNING RESOURCES AND TOOLS.	
Virtual course – presentations and instructions (PDF) Software: AutoMedPrint system (PUT-proprietary, selected modules, for educational use only); Unity (game engine for VR, Personal or Education License – free), slicers for 3D printing (Cura, Bambu Studio)	
PLANNED LEARNING ACTIVITIES AND TEACHING METHODS.	
Lecture: multimedia presentation. | Project – project method.	

7. ASSESSMENT METHODS, CRITERIA AND PERIOD.
Lecture: a written exam (online test, minimum 10 questions), minimum 50% score to pass the exam Project: a report of project advancement (project assignments realized solo or in pairs)
OBSERVATIONS.

8. BIBLIOGRAPHY AND TEACHING MATERIALS.
1. Górski F., 2025, Computer Aided Design of 3D Printable Anatomically Shaped Medical Devices: Methodologies and Applications, CRC Press, Taylor and Francis Group. 2. The Basics of Artificial Organs Charles G. Gebelein, 1984