POLITEHNICA University of Bucharest (**UPB**)
Faculty of Industrial Engineering and Robotics (**IIR**)
Study Programme: Industrial Engineering (**IE**)
Form of study: Master

COURSE SPECIFICATION

Course title:	**ADDITIVE MANUFACTURING**	***Semester:***	**2**
Course code:	**UPB.06.M2.O.01**	***Credits (ECTS):***	**4**

Course structure	Lecture	Seminar	Laboratory	Project	Total hours
Number of hours per week	2		2		4
Number of hours per semester	28		28		56

Lecturer	Lecture	Seminar / Laboratory / Project
Name, academic degree	Prof.dr.ing.ec. DOICIN Cristian Sl.dr.ing.ec. ULMEANU Mihaela-Elena	
Contact (email, location)	cristian.doicin@cont-edu.pub.ro mihaela.lupeanu@yahoo.com	

Course description:

The course is comprised of 14 main chapters, covering all the main topics related to Additive Manufacturing (AM) technologies. The lectures include different subjects in the AM domain, such as:

- Applications of additive manufacturing technologies: Rapid Prototyping**,** Rapid Manufacturing**,** Rapid Tooling**,** Rapid Casting**,** Rapid Molding, Consumer products & Electronics, Motor vehicles, Aerospace, Industrial & business machines, Medical &dental, Academic & research, Government & military, Architectural & Fashion, Niche industries;
- AM Technologies: Solid Freeform Fabrication (SFF) Technologies; Stereolithography (SLA); Selective Laser Sintering; Laminated Object Manufacturing; Laser Powder Forming (LFP) Technologies; Fused Deposition Modelling; LENS ® Technologies; Inkjet Technologies; Balistic Particle Manufacturing; CAD application and 3D printing machines.
- Cost analysis, intellectual property and environmental issues; National and international Research, Development & Innovation (RD&I) in the AM industry.

Lectures will be delivered using a laptop and a projector. Students will receive electronic and printed materials and bibliography. The lecture and laboratory hand-outs will be uploaded on the students' on-line platform.

Laboratory description:

Additive Manufacturing laboratories will be interactive, involving the students in all main manufacturing stages: 3D modeling, STL preparation, print layout optimization, 3D printing and post-processing. Laboratories will start with a general introduction in the subject and a comprehensive description of the available equipment's characteristics. Other laboratories will include: modeling and execution of a 3D printed part using FDM technology and PLA materials; modeling and simulation of a product using Mimics software; 3D printing of an anatomical body part/ custom implant; product manufacturing using Film Transfer Imaging, product 3D scanning and data processing; modeling and execution of a product using 3D Printing; designing a custom product and simulating it in working conditions using 3-Matic software. The laboratory is equipped with the following specific equipment: 1 Projet 1500 3D printer which uses FTI® (Film Transfer Imaging) technology; 1 UV oven for part curing; 1 ZCorp 310 3D printer which uses 3DP® (3D Printing) technology; 1 post-processing unit; 10 Kreator 3D printers which use FDM Fused deposition modelling) technology; 10 post processing stations. Students will receive electronic and printed materials. Work is undertaken on individual computers and 3D printers.

Intended learning outcomes:

Amongst the intended learning outcomes are some of the following:

- Learning of concepts and terminology used in modeling of 3D parts for Additive Manufacturing;
- Setting and deepening knowledge regarding the concepts and terminology used in modeling of 3D parts for additive manufacturing;
- Acquiring knowledge regarding the additive manufacturing technologies and corresponding applications;
- Acquiring knowledge about proper use of the basic commands in a software specific to 3D printers;
- Setting and deepening knowledge regarding the use of the basic commands in a software specific to 3D manufacturing equipment;
- Acquiring knowledge about the development of new products with the use of additive manufacturing technologies;
- Setting and deepening knowledge regarding the development of new products with the use of additive manufacturing technologies.

Assessment method:	% of the final grade	Minimal requirements for award of credits
Written exam	40 %	1 practical topic (30 points) + 1 oral topic (10 points) Knowledge for grade 5: minimum 20 points obtained Knowledge for grade 10: 40 points obtained
Homework	10 %	5 homework topics, 2 points each

Laboratory	50 %	On-going examination during laboratory sessions: • Knowledge for grade 5: minimum 25 points obtained • Knowledge for grade 10: 40 points obtained

References:	
[1] Wohlers, Wohlers Report 2017, Wohlers Associates, Inc., Colorado, USA, 2015. [2] K. Ulrich, S. Eppinger, Product Design and Development, 4th Edition McGraw Hill Publishing Company Ltd., 2009. [3] www.materialise.com [4] www.additivemanufacturing.com [5] http://www.eos.info/en	
Prerequisites:	***Co-requisites*** ***(courses to be taken in parallel as a condition for enrolment):***
Computer Aided Design	Additive Manufacturing - Project

Date: 13.06.2017

Professional degree, Surname, Name:

Prof.dr.ing.ec. DOICIN Cristian

Sl.dr.ing.ec. ULMEANU Mihaela-Elena