Course code: **Course item:** **D.4.8**

1. INFORMATION ABOUT THE COURSE

a. Basic information

Course title	***Additive manufacturing techniques***
Field of study	*Mechanical Engineering*
Cycle	*first degree*
Study profile	*general academic*
Study mode	*full-time*
Specialisation	*Techniques of Plastics*
Unit responsible for the field of study	*Faculty of Mechanical Engineering*
Lecturer	*Karol Pepliński, PhD* *Dawid Marciniak, MSc*
Introductory courses	*Engineering graphics, Engineering materials*
Prerequisites	*Computer aided design - CAD*

b. Semester/ weekly timetable

Semester	Lectures (W)	Classes (C)	Laboratories (L)	Project classes (P)	Seminars (S)	Fieldwork (T)	ECTS credits ECTS*
VI	30		15				4

C. Assumed outcomes and aims - aims bind the course programme with the study programme and are referred to in learning outcomes point 2

2. LEARNING OUTCOMES (acc. to National Qualifications Framework)

No.	Description of learning outcomes	Reference to learning outcomes for the field of study	Reference to learning outcomes for the area of study
KNOWLEDGE			
K1	Has knowledge of: AM systems engineering processes, construction and operation of additive manufacturing and devices.	K_W08	P6S_WG
K2	Has knowledge of how to produce construction and prototype elements from various materials (plastics, metals) by adding successive layers of material.	K_W10	P6S_WG
SKILLS			
S1	Can select construction materials for a specific technique of additive manufacturing and the expected properties of the final product.	K_U05	P6S_UW
S2	Can develop a numerical algorithm to control working elements in additive manufacturing processes.	K_U08	P6S_UW

SOCIAL COMPETENCES			
SC1	Understands the need for continuous training and deepening of his practical skills in the area of additive techniques	K_K02	P6S_KK

3. TEACHING METHODS

multimedia lecture, laboratory and other methods, e.g. videos, books, catalogs, diagrams, blackboard, online techniques, exercise workbook classes, lectures, brainstorming, discussion, show, situational methods, mind maps, drama, etc.

4. METHODS OF EXAMINATION

class attendance, final pass, partial or final report during/after the laboratory

5. COURSE CONTENT

Specify the content separately for each type of classes in accordance with point I.B. Lecture	From traditional manufacturing to additive manufacturing. Systems engineering processes AM. Evaluation of existing modeling software. Additive manufacturing techniques – State of the art and trends: Engineering and manufacturing proces, Rapid prototyping cycle, Exchange format, Economy and users. AM techniques: Laser technologies, Flash technology, Extrusion technologies , Jet technologies, Discussion. New trends in additive manufacturing: Biomedical. Manufacturing interoperability, Rapid tooling, Topological optimization, Standards in additive manufacturing. Additive manufacturing techniques review - from prototyping to production. Stereolithography, Fused deposition modeling, 3D Ink-Jet printing, Direct metal laser sintering, Direct metal deposition, Selective laser sintering, Additive/Subtractive - hybrid manufacturing technologies. Reverse engineering for AM. The use of additive techniques in the construction of prototype and serial tools for the injection and blow molding process. Differences between 3D, 4D and 5D additive techniques. Ecodesign of products in the produced additive technologies in terms of recycling of materials.
laboratory	Properties of materials for additive manufacturing technology, parameters of the additive manufacturing process, software for g-code generation, additive manufacturing in SLA, FDM / FFF, SLS, CFF technology, verification of learning outcomes.

6. VALIDATION OF LEARNING OUTCOMES

(Each learning outcome from the list requires validation methods to ensure that it was achieved by a student.)

Learning outcome	Form of assessment					
	Oral examination	Written examination	Final pass	Test	Report	Class attendance
K1 – K2			x		x	x
S1 – S2			x		x	x
SC1			x		x	x

7. LITERATURE

Basic literature	1. Adedeji B. Badiru et al.: Additive Manufacturing Handbook. 2017 by Taylor & Francis Group, LLC
Supplementary literature	1. Design World. 2021 Additive Manufacturing Handbook. www.designworldonline.com (data access 23.05.2022) 2. Durai P. et al. A current state of metal additive manufacturing methods: A review. Materials Today: Proceedings 59 (2022) 1277–1283 3. Pragana J.P.M. et al.: Hybrid metal additive manufacturing: A state–of–the-art

	review. Advances in Industrial and Manufacturing Engineering 2 (2021) 100032

8. TOTAL STUDENT WORKLOAD REQUIRED TO ACHIEVE EXPECTED LEARNING OUTCOMES EXPRESSED IN TIME AND ECTS CREDITS

Student's activity		Student workload– number of hours
Classes conducted under a direct supervision of an academic teacher or other persons responsible for classes	Participation in classes indicated in point 2.2	45
	Supervision hours	5
Student's own work	Preparation for classes	10
	Reading assignments	30
	Other (preparation for exams, tests, carrying out a project etc)	15
Total student workload		105
	Final number of ECTS credits	**4**