Course Title	Advanced Topics in Additive Manufacturing (Industrial innovations)				
Course Code	MED507				
Course Type	Elective				
Level	Masters (2nd Level)				
Year / Semester	1st year / Spring Semester				
Teacher's Name	Prof. Nikolaos Michailidis, Professor Efstathiou Kyriakos				
ECTS	10	Lectures / week	2	Laboratories/week	1
Course Purpose	The course purpose is for the students to develop the concepts of additive manufacturing (AM), 3D design, reverse engineering and further investigate the complexities of such manufacturing methods. The module will emphasize the strengths and weaknesses of the various technologies and will highlight applications and case studies from the additive manufacturing (AM) industry. It will emphasise the benefits and limitations and will involve applications and case studies in the areas of automotive, aerospace, electronics, consumer goods, medical, etc.				
Learning Outcomes	By the end of the course, students must be able to: 1. Improve the methodology to manufacture products using AM and thus increase design freedom. 2. Choose the appropriate AM methodology to produce functional prototypes, molds, mold inserts and end-use products. 3. Optimize the 3D printing process in order to reduce production costs, increase robustness/reliability and improve performance by optimizing design and printing parameters. 4. Calculate and justify the cost of a typical additive manufacturing operation including labour costs, overhead costs, and consumable costs. 5. Develop initiative and creativity in problem-solving, as well as other design and manufacturing skills. 6. Design, engineer and fabricate an multi-component object using advanced/additive manufacturing processes. 7. Construct a project plan for the installation of the AM systems.				
Prerequisites	None			Corequisites	None
Course Content	1. AM Technology Additive Manufacturing Processes and Technology, AM as an innovative manufacturing process, Related Technologies such as Injection Molding and Casting 2. Software, Methods, 3D scanning Prototypes and models from CAD, Design software, 3D scanner, CT, MRI and printable parts by using AM technologies.				

	3. Materials use in AM Process and Material Selection, Metal Technology & Processes, Multiple Materials, Hybrids, Ceramics and Bioceramics, Composite Materials and future directions, Biomaterials, Bio-printing, Scaffolds and tissue and organ engineering, Metal, thermoplastics, ceramics, biochemicals and types of materials. Methods to limited wastage of material. 4. Applications of AM Applications and advance topics in AM such as stereolithography (SLA), Selective Laser Sintering (SLS), Fused Deposition Modeling (FDM), Direct Metal Laser Sintering (DMLS), Polyjet 3D Printing(PJP), Inkjet 3D Printing (IJP), Colour-Jet-Printing (CJP), Electron Beam Melting (EBM) and Multi-Jet-Printing (MJP), Applications of AM in Aerospace, Biomedical, Automotive, tooling, Bio-printing, Tissue & Organ Engineering, Architectural Engineering, Surgical simulation, Art, Health care, dental, education, Lightweight Construction. 5. The Business of AM Trends, Business Opportunities and Future Directions in Additive Manufacturing, Direct Digital Manufacturing, Distributed Manufacturing and Mass Customization, smart manufacturing system to manufacture customized part, Meets the need of market by design and manufacturing of prototype as well as of the whole product, Test concept or process before starting the full production, Improving Printings speed, Flexibility in the design and manufacture of the product, Overall performance improvement, Customized products through AM in less time, customer satisfaction improvement, increase of the accuracy of products, Improve productivity by less consumption of material, energy and workforce, Research status on additive manufacturing.
Teaching Methodology	Teaching methods are based on problem-based learning, cases-based learning and the use of eLearning platform and online sources. All these approaches are related to a more active student-centred education. Lecture notes and presentations are available through the web for students to use in combination with the textbooks. Furthermore, theoretical principles are explained by means of specific examples and solution of specific problems. Laboratory work. Actual use of 3D printing system for the creation of new parts and investigate their mechanical properties.
Bibliography	**Textbook** 1. Ian Gibson, David Rosen, Brent Stucker, Mahyar Khorasani, Additive Manufacturing Technologies, Springer, 2021 **References** 1. Pou Juan, Riveiro Antonio, Additive Manufacturing, Elsevier, 2021 2. Lucas F. M. da Silva, Paulo A. F. Martins, Mohamad S. El-Zein, Advanced Joining Processes, Springer, 2020 3. Dyuti Sarker, Ehsan Toyserkani, Osezua Obehi Ibhadode, Farzad Liravi, Paola Russo, Katayoon Taherkhani, Metal Additive

	Manufacturing, Wiley, 2021 4. Hisham Abdel-Aal, Additive Manufacturing of Metals: Fundamentals and Testing of 3D and 4D Printing, McGraw Hill, 2021 5. Emrah Celik, Additive Manufacturing: Science and Technology, De Gruyter, 2020 6. T.S. Srivatsan, T.S. Sudarshan, Additive Manufacturing, CRC Press, 2020 7. Adam Řehák, Everything you need to know about 3D Printing, 3D Scanning and 3D Modeling, 2021
Assessment	1. Assignments 40% 2. Final Exam 60%
Language	English