Course Title	Rapid Product Development and 3D printing				
Course Code	MED504				
Course Type	Elective				
Level	Masters (2nd Level)				
Year / Semester	1st year / Spring Semester				
Teacher's Name	Prof. Efstathiou Kyriakos, Prof. Nikolaos Michaelides				
ECTS	10	Lectures / week	2	Laboratories/week	1
Course Purpose	The course purpose is for the students to develop new skills in the design and development of engineering parts and products using specific technics and approaches. Students will gain the ability to evaluate different procedures and available tools that will help them during product development. By the end of this course students should be able to define and select the appropriate rapid prototyping technology for the new and innovative product development.				
Learning Outcomes	By the end of the course, students must be able to: 1. Discussing the wide variety of new rapid prototyping technologies such as liquid or solid based rapid prototyping systems. 2. Combine rapid prototyping technologies in product development. 3. Define the components of product design and development processes and their relationships from concept to customer. 4. Design, optimize, manufacture, and validate a physical system component. 5. Improve the methodical approach and management of product development. 6. Develop new approaches to managing design and product development. 7. Define the design management process and how innovation can be successfully brought to the market place to satisfy customers in an effective manner. 8. Distinguish the differences between the important methods, technologies, latest trends, tools and techniques of product design and development and how they can be effectively utilized 9. Plan carefully the designing of a new products using the theoretical and practical knowledge. 10. Plan new methods and development processes during designing and development of products.				
Prerequisites	None			Corequisites	None

Course Content	1. Product development and customer needs Understanding customer needs, Organizing and prioritizing customer needs, Product development process tools. Product development teams. Product development planning, Product specifications, Establishing target specification. Setting product specifications, Concept specification, selection and testing, Product architecture, Types of modularity, Product change, Establishing the architecture, Assessing the quality of industrial design. 2. Rapid Prototyping process Process chain, 3D Shape Technologies, 3D modelling, Software Engineering, Digital Representation of Shapes, 3D laser scanners and surface generation, Computer tomography and Solid creation, Different algorithms to represent solid objects. Rapid prototyping data formats, Data conversion and transmission, Postprocessing. 3. Rapid Prototyping Techniques Stereolithography, Three-dimensional models from liquid photosensitive polymers, Stereolithography apparatus (SLA) machines, Laminated Object Manufacturing, adhesive-coated sheet material, Selective Laser Sintering, Laser beams, Fused Deposition Modeling, Solid Ground Curing, 3-D Ink-Jet Printing. 4. Liquid, solid and powder based rapid prototyping 3D Systems, Models and specifications, Processes and principles, Microfabrication, Deposition Manufacturing process. 5. Applications of Rapid Prototyping Applications in design, engineering, Analysis and planning, Applications in manufacturing and tooling, Aerospace, automotive, biomedical, Jewellery industry. 6. Design for 3D printing 3D printing cost analysis. Reduce the cost. Reduce the cost of supporting production. Exporting STL files. Innovative Products. 7. Future Developments Technical evaluation through benchmarking, Industrial growth, Accuracy improvement and surface finish, Use of new materials like non-polymeric materials, metals, ceramics and composites, Distance Manufacturing on Demand, Further developments trends. Industrial Experiences of product development. Innovative Products. 8. Patents and intellectual property
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 with complex geometry. The student will be ask to

	solve real problem using laboratory equipment.
Bibliography	**Textbook** 1. The Mechanical Design Process, David G. Ullman, McGraw-Hill, 2010 **References** 1. Adam Řehák, Everything you need to know about 3D Printing, 3D Scanning and 3D Modeling, 2021 2. Fuewen Frank Liou, Rapid Prototyping and Engineering Applications: A Toolbox for Prototype Development, CRC Press, 2019. 3. Additive Manufacturing Technologies, Gibson Ian, Rosen David, Springer, New York. 4. G. Dieter, L. Schmidt, Engineering Design, McGraw Hill, 6th Edition, 2020 5. R. Budynas, Shigley's Mechanical Engineering Design, McGraw Hill, 2019 6. David G. Ullman, The Mechanical Design Process Case Studies, 2017 7. Chee Kai Chua, Kah Fai Leong, 3D Printing and Additive Manufacturing: Principles and Applications, WSPC, 2016 8. Engineering Design, George Dieter, Linda C. Schmidt, McGraw-Hill, 2012 9. Design for Six Sigma, Basem S. El-Haik, McGraw-Hill, 2008 10. Kevin Otto, Product Design, Techniques in Reverse Engineering and New Product Development, Kristin Wood, 2001 11. Karl T. Ulrich, Steven D. Eppinger, Product Design and Development, McGraw-Hill 3rd ed. 2004
Assessment	1. Assignments 40% 2. Final Exam 60%
Language	English