Course Title	Design for Joining Processes				
Course Code	MED502				
Course Type	Compulsory				
Level	Masters (2nd Level)				
Year / Semester	1st year / Fall Semester				
Teacher's Name	Prof. Dimitrios Manolakos, Dr. Loukas Papadakis				
ECTS	10	Lectures / week	2	Laboratories/week	1
Course Purpose	The course purpose is to provide students with up-to-date knowledge in the field of manufacturing and joining processes and their design. Upon completion of this course, the students will have the skills to analyse different manufacturing and joining processes and evaluate their advantages and disadvantages for different practical applications. The combination of theoretical knowledge and industrial examples will enable students to comprehend the benefits of different manufacturing and joining techniques and perform the design of selected processes with the aid of specific practical product examples. Finally, students will investigate selected manufacturing and joining processes and demonstrate their design solution.				
Learning Outcomes	By the end of the course, students must be able to: 1. Analyse the main categories of manufacturing and joining technologies. 2. Comprehend the basic principles of the different manufacturing and joining processes. 3. Provide design solutions for certain products based on selection and evaluation of the appropriate manufacturing and/or joining process. 4. Improve design calculations for manufacturing processes and joining design of certain products. 5. Discuss the different types of loading and environmental conditions at which manufactured and joined structures are subjected to. 6. Analyse the behaviour of different manufactured components and joint types under static and dynamic loading. 7. Analyse the heat effects of manufactured and welded materials during thermal processing. 8. Examine the principles of fracture mechanics and the material failures during manufacturing and joining processes. 9. Discuss the effect of fatigue of manufactured and joined structures				
Prerequisites	None			Corequisites	None
Course Content	1. Engineering design for traditional manufacturing processes Design for Casting, Bulk Deformation Processes, Sheet Metal Forming Processes, Machining, Powder Metallurgy, Polymer Processing, Review				

	of Assembly Processes, Design for Optimization 2. Use of mechanical joints and clips Screw connections, Main dimensions and threads, Stress cross section in screws, Assembly methods and assembly forces 3. Joining through forming Different forms of riveting 4. Design for Welding processes Feasibility, security and suitability of weld, Metallurgy of melting welding processes, Welding through melting, pressing and diffusion, MIG/MAG welding, Laser beam welding, Resistance spot welding, Friction stir welding, Welding defects (porosity, cracks), Quality and test methods of weld seams, Post processing of weld joints and repair 5. Design for Soldering Working temperature, Constructive arrangement of soldering gap, Strength of solder joints 6. Adhesive bonding Chemical mechanism of adhesive bonding, Properties of bonds, Pre-treatment of joint parts 7. Laboratory demonstration work Computer laboratory work, where students can apply their gained knowledge and improve skills in computational methods complies the theoretical part of the course. Students perform the computer laboratory work alone or in small groups of two with the lecturer's supervision. Additionally, during the computer laboratory sessions, students implement the principles taught in the lecture sessions on specific practical examples with the aid of computer tools.
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. Furthermore theoretical principles are explained by means of specific examples and solution of specific problems. Individual or small group modelling performed with the use of common industrial packages such as Solidworks, Cosmos, MDesign. Project: Analyze and optimize a real case study. Investigate the influence of all factors described in the case study.
Bibliography	**Textbook** 1. Lucas F. M. da Silva, Paulo A. F. Martins, Mohamad S. El-Zein, Advanced Joining Processes, Springer, 2020 2. Serope Kalpakjian, Steven Schmid, Manufacturing Engineering and Technology, Pearson, 2020 **References** 3. Manufacturing Processes for Engineering Materials, Fifth Edition, Serope Kalpakjian, Steven R. Schmid, Prentice Hall 4. The Mechanical Design Process, David G. Ullman, McGraw-Hill 5. Engineering Design, George Dieter, Linda C. Schmidt, McGraw-Hill 6. Welding: Processes, Quality & Applications (Mechanical Engineering Theory and Applications). Richard J. Klein, Nova Science Publishers

	Inc, 2011 7. Advanced welding processes, Woodhead Publishing, John Norrish, 2006 8. Adhesive Bonding: Materials, Applications and Technology, Walter Brockmann, Paul Ludwig Geiß, Jürgen Klingen, K. Bernhard Schröder, Wiley, 2008
Assessment	1. Assignments 40% 2. Final Exam 60%
Language	English