

Study program / course: Mechanical Engineering				
Type and level of study: Master academic studies				
Course: Science of welding				
Lecturers: Lazić N. Vukić, Adamović D. Dragan				
Status of course: Obligatory for module M₁, II semester				
Number of ECTS: 6				
Prerequisite: Passed exams from Machine Materials and Production technologies				
The course objective Mastering the specific knowledge from the area of welding and especially from the aspect of mechanical and metallurgical properties of the welded joint – the weld metal, the joining zone and the heat affected zone. This assumes capability of students' independent reasoning to realize and understand the complexity of the thermal and physical-chemical phenomena in welding and ability to relate the welding input parameters to output useful properties of the welded joint (microstructure, hardness, toughness as well as other mechanical properties).				
The course outcome After passing the final exam, students will be able to directly join in either in research or in practical work. They will be trained to both theoretically and practically, independently, estimate the weldability of the base metal, select the most favorable welding procedure, depending on the type of the welded materials, select the optimal filler metal, determine the optimal welding technology and to prescribe the control methods of the welded joint.				
Syllabus				
Theoretical study Introduction. Review of the welding and the similar connecting procedures. Physical and metallurgical fundamentals of welding, heat sources and their characteristics. The thermal balance Temperature fields and cycles in welding. Fixed and movable heat sources. Base and filler metals. Steels and cast irons, colored metals and their alloys. Estimates of the various metals weldability. Structure and construction of the TTT diagrams for steel weldability estimates. Measure for steels and cast iron improvements of weldability. Stresses and strains in welded joints and structural and thermal measures for decreasing the residual stresses and strains. Thermal treatment of welded joints. Methods of prior, current and final control of the welding operations. Reparatory hard facing of the machine elements and parts. Control methods of the parts regenerated by hard facing. Technical and economical justification of the reparatory hard facing of machines and devices parts. Advanced welding technologies. Risks and protection measures in welding.				
Practical classes Laboratory and practical; work. Same areas as for lecturing.				
Recommended reading				
1. Majstorović, A., Jovanović, M., Fundamentals of welding, Scientific Book, Belgrade, 1995 (In Serbian).				
2. Jovanović, M., Lazić, V., Technology of welding and casting, Faculty of Mechanical Engineering, Kragujevac, 2007 (In Serbian).				
3. Sedmak, A., et al., Machine materials – Part two, Faculty of Mechanical Engineering, Belgrade, 2000 (In Serbian).				
4. Jovanović, M., Adamović, D. and Lazić, V., Technology of Welding – A Handbook, Kragujevac, 1996.				
The number of hours of active teaching:				Other classes:
Theory: 2	Practical classes: 1.6	Other forms of teaching: 0.4	Research study: 0	1
Evaluation of knowledge				
Pre-final exam obligations	Points	Final exam	Points	
Activities during the classes:	5	Oral exam	30	
Practical classes:	20			
Colloquia:	45			