

Óbuda University Bánki Donát Faculty of Mechanical and Safety Engineering		Institute of Mechanical Engineering and Technology Department of Materials Technology	
Lecture name and Neptun code: Weldability and material testing BAXHAE1MNF Credits: 4			
Course type: Full-time			
Period: 2024/25 1st semester			
Master course: Mechanical Engineering			
Lecturer :	Dr. Tünde Kovács associate professor	Practice: Dr. Tünde Kovács	
Number of sessions/week/term: Weekly	Lecture: 2	Practise: 1	
Exam/ course assignment: Midterm mark		Language: English	
Course objective			
Goal of the course: Testing the quality of joints made by standard joining processes (welding, bonding, soldering) appropriate to the welding discipline, by understanding and applying the relevant standards. Laboratory exercises to learn how to perform appropriate material tests. Specification of the welding technology, determining the preheating temperature as a function of the selected welding parameters for different steel grades.			
Thematics: Summary of non-destructive and destructive tests and their application in the qualification of the welding process. Description of the tests applicable to different weld configurations, their description and practical applications. Damage and failure of welded structures. EN and ASM welding standard tests, geometry and dimensions of test specimens, test procedure and scope. Definition of weldability, methods of determining preheating temperature for welding technology specification. Detailed knowledge of material testing standards. Welding manufacturer's instruction WPS.			

Subjects		
Weeks	Lectures	Practices
1	Introduction, Weldability, Preheating temperature determinations, cracking susceptibility, carbon equivalent determinations	Order of the Materials Testing Laboratory
2	MSZ EN ISO 15614-1 Specification and qualification of welding procedures for metallic materials, Welding procedure test Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys	Test report
3	MSZ EN ISO 5817 Welding, Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded), Quality levels for imperfections, MSZ EN ISO 2553 Welding and allied processes — Symbolic representation on drawings — Welded joints	Mounting of the metallographic sample
4	MSZ EN ISO 5178 Destructive tests on welds in metallic materials, Longitudinal tensile test on weld metal in fusion welded joints	Grinding of the metallographic sample
5	MSZ EN ISO 17639 Destructive tests on welds in metallic materials, Macroscopic and microscopic examination of welds	Polishing of the metallographic sample
6	First Test MSZ EN ISO 5173 Destructive tests on welds in metallic materials, Bend tests	Microscopy test
7	MSZ EN ISO 9015-1 Destructive tests on welds in metallic materials, Hardness testing Part 1: Hardness test on arc welded joints	Etching materials

8	MSZ EN ISO 10893 Non-destructive testing of steel tubes, Part 10: Automated full peripheral ultrasonic testing of seamless and welded (except submerged arc-welded) steel tubes for the detection of longitudinal and/or transverse imperfections	Microscopy test
9	MSZ EN ISO 9016 Destructive tests on welds in metallic materials, Impact tests, Test specimen location, notch orientation and examination	Non-destructive test of the welded joint 1
10	MSZ EN ISO 17640 Non-destructive testing of welds, Ultrasonic testing, Techniques, testing levels, and assessment MSZ EN ISO 3452 Non-destructive testing Penetrant testing, Part 1: General principles	Non-destructive test of the welded joint 2
11	MSZ EN ISO 10447 Resistance welding, Testing of welds, Peel and chisel testing of resistance spot and projection welds MSZ EN ISO 4136 Destructive tests on welds in metallic materials — Transverse tensile test	Non-destructive test of the welded joint 3
12	MSZ EN ISO 17637 Non-destructive testing of welds, Visual testing of fusion-welded joints MSZ EN ISO 17638 Magnetic particle testing MSZ EN ISO 10893-2 Non-destructive testing of steel tubes Part 2: Automated Eddy current testing of seamless and welded (except submerged arc-welded) steel tubes for the detection of imperfections	Hardness tests
13	MSZ EN ISO 3651 Determination of resistance to intergranular corrosion of stainless steel Part 1: Austenitic and ferritic-austenitic (duplex) stainless steels Corrosion test in nitric acid medium by measurement of loss in mass (Huey test) Determination of resistance to intergranular corrosion of stainless steel Part 2: Ferritic, austenitic and ferritic-austenitic (duplex) stainless steel Corrosion test in media containing sulfuric acid	Second Hardness Test
14	Summary	Replacement of the missed practice

Semester week	Test
6.	First test
13.	Second test (in practice time)
14.	Repeated test (over time)

Course assessments:

Participation in the practices is required. Tests evaluation happens by scoring. The tasks are theoretical and practical. If you can fulfil the requirements of the tests in writing in the 7th and 13th weeks (both tests need to be minimum pass marks) and you participate in lecture and practice classes your midterm mark calculable. The midterm mark is determined from the average test results.

Midterm mark = $(\text{Tes1} + \text{Test2}) / 2$.

Intervals of the grade:

under 50%: 1 (unsatisfying)

50-62,5 %: 2 (pass mark)

62,5-75 %: 3 (satisfactory mark)

75-87,5 % 4 (class)

87,5-100% 5 (Excellence)

In the case of an unsatisfying midterm mark, you can take a midterm grade replacement exam.

The method of the supplement: You can take a midterm mark replacement exam only one time, in the first 10 days of the exam period with the payment of the examination fee. This is a writing exam with the whole curriculum of the subject.

Compulsory literature

- MSZ EN ISO 15614-1 Specification and qualification of welding procedures for metallic materials
- MSZ EN ISO 5817 Welding
- MSZ EN ISO 2553 Welding and allied processes — Symbolic representation on drawings — Welded joints
- MSZ EN ISO 5178 Destructive tests on welds in metallic materials
- MSZ EN ISO 17639 Destructive tests on welds in metallic materials
- MSZ EN ISO 5173 Destructive tests on welds in metallic materials
- MSZ EN ISO 9015-1 Destructive tests on welds in metallic materials, Hardness testing
- MSZ EN ISO 10893 Non-destructive testing of steel tubes, Part 10
- MSZ EN ISO 9016 Destructive tests on welds in metallic materials, Impact tests
- MSZ EN ISO 17640 Non-destructive testing of welds, Ultrasonic testing
- MSZ EN ISO 3452 Non-destructive testing, Penetrant testing,
- MSZ EN ISO 10447 Resistance welding, Testing of welds, Peel and chisel testing of resistance spot and projection welds
- MSZ EN ISO 4136 Destructive tests on welds in metallic materials
- MSZ EN ISO 17637 Non-destructive testing of welds, Visual testing of fusion-welded joints
- MSZ EN ISO 17638 Magnetic particle testing
- MSZ EN ISO 10893-2 Non-destructive testing of steel tubes Part 2
- MSZ EN ISO 3651 Determination of resistance to intergranular corrosion of stainless steel Part 1, Part 2
- Leonard P. Connor: Welding Handbook, American Welding Society 1987. ISBN 0+87171-218-4
- Metal Handbook (VOL.6) Metals Handbook ISBN 0-87170-377-7(V.1) 1993.

Suggested literature

- B.J. Moniz, R.t. Miller: Welding Skills, 3rd edition, American Technical Publisher, Inc. 2004. USA ISBN 0-8269-3010-7
- Anuj Bhatia: Introduction to Welding and Non-Destructive Testing (NDT), 2012.
[https://www.cedengineering.com/userfiles/Introduction%20to%20Welding%20&%20Non-Destructive%20Testing%20\(NDT\)%20-%20R1.pdf](https://www.cedengineering.com/userfiles/Introduction%20to%20Welding%20&%20Non-Destructive%20Testing%20(NDT)%20-%20R1.pdf)

Quality assurance methods of the subject:

The standard of theoretical and practical education is annually overviewed at an institution's conference based on the feedback of the teachers and students. They assess the success of the subject and make suggestions for necessary changes in order to maintain the interaction between theory and practical training.

Budapest, 2024.06.01.



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Lecturer