University of Zagreb

1. GENERAL INFORMATION				
1.1. Course teacher	Prof. Ladislav Vrsalović, PhD		1.6. Year of the study	1st year (2nd semester)
1.2. Name of the course	Corrosion Engineering in Environmental Protection		1.7. ECTS credits	5
1.3. Associate teachers	Assist. Prof. Ivana Smoljko, PhD		1.8. Type of instruction (number of hours L + E + S + e-learning)	Total: 60 (L:30, E:30, S:0)
1.4. Study programme (undergraduate, graduate, integrated)	Graduate		1.9. Expected enrolment in the course	10
1.5. Status of the course	☐ mandatory	☒ elective	1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	2

2. COUSE DESCRIPTION	
2.1. Course objectives	Gaining knowledge about the fundamentals of corrosion engineering and corrosion prevention of metallic and alloys structures. Introduction to different forms of corrosion and its correlation to specific engineering issues and methods being used to reduce control or prevent corrosion regard safety, price and environmental considerations.
2.2. Enrolment requirements and/or entry competences required for the course	
2.3. Learning outcomes at the level of the programme to which the course contributes	• Compile and apply advanced knowledge of natural and technical sciences, particularly chemical engineering and environmental protection in solving scientific, professional and general social problems. • Solve engineering problems using the scientific method combining expert knowledge from chemistry, environmental, and chemical engineering as well as material science and engineering. • Correlate expert knowledge from chemistry, chemical engineering and material engineering with awareness of influence on society, economy and environment. • Plan and independently perform experiments in order to confirm a hypothesis to estimate economic and ecological efficiency of processes. • Create a critical analysis, evaluation and interpretation of personal results, and compare them with existing data in scientific and expert literature • Investigate and analyse implementation of innovative and incoming chemical technologies in multidisciplinary environment • Communicate with the scientific and professional community, as well as society in general in local and international surroundings

	• Develop work ethic, personal responsibility and tendency for further skill and knowledge acquisition, according to standards of engineering practice
2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)	- Define and classify the corrosion processes - Articulate and utilize corrosion prevention strategies and estimate corrosion behaviour of materials - Select the appropriate procedure for the protection of materials - Perform standard corrosion tests, in-depth analyses of test results - Evaluate the efficiency of implementing procedures for the protection of materials and structures
2.5. Course content (syllabus)	**WEEK 1.** Definition and classification of corrosion **WEEK 2.** The economic impact of corrosion. The effects of corrosion on the environment **WEEK 3.** Forms and mechanisms of corrosion processes **WEEK 4.** Selection of the appropriate corrosion protection system Temporary and permanent protection **WEEK 5.** Corrosion protection; corrosion control and prevention by materials selection and design. Surface preparation and standards. **WEEK 6.** Corrosion protection; protective coatings. Inspection of organic coatings **WEEK 7.** Antifouling systems. Metallic coatings. The criteria for metal coatings selection **WEEK 8.** Partial exam **WEEK 9.** Corrosion protection by changing the environmental conditions **WEEK 10.** Corrosion inhibitors. Corrosion protection by environmentally friendly corrosion inhibitors **WEEK 11.** Cathodic and anodic protection. The impact of the sacrificial anodes on the environment **WEEK 12.** Corrosion protection of pipes and tanks by rubber coatings. Bituminous surface treatments. Enamelling **WEEK 13.** Corrosion testing and monitoring **WEEK 14.** Maintenance of corrosion protection systems Health, safety, environment and product life. Literature survey of corrosion of important structural metals and alloys **WEEK 15.** Partial exam Laboratory exercises: Monitor atmospheric corrosion. Examination of corrosion rate by polarization methods. Examination of corroded metal samples by optical microscopy. Investigation of oxide films formed on stainless steel, Determination of the effectiveness of organic corrosion inhibitors. Cathodic protection of metal by protector. Preparation of metal surfaces and application of organic coating. Determination of wet film thickness of the organic coating. Determination of physical and mechanical properties of organic coatings. The application of polarization techniques to determine the protective properties of the coating. Nickel electroplating. Visits to the laboratory for corrosion protection of company Shipbuilding Industry Split.

2.6. Format of instruction:	☒ lectures ☐ seminars and workshops ☒ exercises ☐ online in entirety ☐ partial e-learning ☒ field work			☐ independent assignments ☒ multimedia and the internet ☒ laboratory ☐ work with mentor ☐ (other)			2.7. Comments:		
2.8. Student responsibilities	Lecture attendance: 80 %. Laboratory exercises attendance: 100 %.								
2.9. Monitoring student work	Class attendance	YES		Research		NO	Oral exam		NO
	Experimental work	YES		Report	YES		(other)		
	Essay		NO	Seminar paper		NO	(other)		
	Preliminary exam	YES		Practical work	YES		(other)		
	Project		NO	Written exam	YES		ECTS credits (total)	5	

2.10. Required literature (available in the library and/or via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	J. R. Davis, Corrosion Understanding the basics, ASM International, Materials Park Ohio, USA, 2000.	1	YES
	V. S. Sastri, Green Corrosion Inhibitors, Theory and Practice, John Wiley and Sons Inc., New Jersey, USA, 2011.		YES

2.11. Optional literature	R. Babolan, Corrosion Test and Standards: Application and Interpretation, ASTM International, USA, 2005.
	E. McCafferty, Introduction to Corrosion Science, Springer, New York, USA, 2010.
2.12. Other (as the proposer wishes to add)	