Programme of "Corrosione e Protezione dei Materiali"
"Corrosion and Materials Protection"

- **Code: I0305**
- **type of course: compulsory**
- **level of course unit : 2nd Cycle in Chemical Engineering, 2nd year, 2nd semester**

Number of ECTS credits: 9 (workload is 225 hours; 1 credit = 25 hours)

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1	**Course objectives and learning autcomes**	**Course objectives:** ➢ Basic and advanced knowledge and understanding of corrosion mechanisms of metal alloys, plastics and ceramic materials under different conditions, environments, both for civil and industrial applications. ➢ Applying knowledge and understanding of materials selection, design and protection ➢ Implementing "problem solving skills" both in corrosion assessment and in addressing technical solutions ➢ Learn and apply best practices of reporting and communicating to top management and to the client ➢ Learn and apply best practices to maintain and improve skills throughout his career
2	**Course content and Learning outcomes (Dublin descriptors)**	**Topics of the module include:** Thermodynamic and kinetic aspects of electrochemical corrosion. Low temperature corrosion and degradation of metal alloys: Galvanic, Pitting, Crevice, under deposit corrosion Impingement, Fretting, cavitation, Low temperature embrittlement, HE; Hydrogen Embrittlement, HIC; Hydrogen induced cracking e Hydrogen Blistering, Stress Corrosion Cracking, HSC Hydrogen Stress Cracking, SSC; Sulphide Stress Cracking in wet sour services, CSCC; Chloride Stress Corrosion Cracking, Alkaline stress corrosion cracking, Microbial Corrosion, Stray current corrosion. High temperature corrosion of metal alloys: Spheroidization and graphitization of carbon stell, Temper embrittlement, creep embrittlement, Ferritic stainless steels 475°C embrittlement, Austenitic Stainless steels: Sigma Phase Embrittlement, Sensitization and weld decay Corrosion, Polythionic acid stress corrosion cracking (PASCC), High temperature Hydrogen attack, Sulfidization and sulfidic corrosion, Nitriding, Naphtenic acids Corrosion (NAC). Methods and technologies to protect materials from corrosion. Materials selection and design to reduce corrosion under severe conditions. Case studies in the chemical, petrolchemical and pharmaceutical industry. **On successful completion of this module, the student should** ➢ have profound **knowledge** of corrosion mechanisms in different environments ➢ have **knowledge and understanding** by predicting materials corrosion performances ➢ **understand and explain** materials, corrosion mechanisms, prevention and conservation of material ➢ **demonstrate skill** in material corrosion diagnosis and **ability** to problem solving (materials protection) ➢ demonstrate **capacity** for reporting and solution making
3	**Prerequisites and learning activities**	**Explain if the module is connected with previous learning and if foresees work placement** The student must know the basic of "Materials Science and Technology" and Chemistry
4	**Teaching methods and language**	➢ Lectures, case analysis, team work, exercises, reporting ➢ Language: Italian/english Ref. Text books ▪ Materials Science and engineering an introduction, W- Callister - Wiley ▪ Corrosion and Corrosion Control, H.H.Uhlig - Wiley ▪ Materials selection for Hydrocarbon and chemical Plants, D. Hansen, CRC Press ▪ ASM Handbook - Volume 13A: Corrosion: Fundamentals, Testing, and Protection ▪ ASM Handbook –-Volume 13B: Corrosion: Materials ▪ ASM Handbook Volume 13C: Environments and Industries
5	**Assessment methods and criteria**	**Oral exam**