UNIVERSITY of NICOSIA

Course Code	Course Title	ECTS Credits
OGEE-445	Materials Science & Corrosion Engineering	6
Department	**Semester**	**Prerequisites**
Engineering	Fall, Spring	CHEM-126
Type of Course	**Field**	**Language of Instruction**
Elective	Oil & Gas Engineering	English
Level of Course	**Year of Study**	**Lecturer(s)**
1nd Cycle	4th	Dr Paraskevas Petroyiannis
Mode of Delivery	**Work Placement**	**Co-requisites**
Face-to-face	N/A	None

Objectives of the Course:

The main objectives of the course are to:

- Introduce students to the atomic structure and interatomic binding in molecules;
- Explain the structure of solids and their defects;
- Provide the fundamentals of the mechanism of diffusion and the mechanical properties of metals;
- Familiarize attendees with the failure modes of different materials;
- Explain the fundamental corrosion mechanisms;
- Acquaint students with corrosion electrochemistry, thermodynamics and corrosion kinetics;
- Detail corrosion induced material failures, marine and high-temperature corrosion;
- Outline the principles of corrosion control, the application of coatings and materials selection;

Learning Outcomes:

After completion of the course students are expected to:

- Understand the atomic structure and inter-atomic bonding in materials;
- Be familiar with the fundamental properties of crystalline solids and their imperfections;
- Know the physics of diffusion and the mechanical characteristics of metallic materials;
- Have a thorough appreciation of the failure mechanisms of engineering materials;
- Be acquainted with the principle corrosion mechanisms and their implications;
- Understand the important aspects of corrosion electrochemistry, material thermodynamics and corrosion behavior;
- Recognize corrosion related material failure, aqueous facilitated and temperature governed corrosion;

- Know the fundamentals of corrosion control, the use of protective coatings and material choice.

Course Contents:

- The discipline of Materials Science and Engineering, electrons in atoms, bonding forces, inter-atomic bonds and molecular structures;
- Crystal lattices, polycrystalline materials, anisotropy, closed-packed structures;
- Point defects in solids, dislocations, bulk or volume defects, microscopic examination techniques;
- Physics of diffusion mechanisms, steady and unsteady diffusion;
- Mechanical properties of materials including elastic & plastic deformation and design & safety considerations;
- Failure modes of materials: fracture, fatigue and creep;
- The significance of corrosion, basic concepts in corrosion such as anodic & cathodic reactions, corrosion cells, Nernst equation, influence of pH and acidity;
- Electrochemical reactions, anodic and cathodic processes, surface area effect, concentration polarization, etc;
- Galvanic corrosion, intergranular corrosion, crevice corrosion, pitting corrosion, erosion and biological corrosion, corrosion fatigue, hydrogen damage and liquid metal attack;
- Selection and application of coatings, cathodic protection, corrosion inhibitors, materials selection;
- Heat affected zones, design for corrosion in the oil and gas, pipeline and marine industries.

Learning Activities and Teaching Methods:

Lectures, Discussion

Assessment Methods:

Homework, mid-term exam, final exam, exercises.

Required Textbooks/Reading:

Authors	Title	Publisher	Year	ISBN
Callister D.W. Jr.& Rethwisch G.D.	Materials Science and Engineering— An Introduction, 9th ed.	John Wiley & Sons	2014	978-1-118-32457-8
Roberge R.P.	Corrosion Engineering: Principles and Practice	McGraw Hill	2008	0-07-148243-1

Recommended Textbooks/Reading:

Authors	Title	Publisher	Year	ISBN
Javaherdashti R., Nwaoha C. & Tan H.	Corrosion and Materials in the Oil and Gas Industries	CRC Press	2013	978-1-4665-5625-6

Mitchell S.B.	An Introduction to Materials Engineering and Science	John Wiley & Sons	2004	109-8-7654-321
Ahmad Z.	Principles of Corrosion Engineering and Corrosion Control	Elsevier-BH	2006	978-0-7506-5924-6