

Course Unit	Option 3 - Advanced Materials		Field of study	Mechanical Constructions	
Master in	Mechanical Engineering		School	School of Technology and Management	
Academic Year	2023/2024	Year of study	2	Level	2-2
Type	Semestral	Semester	1	ECTS credits	6.0
			Code	5071-793-2102-01-23	
Workload (hours)	162	Contact hours	T	-	TP
			PL	60	TC
			S	-	E
			OT	-	O

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s) João da Rocha e Silva

#### Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:

1. Acquiring knowledge and understanding the properties of materials used in engineering.
2. Relate structure and properties of materials used in engineering.
3. Acquiring knowledge on the latest materials used in engineering and its applications.
4. Relate the materials and properties in order to propose new materials and new applications.

#### Prerequisites

Before the course unit the learner is expected to be able to:  
Not Applicable

#### Course contents

Composites and their constituents. Reinforcements architectures. Recycling.  
Composite transformation processes. Additive manufacturing of composites. Defects and effect of defects.  
Properties of composite materials.  
Applications of composites in engineering.  
Ceramic materials. Raw Material and Processing.  
6. Polymeric materials and their transformation. Additive manufacturing.  
Additive manufacturing of metallic materials. Sintering of metallic materials. Defects and effect of defects.  
Other material technologies.

#### Course contents (extended version)

1. Chapter 1 Introduction
2. Chapter 2 Aluminum
3. Chapter 3 Magnesium and Beryllium
4. Chapter 4 Titanium
5. Chapter 5 High Strength Steels
6. Chapter 6 Superalloys
7. Chapter 7 Polymer Matrix Composites
8. Chapter 8 Ceramic Matrix Composites

#### Recommended reading

1. William F. Smith; Foundations of materials science and engineering. ISBN: 0-07-112843-3
2. Colling, David A. Industrial materials ISBN 0-02-323560-8
3. Stephen, R. Swanson Introduction to design and analysis with advanced composite materials ISBN0-02-418554-X
4. Hoa, Suong Van, Computer-aided design of polymer-matrix composite structures ISBN 0-8247-0558-X
5. F.C. Campbell, A Manufacturing Technology for Aerospace Structural Materials, ISBN-13: 978-1-85-617495-4

#### Teaching and learning methods

For each topic addressed in the UC there will be a content research phase followed by the analysis of small application examples and case studies.  
Whenever possible, laboratory examples will be performed.  
Methodology and Resources:

- Seminars, accompanied by group resolution of case studies;
- Supplementary research carried out by the student;
- Presentation of the results of each theme to the group.

#### Assessment methods

- Alternative 1 - (Regular, Student Worker) (Final, Supplementary, Special)
  - Intermediate Written Test - 50% (Written test - 50% (minimum grade 10/20))
  - Case Studies - 50% (Technical reports, presentation and oral discussions - 50%);

#### Language of instruction

Portuguese, with additional English support for foreign students.

#### Electronic validation

João da Rocha e Silva	João Eduardo Pinto Castro Ribeiro	Paulo Alexandre Gonçalves Piloto	José Carlos Rufino Amaro
03-10-2023	04-10-2023	04-10-2023	20-10-2023