

# MATERIALS ENGINEERING AND NANOTECHNOLOGY (LM76)

(Lecce - Università degli Studi)

## Teaching METALLIC MATERIALS: PROPERTIES AND APPLICATIONS

GenCod A006457

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PAOLA LEO, GILDA RENNA

**Teaching in italian** METALLIC MATERIALS: PROPERTIES AND

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**SSD code** ING-IND/21

**Reference course** MATERIALS ENGINEERING AND

**Course type** Laurea Magistrale

**Credits** 6.0

**Teaching hours** Front activity hours: 54.0

**For enrolled in** 2022/2023

**Taught in** 2023/2024

**Course year** 2

**Language** ENGLISH

**Curriculum** PERCORSO COMUNE

**Location** Lecce

**Semester** First Semester

**Exam type** Oral

**Assessment** Final grade

**Course timetable**

<https://easyroom.unisalento.it/Orario>

### BRIEF COURSE DESCRIPTION

The course clarifies the microstructure, properties and engineering applications of metallic alloys in the most significant fields ( for example aerospace, automotive, civil, structural, biomedical).

### REQUIREMENTS

Metallurgy basics

### COURSE AIMS

After the course the students:

- 1) will know the various types of major engineering alloys in term of microstructure, properties and applications
- 2) will be able to make decision for material selections for engineering design
- 3) will know the strengthening method, heat treatments and surface hardening/ modifications to apply with regard the required service properties

### TEACHING METHODOLOGY

Lectures, laboratory practice, individual project

### ASSESSMENT TYPE

The exam consists of two parts:

1. first written part: the student is asked to illustrate theoretical topics
2. second part: the student is asked to discuss the laboratory topics and individual project with the lecturer.

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## FULL SYLLABUS

### Lectures:

- 1) Metallic alloys application in aerospace, automotive, civil, structural and biomedical fields. 3h
- 2) Aluminum Alloys: designation, compositions, typical applications, mechanical properties, strengthening methods, corrosion resistance. 5h  
2\_a Case studies analysis to familiarize with the different Al alloys.
- 3) Magnesium Alloys: designation, compositions, typical applications, mechanical properties, strengthening methods, corrosion resistance. 4h  
3\_a Case studies analysis to familiarize with the different Mg alloys.
- 4) Titanium alloys: designation, compositions, typical applications, mechanical properties, strengthening methods, corrosion resistance. 5h  
4\_a Case studies analysis to familiarize with the different Ti alloys.
- 5) Nickel alloys and superalloys: designation, compositions, typical applications, mechanical properties, strengthening methods, corrosion resistance. 4h  
5\_a Case studies analysis to familiarize with the different Ni alloys.
- 6) Plain Carbon Steel: designation, non-heat treatable low carbon sheet steel, microalloyed steels, dual phase steels. Properties and Applications 4h  
6\_a Case studies analysis to familiarize with the different Plain carbon Steel .
- 7) Alloy Steels: classification, alloying element in Steel, Hardenability. Chemical compositions Properties and applications 5h  
7\_a Case studies analysis to familiarize with the different alloy steel
- 8) Stainless Steel: Chemical composition properties and applications 5h  
7\_a Case studies analysis to familiarize with the different stainless Steel
- 9) Hardening Method and surface modification 3h
- 10) Shape memory and superplastic alloys. Applications 3h

### Laboratory:

Analysis of microstructural features and properties of the alloys.

Students will be asked to apply the laboratory practice for solving specific questions related to the above topics.

### Project:

In depth study of a component for aerospace/automotive/civil/structural/biomedical fields by using scientific literature.

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## REFERENCE TEXT BOOKS

- [1] W.F.Smith, *Structure and Properties of Engineering Alloys*, McGraw-Hill
- [2] M.Tisza, *Physical Metallurgy for Engineers*, ASM,
- [3] I.J.Polmear, *Light Alloys*, BH
- [4] G. Lutjering, J. C. Williams, *Titanium*, Springer 2nd edition, New York