

## Introduction to Materials Science

1. **Course number and name:** 020ISMNI2 Introduction to Materials Science
2. **Credits and contact hours:** 2 ECTS credits, 1x1:15 contact hours
3. **Name(s) of instructor(s) or course coordinator(s):** Marie-Jose Zacca, Tala Kanson, Fadel Chamsseddine, Ali Harkous
4. **Instructional materials:** Course handouts; in-class examples and videos.
5. **Specific course information**
  - a. **Catalog description:**

This course begins with an introduction to materials and chemical bonds. It allows students to master the structure of solid, amorphous and crystalline materials with their chemical compositions and crystal defects. Then the properties of the materials (physical, chemical and mechanical) and the phenomena of degradation will be approached (ageing, deterioration, corrosion...) in addition to the use of the materials. Finally, the materials are divided into three main parts and explained: metallic materials (alloys, cast iron and steel), polymer materials and mineral materials. Examples of common applications are discussed after each part in order to familiarize students with the links between structure and properties sought in mechanical engineering.
  - b. **Prerequisites:** None
  - c. **Required/Selected Elective/Open Elective:** Required
6. **Educational objectives for the course**
  - a. **Specific outcomes of instruction:**
    - Have a historical approach and information on families of materials and bonds in chemical structures.
    - Understand the structure of amorphous and crystalline solid materials.
    - Study the details of the chemical composition of a solid and its crystalline defects.
    - Become familiar with the 7 crystal systems.
    - Apply the information acquired on concrete, glass and iron oxides.
    - Master the properties of materials (physical, mechanical and chemical) and the phenomena of degradation (corrosion, aging, deterioration by friction).
    - Address the use of materials and their elastic and plastic behavior.
    - Define ferrous and non-ferrous alloys (metallic materials) with their standardized designations.
    - Detail the manufacture of cast iron and steel.

- Mastering polymer materials (classification, nomenclature, structure and morphology, physico-chemical and mechanical characteristics).
- Understand mineral materials and their subclasses such as glasses, ceramics, glass ceramics, clay, refractory ceramics, abrasive ceramics, cements and technical ceramics.

**b. PI addressed by the course:**

<b>PI</b>	<b>1.1</b>	<b>3.1</b>	<b>7.1</b>
<b>Covered</b>	x	x	x
<b>Assessed</b>	x	x	

**7. Brief list of topics to be covered**

- Chapter 0: Introduction and reminders (1 lecture)
- Chapter 1: Structure of solid materials (2 lectures)
- Applications on Chapter 1 (1 lecture)
- Chapter 2: Material properties and degradation phenomena (2 lectures)
- Applications on Chapter 2 (1 lecture)
- Chapter 3: Metallic Materials (2 lectures)
- Applications on Chapter 3 (1 lecture)
- Chapter 4 : Polymer materials + tutorial exercises (1 lecture)
- Chapter 5: Mineral Materials (1 lecture)