

PONTIFICIA UNIVERSIDAD CATÓLICA DE CHILE  
COLLEGE OF ENGINEERING  
DEPARTMENT OF MECHANICAL AND METALLURGICAL ENGINEERING  
ABET COURSE SYLLABI

**ICM 2403 MATERIALS SCIENCE**

**Credits and contact hours:** 10 UC credits/ 10 hours (3 hours in lectures and 7 individual work hours per week)

**Instructor's name:** Jorge Ramos Grez

**Course coordinator's name** To be defined

**Textbook:** Class notes, "Fundamentos de la Ciencia de Materiales: aspectos cuánticos, termodinámicos, cinéticos y microestructurales de la materia", Jorge Ramos Grez, 2009

**Course Catalog Description:** This course pretends to develop a strong theoretical and practical foundation in the science of the materials used in contemporary engineering. The acquisition and development of knowledge, techniques and skills related to materials science should enhance both scientific and professional performance of the students. This course aims to strengthen student's entrepreneurial and innovative spirit in the characterization and application of materials. At the end of this course, students should perceive their material surrounding in a significantly different way.

**Prerequisite Courses:** ING1024 Properties and Strength of Materials

**Co-requisite Courses:** None

**Status in the Curriculum:** Minimum course

**Course Learning Outcomes:**

1. To understand atomic and molecular structure and microstructure of different class of materials (metals, ceramics and polymers), using fundamentals of classical and quantum mechanics.
2. To understand the physical foundations that govern the mechanical, electrical and microstructural properties of these materials.
3. To analyze and evaluate different materials, to measure and estimate some of their most important mechanical properties.
4. To integrate the processing of these materials and their resulting mechanical properties through microstructural transformations.
5. To perform group work during laboratory sessions and to write laboratory reports.

**Relation of Course to ABET  
Criteria:**

- a. Knowledge of mathematics, science and engineering
- b. Design and conduct experiments: analyze and interpret data
- c. Design a system, component, or process
- d. Multidisciplinary teams
- e. Identify, formulate, and solve engineering problems
- f. Professional and ethical responsibility
- g. Effective communication
- k. Techniques, skills, and modern tools for engineering practice.

**Topics covered:**

1. Quantum approach to atomic structure and chemical bonding. Crystal geometry and X-Ray diffraction
2. Crystal defects
3. Solid state diffusion
4. Phase equilibrium and  $\gamma$  binary phase diagrams
5. Kinetics of microstructural transformations
6. Mechanical properties of materials

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