Summary

The course presents materials science and engineering from the perspective of biological applications. Lectures provide solid fundamentals on the design, fabrication, and characterization of materials. Exercises provide instructive examples on how to implement biomaterials in biomedical research.

Content

Fundamentals of materials science
- Atoms, atomic structure, and bonding forces
- Structural mechanics
- Solid characteristics (electrical, magnetic, and dielectric properties)
- Main material classes: metals, ceramics, polymers, and composites

Fabrication, processing, and analysis of materials
- Casting, molding, printing, coating, self-assembly
- Nano and micro structuring
- Bulk and surface engineering
- Surface characterization
- Sterilization procedures
- Mechanical, chemical, and electrical analysis
- Biostability, biocompatibility, and biodegradation

Applications in biomedicine and bioscience
- Materials used in biomedicine: Natural materials, Synthetic materials and Biologically inspired biomaterials
- Application in basic bioscience research
- Application in tissue engineering
- Application in medical devices

Keywords

Atomic forces, polymers, degradation, fabrication, processing, characterization, biomaterials

Learning Prerequisites

Important concepts to start the course
This class requires a basic knowledge of chemistry and physics

**Learning Outcomes**

By the end of the course, the student must be able to:

- Formulate the main differences among materials classes
- Elaborate the concepts behind the classes of materials used in biomedicine and bioscience
- Recognize the main elements necessary to exploit materials in a project in biomedicine

**Transversal skills**

- Communicate effectively, being understood, including across different languages and cultures.
- Use a work methodology appropriate to the task.
- Assess one's own level of skill acquisition, and plan their on-going learning goals.
- Demonstrate the capacity for critical thinking
- Manage priorities.
- Access and evaluate appropriate sources of information.
- Continue to work through difficulties or initial failure to find optimal solutions.

**Teaching methods**

Lectures integrated with exercises

**Expected student activities**

Attending lectures, completing exercises, group case study, reading material from the course and from literature as preparation.

**Assessment methods**

Final Written Exam

**Supervision**

Office hours: Yes
Assistants: Yes
Forum: Yes

**Resources**

**Bibliography**

- Comprehensive Biomaterials / Ducheyne

**Ressources en bibliothèque**

- Comprehensive biomaterials / Ducheyne
- Fundamentals of materials science and engineering / Callister

**Notes/Handbook**

Will be provided on Moodle webpage
Prerequisite for
Master courses in Biomaterials (BIOENG-442)