

BIOENG-315 **Materials science for bioengineers**

Ghezzi Diego

Cursus	Sem.	Type
Life Sciences Engineering	BA5	Opt.

Language of teaching	English
Credits	4
Session	Winter
Semester	Fall
Exam	Written
Workload	120h
Weeks	14
Hours	4 weekly
Courses	2 weekly
Exercises	2 weekly
Number of positions	

Summary

The course presents materials science 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**SECTION 1: 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

SECTION 2: 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

SECTION 3: 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

- Fundamentals of materials science and engineering 4th ed., SI version
- Reference Module in Materials Science and Materials Engineering; ISBN: 978-0-12-803581-8
- Comprehensive Biomaterials / Ducheyne

Ressources en bibliothèque

- [Fundamentals of materials science and engineering / Callister](#)
- [Comprehensive biomaterials / Ducheyne](#)

Notes/Handbook

Will be provided on Moodle webpage

Prerequisite for

Master courses in Biomaterials (BIOENG-442)