COURSE DESCRIPTION
FUNDAMENTALS OF MATERIALS FOR BIOMEDICINE

SSD: BIOINGEGNERIA INDUSTRIALE (ING-IND/34)

DEGREE PROGRAMME: BIOINGEGNERIA INDUSTRIALE (P16)
ACADEMIC YEAR 2024/2025

COURSE DESCRIPTION

TEACHER: CAUSA FILIPPO
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GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: NOT APPLICABLE
MODULE: NOT APPLICABLE
TEACHING LANGUAGE: INGLESE
CHANNEL: FG A-Z
YEAR OF THE DEGREE PROGRAMME: I
PERIOD IN WHICH THE COURSE IS DELIVERED: SEMESTER I
CFU: 6

REQUIRED PRELIMINARY COURSES

None

PREREQUISITES

None

LEARNING GOALS

The course aims to present the basics of chemistry, thermodynamics and technology for the study of materials most used in the design and production of biomaterials and biomedical devices. In particular, the main objective of the course will be to describe the fundamental principles of conformation of engineering properties that describe metallic, ceramic and composite materials. Particular attention will be paid to the macromolecular chemistry that makes up the polymers and characterizes their chemical, physical and mechanical properties. Finally, the techniques useful for the processing and modelling of these materials will be presented, including their applications in biomedicine.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

At the end of the course the student knows the basics of chemistry, physics and microscopic and macroscopic properties of the mechanics of metal materials, ceramics, composites and polymers. He knows the latest techniques and technologies for the treatment and use of materials for the design and production of biomedical devices. It can recognize which material is most suitable for chemistry, physics and mechanical properties to be used for biomedical device manufacturing purposes.

Applying knowledge and understanding

The student is able to apply the knowledge obtained to design and produce biomaterials to develop biomedical devices and contextualize the use of a specific material for a prescribed purpose. He knows the characteristics of the materials in order to define what type of interface can be used and what treatments can be applied to obtain the finished result.

COURSE CONTENT/SYLLABUS

Part I: Introduction to metal, ceramic, and composite materials: atomic number and atomic mass. Crystalline structure. Phase regulation and thermodynamics of materials. Mechanical properties. Materials treatment techniques.
Part II: macromolecules, polymers, hydrogel: Monomers, molecular weight and structural configurations. Classification of polymers by structure. Thermodynamics of polymers. Mechanical properties. Processing of polymers. Microfabrication.
Part III: Surface properties. Interfacial tension. Surface treatments. Measurement methods.
Part IV: Examples of biomaterials, viscoelastic fluids, and biomaterial applications for the production of medical devices. Microfluidic applications for biomaterials and biomedical devices.

READINGS/BIBLIOGRAPHY

Book: James F. Shackelford, Introduction to Materials Science for Engineers, Prentice Hall
Slides and exercises

TEACHING METHODS OF THE COURSE (OR MODULE)

Class lessons and semoinars

EXAMINATION/EVALUATION CRITERIA

a) Exam type

- [x] Written
- [ ] Oral
- [ ] Project discussion
- [ ] Other

In case of a written exam, questions refer to

- ☐ Multiple choice answers
- ☐ Open answers
- ☑ Numerical exercises

b) Evaluation pattern

Understanding of topics presented and correctness of exercises