MATERIALS ENGINEERING AND NANOTECHNOLOGY (LM56)

(Lecce - Università degli Studi)

Teaching BIOMATERIALS

GenCod A003986

Owner professor Marta MADAGHIELE

Teaching in italian BIOMATERIALS

Teaching BIOMATERIALS

SSD code ING-IND/22

Reference course MATERIALS ENGINEERING AND

Course type Laurea Magistrale

Credits 9.0

Teaching hours Front activity hours: 81.0

For enrolled in 2019/2020

Taught in 2020/2021

Course year 2

Language ENGLISH

Curriculum MATERIALS FOR BIOMEDICAL APPLICATIONS

Location Lecce

Semester Second Semester

Exam type Oral

Assessment Final grade

Course timetable https://easyroom.unisalento.it/Orario

BRIEF COURSE DESCRIPTION

The aim of the course is to provide students with basic knowledge on the design of medical devices for given applications, from biomaterial choice to manufacturing technologies. Particular attention is given to the development of the following devices: a) artificial prostheses; b) scaffolds for regenerative medicine and tissue engineering; c) devices for controlled drug release.

REQUIREMENTS

Basic knowledge on polymer science and technology is suggested.

COURSE AIMS

This course aims to highlight the properties of biomaterials affecting their performance as medical implants, scaffolds for tissue engineering and drug delivery devices. At the end of the course, students are expected to:

- understand the physiological response to medical implants;
- know the principles of scaffold design and related manufacturing technologies;
- know the principles of drug delivery design;
- identify the most suitable biomaterial(s) for given applications;
- know the methods for bulk and surface characterization of biomaterials.

TEACHING METHODOLOGY

The course includes lectures, lab experiences and seminars on selected topics.

ASSESSMENT TYPE

Final exam will consists of an oral interview, during which the student is expected to show complete knowledge and comprehension of the topics of the course.

FULL SYLLABUS

- Introduction on biomaterials and medical devices. Metals, bioceramics, natural and synthetic polymers (6 ore).
- Viscoelasticity of polymers and biological tissues. Hydrogels: definition and applications; thermodynamics and kinetics of swelling; crosslink density (rubber elasticity theory) (16 hours). Laboratory activities (4 hours).
- Diffusion in polymers and principles of drug delivery devices. Diffusion and erosion-based mechanisms. Examples: hydrogels, micro- and nano-particles. Transdermal drug release devices. Drug targeting for cancer therapy (14 hours).
- Physiological response to permanent implants. Definitions and examples of favourable or adverse responses. Wound healing: acute and chronic response. Examples of permanent implants: orthopedic prostheses; contact lenses; stents (8 hours).
- Principles of tissue engineering. Scaffold design: structure and properties; porosity, degradation, mechanical properties, manufacturing technologies. Bioreactors; cells for tissue engineering (16 hours). Laboratory activities (5 hours).
- Case studies: biomaterials and scaffolds for regeneration of nerves, bone, cartilage, tendons and ligaments. Biomaterials for cell encapsulation (9 hours).
- Classification and regulatory issues for medical devices (3 hours).

REFERENCE TEXT BOOKS

[1] Pietrabissa, R. *Biomateriali per protesi e organi artificiali.* Patron Editore.
[2] Yannas I.V. *Tissue and Organ Regeneration in Adults.* Springer
[3] Class notes and slides