# Advanced material sciences & Integrated design

Crédits ECTS
5 crédits

## En bref

**Langue de cours:** Anglais

# Présentation

## Prérequis

· Strength of Materials (stress, strain, basic loading cases)

· Mechanics (forces, moments, equilibrium)

· Having followed and succeeded in the MTSC - Introduction to Material Science lectures or equivalent.

## Objectifs d'apprentissage

· Understand the full medical device lifecycle, from early concept and design to market access and post#market surveillance.

· Identify the specific constraints of biomedical applications, including material selection, biocompatibility, and safety requirements.

· Select and justify materials and design choices in compliance with biomedical and regulatory constraints.

· Understand the fundamental principles of the Finite Element Method (FEM) and its role as a design and verification tool.

· Build and interpret numerical simulations (FEM/Abaqus) to support mechanical analysis of medical devices.

· Understand how design verification tools (tests and simulations) contribute to risk management and device validation.

· Identify the key steps for placing a medical device on the European market under the Medical Device Regulation (MDR 2017/745).

· Develop a system#level understanding linking engineering, materials, numerical analysis, and regulatory compliance throughout the medical device lifecycle.

Centrale Méditerranée

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## Description du programme

This course provides an integrated view of medical device development, combining materials science, numerical modeling, and regulatory requirements. Students are introduced to the constraints specific to biomedical applications, including material selection, biocompatibility, and mechanical performance.

The course then presents numerical simulation methods, with an introduction to the Finite Element Method and its application to medical devices.

A major part of the course focuses on medical device regulation, with an emphasis on the European Medical Device Regulation (MDR 2017/745). Students learn the key steps required to place a medical device on the European market, from device qualification and risk classification to conformity assessment procedures, technical documentation, clinical evaluation, CE marking, and post#market surveillance.

The course combines theoretical lectures with practical examples and case studies extracted from real medical devices.

## Equipe pédagogique

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| **Total des heures** | | **36h** |
| CM | Cours Magistral | 24h |
| TD | Travaux Dirigés | 12h |

# Infos pratiques

## Nom responsable UE

### Responsable pédagogique

Amal Bechikh
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