



UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

3d Printing: Applicazioni in Medicina Personalizzata e Dispositivi Medici

2627-2-H4103D167

Aims

The course aims to provide physicians with the theoretical, conceptual, and applicative foundations of 3D printing and 3D bioprinting in the context of personalized medicine and the development of personalized medical devices. The most widely used printing technologies, clinically compatible materials, criteria for designing personalized models, and key clinical applications will be covered.

The ultimate goal is to provide physicians with the skills to:

- Understand the clinical potential of 3D printing and bioprinting technologies.
- Evaluate the possibilities for integrating 3D printing into medical practice.
- Interact with multidisciplinary teams (bioengineers, chemists, biotechnologists, computer scientists) in the design and implementation of high-tech, personalized solutions for patients

Contents

The course will cover the following main topics:

- Fundamentals of 3D printing and 3D bioprinting technologies.
- Existing and potential applications relevant to clinical practice and simulation.
- Design and fabrication of medical devices and regenerative medicine applications: from prosthetics to the bioprinting of biological tissues.
- Clinical cases, translational applications, and future perspectives (from 3D printing to robot-assisted 3D bioprinting).
- Regulatory and ethical aspects, and clinical validation of printed devices.
- Integration with Artificial Intelligence (AI, ML, DL) for automated design and parameter prediction in the development of personalized materials.

Detailed program

- Introduction to 3D Printing in Medicine (Evolution of 3D Printing; Differences between Printing, Bioprinting, and Biofabrication)
- 3D Printing Technologies for Clinical Use (Comparison of Techniques and Clinical Applications)
- Medical-Friendly Materials (Synthetic and Natural Polymers, Hydrogels, Biomaterials for Bioprinting)
- Clinical and Preclinical Applications of 3D Printing (Preoperative and Simulation Models, Prosthetic Devices, Semi-Permanent Devices, Customized Implants and Scaffolds for Regeneration / Tissue Mimetics)
- 3D Bioprinting: Emerging Technologies (Bioinks and Biological Tissues, Design of Vascularized Tissues, Applications in Tissue Engineering)
- Real-World Clinical Cases (Multidisciplinary Analysis of Cases Treated with 3D Printing, Workflow Study and Clinical Validation)
- AI and Customized 3D Printing (Predictive Design, Prediction of Optimal Clinical Parameters, Prediction and Optimization of Materials and Techniques) (geometries)
- Regulatory information and aspects (Classification, CE marking and off-label use, validation, testing, and clinical liability)

Prerequisites

- NA

Teaching form

- 14 hours in total:
 - o 6 in-person lessons (lectures), 2 hours each
 - o 1 seminar + laboratory visit (2 hours) focusing on clinical-applied aspects
 - o Materials: slides, videos, scientific articles, software demos

Textbook and teaching resource

Slides, websites (regulatory agencies, clinical trials, software e open sources tools....), articles and reviews, guidelines & SOPs

Semester

- II Semester – starting period: II Semester

Assessment method

Attendance

Office hours

By appointment

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING
