COURSE DESCRIPTION
MICROFLUIDICS FOR LAB-ON-CHIP

SSD: TEORIA DELLO SVILUPPO DEI PROCESSI CHIMICI (ING-IND/26)

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

COURSE DESCRIPTION

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GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: U5489 - MICROFLUIDICS AND SYSTEMS AND SYNTHETIC BIOLOGY
MODULE: U1626 - MICROFLUIDICS FOR LAB-ON-CHIP
TEACHING LANGUAGE: INGLESE
CHANNEL: FG A-Z
YEAR OF THE DEGREE PROGRAMME: I
PERIOD IN WHICH THE COURSE IS DELIVERED: SEMESTER II
CFU: 6

REQUIRED PRELIMINARY COURSES

None

PREREQUISITES

None

LEARNING GOALS

The course aims at providing students with the basis of microfluidics. This course is designed with the goal of bringing together fluid mechanics, interfacial chemistry and computer simulations to prepare the modern bioengineer to analyze and model continuum fluid-mechanical systems encountered when working with microfabricated devices.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

Understanding the characteristics of microfluidic flows and its operations. Ability to correctly identify the different classes of microfluidic devices for diagnostic applications, the relevant factors that play a role in their dynamics, and the key technological parameters.

Applying knowledge and understanding

Ability to design lab-on-chip devices, even by making use of CFD simulations, selecting appropriate tools and operating conditions for specific diagnostic applications.

COURSE CONTENT/SYLLABUS

Dimensional analysis and scaling laws
Fundamentals of Fluid Mechanics
Basics of Diffusion
Microchannel Flows
Introduction to CFD
Geometry and Mesh Generation
CFD: Proteomic Microreactor
Microparticle manipulation in microfluidics
Microfluidics with Non-Newtonian Liquids
Droplets and Plugs in Microchannels
Mixing and Diffusion in Microfluidics
CFD: Drop formation in T-Junction
Design and Microfabrication of a Microchannel
Lab-on-a-chip for biomedical applications

READINGS/BIBLIOGRAPHY

Brian J. Kirby, Micro- and Nanoscale Fluid Mechanics, Cambridge University Press
Lecture notes

TEACHING METHODS OF THE COURSE (OR MODULE)

The teacher will use: a) frontal lessons for about 60% of the total hours; b) CFD practical exercises for about 25% of the total hours; c) laboratories to deepen the applied knowledge for about 10% of the total hours; d) flipped classrooms for about 5%.
Tasks are assigned to teams to analyze the presented concepts.

EXAMINATION/EVALUATION CRITERIA

a) Exam type

- ☐ Written
- ☑ Oral
- ☑ Project discussion

☐ Other

In case of a written exam, questions refer to

☐ Multiple choice answers

☐ Open answers

☐ Numerical exercises

b) Evaluation pattern

Activities during the course will give you access to bonus points

The final grade consists of an evaluation of the oral exam (70%) and the discussion of the report (30%)