Course offered for the PhD program
in Civil, Chemical and Environmental Engineering
Curriculum in Chemical, Material and Process Engineering –
a.a. 2022/2023 (cycles XXXVIII, XXXVII and XXXVI)

(possibility of participation for students in other PhD cycles or other PhD courses)

1. Title

Micro- and nanostructured sensors

2. Course Description

The course aims at providing notions to the future PhD students on the general principles of operation of bio- and chemical sensors based on the use of nanostructured surfaces.
The course will include the following topics:

- bioanalytes: biomolecules, biopolymers, viruses/bacteria
- random walk, diffusion distance, sensor surface "stickyness"
- label-free sensors: amperometric, potentiometric, mass sensors
- steady state sensor analogy with electrostatics: capacitance model
- planar sensor, nanowire sensor, fractal surface sensor: regular and irregular fractals
- settling time principle; nanowire vs planar sensor
- nanosphere sensor; array of wires: fractional dimension sensor
- approaches to beat the diffusion limit: biobarcode, droplet evaporation
- nanostructuring surfaces by anodization, anodic nanoporous sensing surfaces.
- quartz crystal microbalance
- cantilever sensors: dynamic microbalance, static stress sensing
- hybrid MCL-FET sensors

3. Course Organization

The course, organized into a single module, will consist of classroom lessons and exercises.

4. Teacher

The course teacher will be Dr. Marco Salerno of the Technical University of Dresden.

5. Duration and credits

The course (15 hours) will consist of 7 lessons, 2 hours each, and a 1 hour exercising session, for a total of 3 credits.

6. Activation mode and teaching period

The course will be held yearly if at least one student will be registered by simple contact with both teachers by email. The course will be held on May-June 2023. The exact dates of the lessons will be confirmed about one month before the beginning of the course.

7. Deadline for registration

Registration to the course must be made before April 20th, 2023. Students are asked to inform teachers by e-mail (marco.salerno@uni-dresden.de) about their registration.

8. Final exam

The final exam will consist in an interview on the topics covered by the course. The students are requested to contact both teachers by email to establish the date of the exam.