Saša Omanović	Nanotechnology in electrochemistry

Name of the course	**Nanotechnology in electrochemistry**
Number of instruction hours	20
Outline of course/module content	Nanomaterials and nanomaterials production approaches. Nanomaterial characterization techniques: Electronic microscopy (SEM, EDX, ETM), Atomic force microscopy (AFM), Scanning tunneling microscopy (STM), X-Ray techniques (XRD/XRF, XPS/AES), Surface/interface techniques (adsorption, contact angle, zeta potential, polarization-modulation infrared absorption reflection spectroscopy). Specific applications of nanotechnology: Fuel cells; Biofuel cells; Hydrogen production by electrolysis of water and regenerative fuel cells; Flow batteries; Nanostructured oxide materials as catalysts for the treatment of wastewaters (electrochemical and photo-electrochemical); Nanotechnology in the development of medical biosensors and controlled drug release; Development of biomolecule-based electrochemical reactors for biocatalysis; Nanotechnology in development of smart and self-healing anti-corrosive coatings.
Description of instruction methods	A student is assigned a topic related to his/her PhD project, if possible. The topic needs to be researched, and the corresponding written (seminar) report needs to be submitted to the instructor for grading.
Description of course/module requirements	A student is obliged to submit a written report on the assigned topic, to the instructor for grading. The report needs to be of a review-article type, based on the most relevant and recent literature findings related to the assigned topic. This, in general, assumes the student needs to read the topic-related literature extensively (min. 50 references), and understand the findings reported in the literature. A first version of the report is sent to the course instructor for the first reading. The instructor responds to the student with comments and a request for revision of the report. Alternatively, the student is offered a possibility to accept a grade related to the first version (draft) of the report (without further revising the draft).

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Chemical approach to nanotechnology: fundamentals and applications
1. To categorize different nanomaterials used in certain areas of science or in everyday applications. 2. To evaluate nanomaterials in the fields of electrochemical systems for energy production, wastewater treatment, detection of molecules (sensors) and medical applications. 3. To interpret theoretical fundamentals of a series of experimental techniques used to characterize nanomaterials. 4. To choose experimental techniques suitable for characterizing nanomaterials with respect to targeted properties. 5. To interpret experimental results obtained using the techniques for characterization of nanomaterials.