

**Course title:** **Nanomaterials for optoelectronic and biological applications**

**Institute/Speciality:** **FACULTY OF CHEMICAL ENGINEERING AND TECHNOLOGY /** Engineering of Technological Processes

**Erasmus subject code:** Innochem O3 16/17

**Number of contact hours:** 30 hours (lectures)

**Course duration:** 1 semester

**ETCS credits:** **2**

**Course description:** The course aims: expanding knowledge of students to comprehensive overview of synthesis and characterization of nanomaterials especially for optoelectronic and biological applications. Course modules will cover the fundamental scientific principles controlling assembly of nanostructured materials, novel synthesis methods and toxicity problem of nanomaterials. Expanding knowledge of students to understanding the design and properties of hierarchical nanostructures that are utilized in advanced applications, including photovoltaic applications, drug delivery, LEDs and others. The course will also provide the students with necessary background for understanding basic nanomaterials characterization techniques, including X-ray scattering diffraction, crystal structure analysis, microscopy techniques, dynamic light scattering and others.

**Lectures content:** Definition of nanotechnology and nanomaterials, classifications of nanomaterials, including quantum dots nanoparticles, hybrid organic-inorganic nanocomposites / Nanoparticles, shapes, dimensionality, surface modifications, methods of stabilization of nanomaterials, the process of self-organization / The main synthesis methods of nanomaterials: bottom-up and top-down approaches including sol-gel reactions, colloidal methods, solvothermal synthesis, microwave synthesis / The main analytical methods for characterization of nanomaterials including: microscopic techniques (SEM, TEM, AFM, HRTEM, EDX), diffractive techniques (XRD, and spectroscopy techniques (DLS, XPS, SIMS, NMR, UV-VIS, ICP-AES, FT-IR and ellipsometry) / Optoelectronics application of nanomaterials including photovoltaic cells, transistors, LEDs, sensors / Biology and medicine applications of nanomaterials: drug delivery, including cancer therapy, biosensors, bio-labeling / Toxicity of Nanomaterials.

**Literature:** [1] Vijaykumar B. Sutariya, Yashwant Pathak, „Biointeractions of Nanomaterials” 2015, Taylor & Francis Group  
[2] Wei Chen, Shaowei Chen „Functional Nanometer-Sized Clusters of Transition Metals – synthesis, properties and applications”; 2013, Royal Society of Chemistry

**Assessment method:** **Final test**

**Prerequisites:** **Student should have basic knowledge from physical, inorganic and organic chemistry, electrochemistry and biology**

**Primary target group:** **all specialties students (Chemical Engineering / Chemical Technology)**

**Lecturer:** dr inż. Katarzyna Matras-Postołek

**Contact person:** dr inż. Katarzyna Matras-Postołek (kontakt: matras@chemia.pk.edu.pl)

**Deadline for application:** **15th of January for students applying for spring semester, 30th of August for students applying for winter semester**

**Remarks:** **The course will start for at least 3-5 foreign student**