Name of the course	**Advanced oxidation processes for water treatment**
Number of instruction hours	20
Outline of course/module content	Fundamentals and background of advanced oxidation processes (AOPs). The role of hydroxyl radicals and their generation. Reaction kinetics and degradation mechanisms of organic pollutants by hydroxyl radicals. The effects of process parameters and scavenging media on degradation efficiency. Removal of specific pollutants in aqueous media; biodegradability enhancement and toxicity reduction. Practical application of AOPs for water and wastewater treatment; opportunities and limitations. Modeling approaches for AOPs simulation. Fundamentals of UV irradiation. Absorption and bond dissociation energy. UV sources and their characteristics. UV photolysis background. Actinometry. Molar absorption coefficient and quantum yield. Direct photolysis. UV light based (photochemical and photocatalytic) AOPs for water treatment; common oxidants and catalysts and their alternatives. Fenton reaction. Alternative catalysts for Fenton reaction. Types of homogeneous and heterogeneous Fenton and photo-Fenton processes; influencing parameters, reaction kinetics and mechanisms. The role of ligands in modified photo-Fenton processes. Iron catalysts in heterogeneous Fenton processes; sources and supports. Ozonation; background and fundamentals, reaction kinetics and mechanisms. Application of homogeneous and heterogeneous catalytic ozonation in water treatment. Ultrasound processes; principles of sonochemistry and acoustic cavitation. Homogeneous (liquid-phase) and heterogeneous (solid surface-liquid, particle-liquid and liquid-liquid) reactions. Reactor configurations; batch and flow systems. Combined application of ultrasound with ozone and/or UV light; synergistic and antagonistic effects. Electrical discharge based processes; potentials and limitations. Types of electrical fields and their influence on process efficiency. High voltage electrical discharge (“Corona”) processes; reactor configurations influencing process chemistry. Water radiolysis; principles, formation of reactive species and limitations.
Description of instruction methods	Lectures, seminars, consultations
Description of course/module requirements	Written exam, oral exam