Level: master

Course title: Sensors in Chemistry

Status: election

ECTS: 5

Requirements: none

Learning objectives

Broadening the knowledge about physical, physico-chemical, biochemical and analytical working principles of sensors/chemical sensors. Introduction to the role, significance, design and application of chemical sensors. Training in practical skills, which enable professional and independent handling with sensors and instruments during the analysis. Developing students' ability to independently solve problems related to the design and application of sensors/chemical sensors during the execution of the analysis.

Learning outcomes

Applying the knowledge about the methods of analysis based on sensors during execution of different analysis. Selecting the appropriate measurement technique, simple or sophisticated equipment, and methodology in solving complex problems with sensors. Independently and completely handling the instruments/sensors for analysis of different samples. Select, optimize, modify and adapt appropriate methods when performing different analysis. Objective evaluation and presentation of research results.

Syllabus

Theoretical instruction.

Limit of detection, limit of quantification, and response time of chemical sensors. Basics of potentiometric measurements. Solid electrodes in potentiometry. Glass and other electrodes for pH measurements, and measurements of other cations. Ion selective electrodes. Liquid membrane-based electrodes with ion exchangers, neutral carriers, and ionic liquids. Optical chemical sensors. Direct and indirect optodes. Basics of voltammetric measurements. Pulse techniques. Stripping voltammertry. Working electrodes (electrode materials and their classification). Gas sensors. Electrochemical biosensors. Enzymatic biosensors. Immunosensors. DNA sensors. Oligonucleotide sensors. Enzymatic amplifiers, nanoparticles and q-dots. Biosensor chips. Scanning electrochemical microscope. Quartz crystal microbalance. Atomic force microscopy. Surface plasmon resonance spectroscopy (SPR). *On line* and *in vivo* measurements. Voltammetric and potentiometric electrode array. Miniaturization of sensor chips. Biological sensors. Nanomotors. Wireless communication.

Practical instruction.

Ion selective electrodes and their applications. Voltammetric determination of selected metals in selected samples. Thermometric biosensors. Measurements of oxygen. Measurement of glucose in blood.

Weekly teaching load				Other:
Lectures: 2	Exercises: 2	Other forms of teaching:	Student research:	