Study Programme: Master Academic Studies in Chemistry

Course Unit Title: Sensors in Chemistry

Course Unit Code: IHA-403

Name of Lecturer(s): Assistant Professor Jasmina Anojčić

Type and Level of Studies: Master of Science Degree

Course Status (compulsory/elective): Elective

Semester (winter/summer): Winter

Language of instruction: English

Mode of course unit delivery (face-to-face/distance learning): Face-to-face

Number of ECTS Allocated: 6

Prerequisites: None

Course Aims:

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:

Theory

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.

Practice

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

Required Reading:

1. Susan R. Mikkelsen, Eduardo Corton, Bioanalytical Chemistry, Wiley, 2004
2. Jon Cooper, Tony Cass, Biosensors, Oxford Univ, 2004
3. E. Bakker, Ph. Bühlmann, E. Pretsch, Carrier-Based Ion-Selective Electrodes and Bulk Optodes. Ionophores for Potentiometric and Optical Sensors, Chem Rev. 1998, 98, 1593-1687
4. D. Thrévenot, K. Toth, R. A. Durst, G. S. Wilson, Electrochemical biosensors:recommended definitions and classification, Biosensors&Bioelectronics 2001, 16, 121-131.

Weekly Contact Hours:	**Lectures:** 3 (45)	**Practical work:** 2 (30)

Teaching Methods:

Lectures, laboratory work, seminar(s)

Knowledge Assessment (maximum of 100 points): 100			
Pre-exam obligations	points	**Final exam**	points
Active class participation	10	oral exam	60
Practical work	20	……..	
Seminar(s)	10		