**SYLLABUS**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Basic data of the subject** | | | | |
| **Academic Unit:** | | **Chemistry Department, Faculty of Mathematics & Natural Sciences,** | | |
| **Course title:** | | **Electrochemical sensors** | | |
| **Level:** | | **Master** | | |
| **Course status:** | | **Elective** | | |
| **Study year:** | | **II** | | |
| **Number of hours per week:** | | **2+2** | | |
| **Credit value – ECTS:** | | **6** | | |
| **Time / location:** | | **Will be appointed by the Department** | | |
| **Lecturer:** | | **Prof. Dr. Ramë VATAJ** | | |
| **Contact details:** | | **Email:** [rame.vataj@uni-pr.edu/](mailto:rame.vataj@uni-pr.edu/)  **Tel:** /038-229-964/ | | |
|  | | | | |
| **Course description** | | This course will help students to learn about electrochemical sensors and their use. Introduction to Electrochemical Sensors. Nitric Oxide (NO) Electrochemical Sensors. Electrochemical Glucose Biosensors. Biosensors for pesticides. Ion Selective Electrodes. Electrochemical Immuno assays. Superoxide Electrochemical Sensors. Electrochemical sensors for the determination of hydrogen sulfide. Biochips-fundamentals and applications. Nanoparticles-based biosensors. Electrochemical sensors based on carbon nanotubes. Chemical and biological sensors based on electroactive inorganic polycrystals. Biosensors based on direct electron transfer of proteins. | | |
| **Course objectives:** | | The module will permit to the students to learn about the concept, the structure and the application of sensors in chemical and biochemical analyses. The students will be able to understand direct use of electrochemistry for a significant number of detection of different important compounds in real life. | | |
| **Learning outcomes:** | | At the end of the courses the student will be able:   * To introduce basic principles of sensors. * To make the difference between different types of electrochemical sensors. * To know to interpret the data collected from EC sensors. * To explain the use of EC sensors for engineering processes. | | |
| **Contribution on student load (must correspond with learning outcomes)** | | | | |
| **Activity** | | **Hours** | **week** | **Total /hours** |
| Lectures | | 2 | 15 | 30 |
| Exercise theoretical/laboratory | | 2 | 15 | 30 |
| Practice work | |  |  |  |
| Contact with lecturer/consultations | | 1 | 10 | 10 |
| Field exercises | |  |  |  |
| Mid-terms, seminars | | 2 | 2 | 4 |
| Homework | | 1 | 10 | 10 |
| Individual time spent studying (at the library or home) | | 2 | 10 | 20 |
| Final preparation for the exam | | 2 | 15 | 30 |
| Time spent in evaluation (tests, quiz, final exam) | | 2 | 5 | 10 |
| Projects, presentations, etc. | | 2 | 3 | 6 |
| **Total** | |  |  | **150** |
| **Teaching methods** | | Lectures, discussions, exercises, consultations, homework, colloquies and exams. | | |
|  | |  | | |
| **Evaluation methods** | | The first test is 15%,  Second test is 15%,  Attendance 5%,  Engagements in practical exercises 15%  Final exam 50%. | | |
| **Literature** | | | | |
| **Basic Literature:** | Electrochemical sensors, biosensors and their biomedical applications, X. Zhang, H. Ju, J. Wang, Elsevier (2008). | | | |
| **Additional Literature** | Electrochemical Sensor Analysis, Volume 49 (Comprehensive Analytical Chemistry); Elsevier Science (2007). | | | |

|  |  |
| --- | --- |
| **Designed study plan:** | |
| **Week** | **Lectures which will be held** |
| ***First week:*** | Introduction to Electrochemical Sensors. |
| ***Second week:*** | Nitric Oxide Electrochemical Sensors (NO). |
| ***Third week:*** | Biosensors for pesticides. |
| ***Fourth week:*** | Electrochemical Glucose Biosensors. |
| ***Fifth week:*** | Ion Selective Electrodes. New trends of Ion-Selective Electrodes. |
| ***Sixth week:*** | Recent developments in electrochemical immunoassays and immunosensors. |
| ***Seventh week:*** | **1st mid-term evaluation** |
| ***Eighth week:*** | Superoxide Electrochemical Biosensors. |
| ***Ninth week:*** | Electrochemical sensors for the determination of hydrogen sulfide. |
| ***Tenth week:*** | Biochips-fundamentals and applications. |
| ***Eleventh week:*** | Electrochemical sensors based on carbon nanotubes. |
| ***Twelfth week:*** | Nanoparticles-based biosensors. |
| ***Thirteenth week:*** | Chemical and biological sensors based on electroactive inorganic polycrystals. |
| ***Fourteenth week:*** | Biosensors based on direct electron transfer of proteins |
| ***Fifteenth week:*** | 2nd mid-term evaluation |
| **Designed study plan:** |  |
|  | **Exercises which will be held** |

|  |
| --- |
| Electrochemical reduction of oxygen |
| Electrochemical reduction of hydrogen peroxide |
| Mediators, ferrocene |
| Preparation of a glucose electrochemical sensor |
| Use of SAMs for preparation of electrochemical sensors |
| Electrochemical sensor for determination of lead ion concentration |
| Electrochemical sensor for determination of copper ion concentration |
|  |
| **Academic policies and rules of conduct:** |
| Attendance at lectures and exercises should be regular and scheduled time. Students must be in commensurate to the general rules of the university. For specific rules and specifics of organizing lectures and exercises, students are notified by the professor of the course. |