UNIWERSYTET GDAŃSKI

Course title Metody elektroanalityczne / Electroanalytical methods	**ECTS code** 13.3.0468

Name of unit administrating study
Faculty of Chemistry

Studies

Field of study	Type	Form	
Chemistry	Bachelor	Full-time studies	

Teaching staff
Prof. dr hab. inż. Tadeusz Ossowski, dr Anna Wcisło, dr Iwona Dąbkowska

Forms of classes, the realization and number of hours

A. Forms of classes, in accordance with the UG Rector's regulations
lecture, laboratory class

B. The realization of activities
in-class learning

C. Number of hours
75 h (30 h lecture, 45 h laboratory class)

ECTS credits 6

classes - 75 h
tutorial classes – 10 h
student's own work – 65 h

Total: 150 h - 6 ECTS

The academic cycle
2020/21 summer semester

Type of course
obligatory

Language of instruction
Polish

Teaching methods

Laboratory exercises: performing planned experiments, analyzing the results of experiments combined with discussion
Lecture with multimedia presentation

Form and method of assessment and basic criteria for evaluation or examination requirements

A. Final evaluation, in accordance with the UG study regulations
lecture – exam
auditorium classes – course completion (with a grade)
laboratory classes – course completion (with a grade)

B. Assessment methods
Laboratory exercises:
determination of the final grade based on five partial grades obtained during the semester (50%), work efficiency in the laboratory, reports on experiments (30%) and calculation test (20%).

C. The basic criteria for evaluation or exam requirements
• getting 51% of points from the written exam consisting of 5-15 open questions and 10-40 test questions covering issues mentioned in the lecture's program content.
• Laboratory exercises:
determination of the final grade on the basis of partial grades received during the semester (50%), work efficiency in the laboratory (development of results obtained in the experimental part in the form of report, application of safety and health at work in the electroanalytical laboratory.) (30%) and calculation test (20%).

Required courses and introductory requirements
completed course in general chemistry, analytical chemistry
knowledge of the basics of general and analytical chemistry, ability to write equations of oxidation-reduction reactions, knowledge of the principles of work and safety in a chemical laboratory;

Aims of education
A. Formal requirements: completed course in general chemistry, analytical chemistry
B. Prerequisites: knowledge of the basics of general and analytical chemistry, ability to write equations of oxidation-reduction reactions, knowledge of working principles and safety in a chemical laboratory

Course contents

A. Lecture topics:

Theoretical foundations of electroanalytical methods, types of measurement techniques. Potentiometry: pH-metric electrodes, measuring principles in the water environment, measuring apparatus. Conductometry: principles and measuring apparatus, probes and measuring cells, conductivity models, practical applications for analytical purposes. Electrogravimetry: classical, internal and controlled potential, electrolysis in qualitative and quantitative analysis. Voltamprometric and polarographic measurement techniques in chemical analysis: cyclic and linear voltammetry, coulometry. Voltammetric stripping in chemical analysis.

B. Laboratory topics:

Potentiometric measurements: types of electrodes, ion-selective electrodes, measurement techniques. pH-metric measurements. Calibration of a combined electrode and multi-proton acid titration, Electrogravimetry: measurement methods, micro and macro analysis of components. Electrolytic determination of copper and nickel in solution. Conductometric determination of complex mixtures. Voltammetric methods: experimental methods, principles of measuring, system construction, techniques and measurement methods, reversibility of the electrode process. Determination of ascorbic acid content by cyclic voltammetry. Electrochemical concentration (stripping) methods in the analysis: concentration methodology, amalgams. The influence of voltammetric stripper parameters on the peak current. Titration analysis. Automation and computerization of electrochemical methods. Assessment of the usefulness of a given electrochemical method in the context of the purpose and scope of the analysis. Acquiring the skills of selection, servicing of apparatus and appropriate electroanalytical techniques to perform a specific electroanalytical determination. Learning to obtain electrochemical data, assess their accuracy. Evaluation of the precision of the markings.

Bibliography of literature

A. Literature required to pass the course

1. Cygański – Podstawy metod elektroanalitycznych, WNT, Warszawa
2. Z. Galus – Elektrochemiczne metody wyznaczania stałych fizykochemicznych, PWN, Warszawa
3. J. Garaj – Fizyczne i fizykochemiczne metody analizy, WNT, Warszawa

A.2. studiowana samodzielnie przez studenta

1. W. Szczepaniak – Metody instrumentalne w analizie chemicznej, PWN, Warszawa
2. J. Minczewski – Chemia analityczna – t. III, PWN, Warszawa
3. Z. Galus – Teoretyczne podstawy elektroanalizy chemicznej, PWN, Warszawa
4. A. Kisza – Elektrochemia – cz. I i II, WNT, Warszawa
5. L. Sobczyk, A. Kisza, K. Gatner, A. Koll – Eksperymentalna chemia fizyczna, PWN, Warszawa

B. Literatura uzupełniająca:

1. K. Kraman – Zastosowania elektrod jonoselektywnych, WNT, Warszawa

B. Extracurricular readings

Knowledge

1. Defines basic terms in electrochemical analysis.
2. Describes and classifies types of electrochemical methods and their applications.
3. Lists and defines types of electrodes.
4. Defines the electrode processes and presents their mechanisms.
5. Explains the methods of measurement of basic electrochemical quantities.
6. Describes the construction and operation of electrochemical devices, eg. potentiostat, conductometer, laboratory power supply, galvanostat

Skills

1. Uses appropriate electroanalytical techniques to solve a given analysis problem.
2. Selects electrodes and uses them in electrochemical analysis.
3. Interprets the measurement results obtained during electrochemical analysis.
4. Prepares the results of the analysis in the form of a report containing a description of the experiment, calculations and interpretation of the data.
5. Illustrates and analyzes the course of titrations made with electroanalytic methods.
6. Analyzes the composition of the solution based on electroanalytical techniques.
7. Organizes the workplace in accordance with the principles of health and safety at the electroanalytical laboratory.

Social competence

1. Improves skills in the use of electrochemical devices.
2. Effectively communicates in a group and uses the experience of other people.
3. Is guided by the principle of saving materials and resources.