

| FACULTY OF CHEMISTRY | | | | | |
|--|--|---------|----------------------|---------|---------|
| SUBJECT CARD | | | | | |
| Name of subject in Polish: | Metody analityczne stosowane w badaniu chemikaliów specjalistycznych | | | | |
| Name of subject in English: | Analytical Methods in Fine Chemicals | | | | |
| Main field of study: | Chemical Technology | | | | |
| Specialization: | Technology of Fine Chemicals | | | | |
| Profile: | academic and practical | | | | |
| Level and form of studies: | 2 nd level, full-time | | | | |
| Kind of subject: | obligatory | | | | |
| Subject code: | TCC024024 | | | | |
| Group of courses: | NO | | | | |
| | Lecture | Classes | Laboratory | Project | Seminar |
| Number of hours of organized classes in University (ZZU) | 30 | | 30 | | |
| Number of hours of total student workload (CNPS) | 60 | | 60 | | |
| Form of crediting | crediting with grade | | crediting with grade | | |
| For group of courses mark (X) final course | X | | | | |
| Number of ECTS points | 2 | | 2 | | |
| including number of ECTS points for practical (P) classes | 0 | | 2 | | |
| including number of ECTS points for direct teacher-student contact (BK) classes | 1 | | 1 | | |
| PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES | | | | | |
| 1. Basic theoretical knowledge in a field of spectroscopic and chromatographic analytical methods and techniques. 2. Ability to use basic laboratory glassware and equipment and to apply the safety rules of work in a chemical laboratory. 3. Fluency in performing chemical calculation. 4. Ability to work in a group. | | | | | |
| SUBJECT OBJECTIVES | | | | | |
| C1 To acquaint student with the basics concerning fine chemicals. C2 To familiarize the student with the regulations, function and effects of the REACH regulation in the context of scientific research and industrial activity. C3 To familiarize the student with a technical dossier containing information on substance properties depending on the type and tonnage in which the substance is manufactured or imported into the EU under REACH. C4 To acquaint student with the theoretical and practical aspects of good laboratory practice (GLP) and good manufacture practice (GMP). C5 To familiarize the student with principles and recommendations of analytical green chemistry C6 To familiarize the student with the techniques of preparing complex samples of various origins for the analysis. C7 To acquaint the student with advanced methods and techniques of qualitative and quantitative analysis (chemical, electrochemical, chromatographic and spectroscopic) used in various branches of industry related to fine chemicals. C8 To familiarize the student with practical approach of selected analytical methods and techniques (chemical, electrochemical, chromatographic and spectroscopic) used in various industries related to fine chemicals. | | | | | |

C9 To acquaint student with the analytical equipment and instruments, as well as principles of its operation.

SUBJECT LEARNING OUTCOMES

Relating to knowledge:

Student, who has completed the course:

PEK_W01 gained the knowledge concerning fine chemicals.

PEK_W02 has knowledge of the regulations, functions and effects of the REACH regulation in the aspect of scientific research and industrial activity.

PEK_W03 has knowledge about the obligations in the supply chain for registering chemical substances under REACH, which are manufactured or imported into the EU, and can determine the 7 key steps to successful registration.

PEK_W04 gained theoretical knowledge concerning application of the good laboratory practice (GLP) and good manufacturing practice (GMP) in terms of fine chemicals.

PEK_W05 knows the recommendations of green analytical chemistry.

PEK_W06 is familiar with basic definitions and types of errors, their causes and means of elimination in the quantitative analysis of fine chemicals.

PEK_W07 is familiar with definitions and approaches of analytical data quality objectives associated with validation, remediation, assessment, accuracy, precision, specificity and sensitivity of analytical methods and techniques, and the basics of their control.

PEK_W08 gained a wide knowledge in a field of various methods and techniques utilized in a qualitative and quantitative analysis (physical, chromatographic, chemical, electrochemical, spectroscopic) of fine chemicals in different industrial branches.

PEK_W09 is familiar with the construction of the laboratory equipment and instruments which are used in analysis of fine chemicals in different industrial branches and understands its operating principles.

Relating to skills:

Student, who has completed the course:

PEK_U01 is able to apply principles of good laboratory practice (GLP).

PEK_U02 is able to assess necessity to comply with the requirements imposed by the REACH regulation.

PEK_U03 is able to develop a workflow when necessary to meet the requirements imposed by the REACH regulation.

PEK_U04 is able to properly sample an analytical sample and prepare it for various analytical processes.

PEK_U05 is able to apply various methods of separation of single components of the complex matrix.

PEK_U06 is able to select and apply appropriate analytical methods (chemical, electrochemical, chromatographic and spectroscopic) to determine the quality and purity of fine chemicals.

PEK_U07 is able to select and apply an appropriate analytical methods (chemical, electrochemical, chromatographic and spectroscopic) for quantitative analysis of specialty chemicals.

PEK_U08 is able to select and apply an appropriate research equipment to conduct qualitative and quantitative analysis of fine chemicals.

PEK_U09 is able to adjust the analytical procedure and the research method to the recommendations of analytical green chemistry.

PEK_U10 is able to prepare a report concerning performed experiments and obtained results, including their basic statistical analysis.

Relating to social competences:

PEK_K01 has the competence to cooperate in a team.

PEK_K02 has competence for efficient communication.

PEK_K03 is focused on acquiring and consolidating knowledge.

PEK_K04 is aware of the responsibility for the results obtained.

PROGRAMME CONTENT

| Lectures | | Number of hours |
|----------|---------------------------------|-----------------|
| Lec 1 | Introduction to fine chemicals. | 2 |

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|--------|---|----|
| Lec 2 | Regulations, function and effects of REACH regulation in scientific research and industrial activity - substance identification. | 2 |
| Lec 3 | Key steps towards the successful registration of REACH, preparation of technical documentation and chemical safety assessment. | 2 |
| Lec 4 | Analytical data quality objectives associated with GLP & GMP standards – validation, remediation, assessment, accuracy and precision. | 4 |
| Lec 5 | General review of quantitative and qualitative analytical methods and techniques utilized in various branches of industry related to fine chemicals | 4 |
| Lec 6 | Green analytical chemistry recommendations. | 2 |
| Lec 7 | Analytical techniques utilized to study active ingredients in various formulations, detecting impurities and trace analysis. | 3 |
| Lec 8 | Methods and techniques applied to investigate food additives. | 2 |
| Lec 9 | Methods and techniques applied for analysis of surfactants. | 2 |
| Lec 10 | Methods and techniques applied to study additives for polymers, plastics and textiles. | 2 |
| Lec 11 | Methods and techniques applied for analysis of coatings and thin films. | 2 |
| Lec 12 | Methods and techniques applied for analysis of colorants and dyes. | 2 |
| Lec 13 | Final test. | 1 |
| | Total hours | 30 |

| Laboratory | | Number of hours |
|------------|---|-----------------|
| Lab 1 | Introductory class: the terms of the subject and its crediting, safety rules, rules of the chemical laboratory in terms of selected aspects of GLP. | 2 |
| Lab 2 | Qualitative analysis of selected ingredients in a shampoo. | 4 |
| Lab 3 | Qualitative and quantitative analysis of a dye in a fabric. | 4 |
| Lab 4 | Qualitative and quantitative analysis and estimation of antioxidant activity of substances isolated from plant material. | 4 |
| Lab 5 | Food additives in a beverage – isolation of preservatives. | 4 |
| Lab 6 | Food additives in a beverage – quantitative analysis of preservatives, sweeteners and other additives. | 4 |
| Lab 7 | Quantitative analysis of vitamins in a cosmetic product. | 4 |
| Lab 8 | Additional classes; consultations; credits. | 4 |
| | Total hours | 30 |
| | Total hours | 30 |
| | | |
| | Total hours | 30 |

TEACHING TOLS

N1 Multimedial presentation.

N2 Performing experiments with different laboratory equipment and instruments.

N3 Preparation of report including analysis and interpretation of obtained results.

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

| | | |
|---|--------------------------|---|
| Evaluation (F – forming (during semester), P – concluding (at semester end)) | Learning outcomes number | Way of evaluating learning outcomes achievement |
|---|--------------------------|---|

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| F1 | PEK_W01 – PEK_W09 PEK_K03, PEK_K04 | Regular attendance and active participation during the lectures. |
| F2 | PEK_W04 – PEK_W09 PEK_U01 – PEK_U10 PEK_W01, PEK_W02 | 5 grades for reports on the experiments conducted. |
| P1 (lecture) | PEK_W01– PEK_W09, PEK_K03 | Grade for the final test. |
| P2 (laboratory) | PEK_W04 – PEK_W09 PEK_U01 – PEK_U10 | Average from 5 grades for reports on the experiments conducted (F2) $P2 = (\Sigma F2)/5$ |
| PRIMARY AND SECONDARY LITERATURE | | |
| <p><u>PRIMARY LITERATURE:</u></p> <p>[1] G.D. Christian, <i>Analytical Chemistry</i>, John Wiley & Sons, New York, ,1994.</p> <p>[2] R.S. Khandpur, <i>Handbook of Analytical Instruments</i>, ed.India Published, New York 2006;</p> <p>[3] H. Schmidt-Traub, <i>Preparative Chromatography of Fine Chemicals and Pharmaceutical Agents</i>, Wiley-VCH, Verlag, 2005</p> <p>[4] P. Pollack, <i>Fine Chemicals. The Industry and the Business</i>, John Wiley & Sons, New York, 2007.</p> <p>[5] <i>Ullmann's Encyclopedia of Industrial Chemistry</i>, Vol. A20, 193, VCH Verlagsgesellschaft, Weinheim 1994.</p> <p><u>SECONDARY LITERATURE:</u></p> <p>[1] F.A. Settle, <i>Handbook of Instrumental Techniques for Analytical Chemistry</i>. Prentice-Hall Inc., 1997.</p> <p>[2] K.A. Rubinson, J.F. Rubinson, <i>Contemporary Instrumental Analysis</i>, Upper Saddle River Prentice Hall, 2000.</p> <p>[3] S.S. Nielsen, <i>Food Analysis Laboratory Manual</i>, Springer, West Lafayette, IN, USA, 2010</p> | | |
| SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS) | | |
| dr inż. Marta Tsirigotis-Maniecka (marta.tsirigotis@pwr.edu.pl) | | |