Universitat de Lleida

DEGREE CURRICULUM

INDUSTRIAL CHEMICAL ANALYSIS

Coordination: FONT VALLÈS, JOAQUIM

Academic year 2018-19

INDUSTRIAL CHEMICAL ANALYSIS 2018-19

Subject's general information

Subject name	INDUSTRIAL CHEMICAL ANALYSIS
Code	102347
Semester	2nd Q(SEMESTER) CONTINUED EVALUATION
Typology	

Degree	Course	Character	Modality
Not informed	3	COMPULSORY	Attendance-based

Course number of credits (ECTS)	6
Type of activity, credits, and groups	

Activity type	PRALAB	PRAULA	TEORIA
Number of credits	2.4	0.6	3
Number of groups	1	1	1

Coordination	FONT VALLÈS, JOAQUIM
Department	CHEMISTRY
Teaching load distribution between lectures and independent student work	Lectures and laboratory activities 60 hours Independent study work 90 hours
Important information on data processing	Consult this link for more information.
Language	Catalan. Part of the documentation is in Catalan, part in Spanish, and part in English.
Distribution of credits	Joaquim Font 5,8C Trini Canals 2,6C Lectures 1C Lectures 2C Pralab 4,8C Praula 0,6C

INDUSTRIAL CHEMICAL ANALYSIS 2018-19

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
FONT VALLÈS, JOAQUIM	joaquim.font@udl.cat	6	

Subject's extra information

Analytical Chemistry has two key objectives. The first one is to develop methods for a qualitative and quantitative characterization, with an uncertainty as small as possible.

The second one is the solution of analytical problems derived from the need of chemical information, resulting from all kinds of economic, social and health activities.

The Industrial Chemical Analysis aims to find a balance between the both following aspects. On the one hand, it intends to obtain the maximum amount of information with the best quality possible, but also minimizing the investments in devices and instruments, human resources, working risks, and the environmental impact.

In this Subject, the fundamentals and the functionality of the Analytical Chemistry are studied so as to solve engineering problems. By making use of the chemical analysis, correct decisions about the quality control of raw materials, procedures, finished product parameters, environmental control and the correct application of the regulations and quality guidelines can be made.

This Subject takes part in the Integrating Project, which is done during the second semester of the third year from the degree. The other Subjects in the Project are Biotechnology and Industrial Chemical Legislation.

In addition to the lectures and exercise solving lessons, there are practical activities as well.

In order to accomplish the goals appropriately, it is extremely convenient to pass the previous Subjects of Statistic Methods, Chemistry, and Organic Chemistry.

It is **COMPULSORY** that the students bring the following elements of individual protection (EPI) to the practices at the laboratory.

- Laboratory gown from UdL
- Protection glasses
- Mechanical protection gloves

They can be purchased through the shop Údels of the UdL:

C/ Jaume II, 67 baixos
Centre the Cultures i Cooperació Transfronterera

http://www.publicacions.udl.cat/

There will be a specific service for the *Campus Universitari d'Igualada*.

The use of other elements of protection (for example caps, masks, gloves of chemical or electrical risk, etc.) will depend on the type of practice to be done. In that case, the teacher will inform of the necessity of specific EPI.

Not bringing the EPI's described or not fulfilling the norms of general security that are detailed below imply that the student can not access to the laboratories or have to go out of them. The no realisation of the practices for this reason imply the **consequences in the evaluation** of the subject that are described in this course guide.

GENERAL NORMS OF SECURITY IN LABORATORY PRACTICES

- Keep the place of realisation of the practices clean and tidy. The table of work has to be free from backpacks, folders, coats...
- No short trousers or short skirts are allowed in the laboratory.
- Closed and covered footwear is compulsory in the laboratory.
- Long hair needs to be tied.
- Keep the laboratoy gown laced in order to be protected from spills of chemicals.
- Bangles, pendants or wide sleeves are not allowed as they can be trapped.
- Avoid the use of contact lenses, since the effect of the chemical products is much bigger if they enter between the contact lense and the cornea. Protection over-glasses can be purchased.
- No food or drink is allowed in the laboratory.
- It is forbidden to smoke in the laboratories.
- Wash your hands whenever you have contact with a chemical product and before going out of the laboratory.
- Follow the instructions of the teacher and of the laboratory technicians and ask for any doubt on security.

For further information, you can check the following document of the *Servei de Prevenció de Riscos Laborals de la UdL*: http://www.sprl.udl.cat/alumnes/index.html

Learning objectives

- To have an overall vision about the analytical chemistry and, more specifically, about its connection with engineering.
- Calibration, calculation and comparison of uncertainties.
- To know the different sampling techniques.
- To comprehend the fundamentals of chemical equilibrium in dissolution.
- Solving exercises about acid-base titration.
- Solving exercises about precipitation titration.
- Solving exercises about redox titration.
- To comprehend the fundamentals of gravimetric analysis.
- To comprehend the fundamentals of electro analysis.
- To comprehend the origin and fundamentals of the atomic and molecular spectroscopy.
- To know the Beer-Lambert law and the fundamentals of the absorption spectroscopy.
- To know the fundamentals of the separation processes in chromatography, as well as the essentials and applications of the gas and liquid chromatography (*High Performance Liquid Chromatography*, HPLC).
- Calculate and apply optical and chromatographic methods.
- To know how to perform in the analytical laboratory.
- To check and apply the theory learned about the spectroscopy and chromatography in the laboratory practices.
- Use diverse applications of analytical chemistry in discharge control and debugging and, in general, in environmental management.
- To learn and use the analytical chemistry terminology in English to facilitate the consultation of the specialized bibliography.

Competences

Basic Competences

B01 That students have demonstrated to possess and understand knowledge in an area of study that starts from the base of general secondary education, and is usually found at a level that, although supported by advanced textbooks, also includes some aspects that imply knowledge coming from the vanguard of his/her field of study.

B02 That students know how to apply their knowledge to their work or vocation in a professional manner and possess the skills that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study.

B03 That students have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include a reflection on relevant social, scientific or ethical issues.

B04 That students can transmit information, ideas, problems and solutions to a specialized and non-specialized public.

B05 That students have developed those learning skills necessary to undertake further studies with a high degree of autonomy.

Transversal

CT1. To develop a proper understanding and oral and written expression of Catalan and Spanish.

CT2. To develop meaningful command of a foreign language, especially English.

CT3. To iImplement new technologies and technologies of information and communication.

CT5. To apply essential notions of scientific thinking.

General

CG3. To synthesize basic and technological subjects, which enable them to learn new methods and theories, and provide them with versatility to adapt to new situations.

CG4. To solve problems with initiative, make decisions, creativity, critical reasoning and to communicate and transmit knowledge, skills and abilities in the field of Industrial Chemical Engineering/Industrial Organization Engineering.

CG5. To carry out measurements, calculations, valuations, appraisals, surveys, studies, reports, work plans and other analogous work.

CG6. To implement specifications, regulations and mandatory rules.

CG8. To apply the principles and methods of quality.

CG10. To work in a multilingual and multidisciplinary environment.

CG11. To understand and apply the necessary legislation in the exercise of the profession of Industrial Technical Engineer/Industrial Organization Engineer.

Specific competences

CE2. To conceptualize and command the fundamental concepts about the general laws of mechanics, thermodynamics, fields and waves and electromagnetism and their application to solve problems in engineering.

CE4. To apply the principles of fundamental knowledge of general chemistry, organic and inorganic chemistry and their applications in engineering.

CE7. To conceptualize applied thermodynamics and heat transmission. To recognize the basic principles and their application to solving engineering problems.

CE19. To calculate material and energy balances, biotechnology, material transfer, separation operations, chemical reaction engineering, design reactors, and valorize and transform raw materials and energy resources.

CE21. To design and manage applied experimentation procedures, especially for the determination of thermodynamic and transport properties, and modeling of phenomena and systems in the field of chemical engineering, systems with fluid flow, heat transfer, material transfer operations, kinetics of chemical reactions and reactors.

Subject contents

This subject is divided in three parts :

- Part 1: Fundamental concepts of Analytical Chemistry.

- Part 2: Introduction to the Instrumental Analysis.

- Part 3: Experimentation in Analytical Chemistry.

Part 1:

Unit 1. Analytical Chemistry.

Unit 2. Assesment of data

Unit 3. Sampling in analytical chemistry.

Unit 4. Volumetric analysis methods.

Unit 5. Gravimetrical methods.

Unit 6. Electrochemical methods.

Part 2:

Unit 1. Fundamentals of spectroscopy.

Unit 2. VIS-UV Spectroscopy

Unit 3. Atomic spectroscopy

Unit 4. Separations.

Unit 5. Fundamentals of chromatography.

Unit 6. Gas chromatography.

Unit 7. Liquid chromatography.

Unit 8. Quantitative analysis in chromatography.

Part 3:

VIS-UV molecular spectroscopy, atomic spectroscopy, conductometry, Kjeldhal separations, gas and liquid chromatography laboratory practices.

Integrating Project: The project taught in the third year 2nd semester integrates the following courses: Industrial Chemical Analysis, Biotechnology and Industrial Chemical Legislation. The project coordinator will supervise the accomplishment of the assignments detailed in the course plan, which will be available to students at the beginning of the semester.

Methodology

The development of the Subject includes:

1. Theory in large group classes: Lectures where the professor exposes the definitions, materials and the working plan.

2. Exercises: Problem solving of exercises based on real data.

3. Team work with oral and written communication.

4. Integrating Project.

5. Visit to the facilities of the A3 *Leather Innovation Centre.*

6. Practical activities: Laboratory practices, with a later written report.

In every unit, various exercises will have to be done individually and autonomously by the students, and delivered to the teacher to be assessed.

In addition, the students have the responsibility to reinforce their knowledge in an autonomous approach, taking as a basis the content given and/or recommended by the professor.

Development plan

Week	Methodology	Units	Attendance hours	Autonomous working hours
1	Lectures and exercise solving lessons.	Part I: Modules 1 and 2	4	6
2	Lectures and exercise solving lessons.	Part I: Modules 2 and 3	4	6
3	Integrating Project	Developing the Integrating Project	2	3
3	Lectures and exercise solving lessons.	Part I: Modules 3 and 4	4	6
4	Lectures and exercise solving lessons.	Part I: Module 4	4	6
5	Lectures and exercise solving lessons.	Part I: Module 4	4	6
6	Integrating Project	Developing the Integrating Project	2	3
6	Lectures and exercise solving lessons.	Part II: Modules 4 and 5	4	6
7	Lectures and exercise solving lessons. Practical Activity	Part I: Modules 5 and 6	4	6
8	Lectures and exercise solving lessons. Practical activity.	Part II: Modules 1 and 2	4	6
9	Mid-course Exam	Part I: Modules 1-6 Part II: Modules 1-2.		
10	Integrating Project	Developing the Integrating Project	2	3
10	Lectures and exercise solving lessons.	Part II: Modules 2 and 3	4	6
11	Lectures and exercise solving lessons. Practical activity.	Part II: Modules 3 and 4	4	6
12	Integrating Project	Developing the Integrating Project	2	3
12	Lectures and exercise solving lessons.	Part II: Modules 5 and 6.	4	6
13	Lectures and exercise solving lessons. Practical activity.	Part II: Module 6	4	6
14	Lectures and exercise solving lessons. Practical activity.	Part II: Modules 6 and 7	4	6
15	Lectures and exercise solving lessons. Oral and written presentation of the Integrating Project.	Part II: Module 8. Integrating Project Evaluation	4	6
16-17	Final Exam	Modules 1 to 10		

18	Tutoring			
19	Second-chance Exam			

Evaluation

Exercises 8%

Integrating Project 15%

Laboratory 12%

Written test 1 20%

Written test 2 45%

Students have the right to take the second-chance exam of the Written Test 2 in the 19th week.

In order to have the right to obtain the final grade, the Laboratory and Integrating Project divisions must be evaluated.

Bibliography

BASIC

- Documentation of the Subject Part I. Trini Canals. Digital Campus UdL.
- Documentation of the Subject Part II. Joaquim Font. Digital Campus UdL.
- G. Christian. Química Analítica (2009). Ed. Mc Graw Hill, 6ª Edición.
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ADDITIONAL BIBLIOGRAPHY

- D.A. Skoog, F.J. Holler, S.R. Crouch. Principios de anàlisis instrumental (2008). 6ª edición. Ed. Cengage Learning.
- D.A. Skoog, D.H.West, F.J. Holler, S.R. Crouch. Fundamentos de química analítica. 9ª edición. (2014). Cengage Learning.
- Rice, Eugene W. (Ed). Standard methods for the examination of water and wastewaters. American Public Health Association, WEF, AWWA. 22th Ed (2012).
- Chromatographic separations. An. Chem. by Open Learning Series. P.A. Sewell, B. Clarke. Wiley 1987.
- H.P.L.C. Analytical Chemistry by Open Learning Series. S. Lindsey. Wiley 1989.
- Gas chromatography. An. Chem. by Open Learning Series. J.E. Willett. Wiley 1988.