



Universitat de Lleida

DEGREE CURRICULUM **UNIT OPERATIONS**

Coordination: BARTOLI SOLER, ESTHER

Academic year 2022-23

Subject's general information

Subject name	UNIT OPERATIONS			
Code	102340			
Semester	1st 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	0.4	2.6	3
	Number of groups	1	1	1
Coordination	BARTOLI SOLER, ESTHER			
Department	COMPUTER SCIENCE AND INDUSTRIAL ENGINEERING			
Teaching load distribution between lectures and independent student work	60 hours classroom lessons Self study 90 hours			
Important information on data processing	Consult this link for more information.			
Language	Catalan, Spanish			
Distribution of credits	3 praula, 2,6 pralab1, 0,4 pralab2			

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
BARTOLI SOLER, ESTHER	esther.bartoli@udl.cat	6	

Subject's extra information

Previous knowledge

To be able to take this course, the student must have a minimum of basic knowledge about balance relations (Dalton, Raoult, Henry, Nerts ...)

General objectives

The subject is oriented in order to be able to identify in a general way all the basic operations that can be used in a process of transformation from raw materials to final products.

Each of the operations that are needed to make the transformation is called a basic operation.

All these operations will be classified according to the conservation of matter and energy. That is why the balances of matter and energy will be introduced, but at a very basic level.

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 laboratory 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

When finishing the subject the student or student must be able to:

- Know and measure the separation operations.
- Detect, plan, analyze, model, make decisions and solve problems in process flow.
- Know and use the tools to correctly apply the balances of matter and energy.
- Know and use the most sustainable basic operations.
- Know and apply the appropriate treatments.
- Carry out the design and calculation of the different basic operations of a process.
- Be able to develop a technology that respects the environment and integrates in the work of engineering.
- Know the different options for the design and dimensioning of the different basic operations used in the engineering processes.
- Carry out the tasks assigned based on the basic guidelines given by the teacher, deciding the time to use in each section, including personal contributions and extending the sources of information indicated.

Competences

Basic:

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.

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

Transversal:

CT5. To apply essential notions of scientific thinking.

General competences:

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.

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

Specific competences:

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, systems with fluid flow, heat transfer, material transfer operations.

Subject contents

1. The basic operations
 - 1.1. Classification of the basic operations
 - 1.2. Introduction to the balances of matter and energy
2. Basic physical operations controlled by the transfer of matter
 - 2.1. Distillation - Rectification
 - 2.2. Absorption - Desorption
 - 2.3. Extraction
 - 2.4. Ion adsorption and exchange
3. Balance of matter in systems without and with chemical reaction and in stationary state
 - 3.1. Material balance without chemical reaction and steady state
 - 3.2. Material balance with chemical reaction and steady state
4. Energy balance systems without and with chemical reaction and in stationary state
 - 4.1. Balance of energy without chemical reaction and stationary state
 - 4.2. Balance of energy with chemical reaction and steady state
5. Balances of matter and energy with non-stationary status
 - 5.1. Balances of matter and energy without chemical reaction and in non-stationary state
 - 5.2. Balances of matter and energy with chemical reaction and in non-stationary state

Methodology

Master class, where the basic concepts are exposed in a deductive sequence.

Problem solving. The methodology to solve the typical problems is exposed, starting from the basic concepts.

Practicum, will be performed at the laboratory in groups of 5 people. Each group will then present a report analyzing the experimental data.

Written exam. At day and time established by the study board. Each student has to solve by its own the proposed questions in a limited time. The students know the punctuation criteria.

Development plan

Week	Methodology	Contents	Classroom/Virtual hours	Self study hours
1-8	Master class Problems	Chapters 1,2,3	32	55

9	Written exam (E1)	Chapters 1,2	2	
10-11	Practicum	Practicum at laboratory	4	5
12-15	Master class Problems	Chapters 4,5	20	30
16	Written exam (E2)	Chapters 3,4,5	2	

Evaluation

Halfway through the semester, a written test (E1) will be taken, corresponding to the subject taught during this first part and representing 25% of the overall mark. At the end of the semester there will be another written test (E2) with the total of the subject taught corresponding to 45% of the overall mark. There will also be a practical note (P) that represents 15% of the overall mark and a note of the project (PI) that also represents 15% of the overall mark.

The note will be:

$$NO1 = 0,25 E1 + 0,45 E2 + 0,15 P + 0,15 PI$$

Those who have not passed the subject at the first opportunity may take a final examination of recovery (ER) that will include all the subjects taught during the course.

The final grade of the subject will be:

$$NO2 = 0,70 ER + 0,15P + 0,15PI$$

Tests E1, E2, and ER will be carried out on the dates set by the Studies Directorate. The practices will be done during the last weeks of the course agreed with the students.

Bibliography

-Coulson, John Metcalfe.; Richardson, John Francis. Ingeniería química : unidades SI. Barcelona: Reverté, 1979-1984. ISBN 8429171347 (O.C.).

-Reklaitis, Gintaras. V.; Schneider, Daniel R. Balances de materia y energía. México [etc.]: Nueva Editorial Interamericana, 1986. ISBN 9682511461.

- McCabe, Warren L.; Smith, Julian C.; Harriott, Peter. Operaciones unitarias en ingeniería química. 6ª. Madrid [etc.]: McGrawHill, 2002. ISBN 9701036484.

-Costa López, José. Curso de química técnica : introducción a los procesos, las operaciones unitarias y los fenómenos de transporte en la ingeniería química. Barcelona: Reverté, 1984. ISBN 8429171266.

