COURSE DATA

DATA SUBJECT

Code: 34767
Name: Unit operations of chemical engineering II
Cycle: Undergraduate Studies
ECTS Credits: 4.5
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1401 - Degree in Chemical Engineering	Escola Tècnica Superior d'Enginyeria	3	First quarter
1934 - Double Degree Program in Chemistry-Chemical Engineering	Facultat de Química	3	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1401 - Degree in Chemical Engineering	Basic operations of chemical engineering	COMPULSORY
1934 - Double Degree Program in Chemistry-Chemical Engineering	Tercer curso	COMPULSORY

COORDINATION

LLOPIS ALONSO FRANCISCO

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SUMMARY

The subject Basic Operations of Chemical Engineering-II (OBIQ-II) is part of the matter Unit Operations of Chemical Engineering, whose overall objective is to enable the student to the design and performance analysis of different types of basic operations of the industry process. As regards the subject OBIQ-II, it focuses on the basic operations based on heat transfer. It aims to give students the ability to design and manage the operation of thermal systems own industrial systems.

It is a compulsory subject that is taught in the third year of Degree in Chemical Engineering. The curriculum consists of a total of 4.5 ECTS credits.

This is a subject with a practical component in which, following the introduction of the concepts, students will undertake numerous practical exercises.

The subject **contents** of the course are: heat transport Basic Operations: basic design equations. Design and analysis of heat transfer equipment.

Observations: Theoretical classes will be taught in Spanish and the practical classes as stated in the course sheet available on the degree website.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS

To successfully addressing this subject is recommended that the student has previous knowledge required level for the subjects studied in first and second course. Among others include:
- Fundamentals of physics, chemistry and mathematics.
- Balance of property approach (matter and energy).
- Transport phenomena. Determination of transport coefficients.

COMPETENCES / LEARNING OUTCOMES

1401 - Degree in Chemical Engineering

Ability to handle specifications, regulations and standards of compliance.

Acquire knowledge of basic and technological subjects to facilitate the learning of new methods and theories, and develop the versatility to adapt to new situations.

Act autonomously in learning, make informed decisions in different contexts, issue judgements based on experimentation and analysis and transfer knowledge to new situations.

Analyse, design, simulate and optimise processes and products.

Be able to understand and apply the legislation required for the practice of the profession of technical industrial engineer.

Propose creative and innovative solutions to complex situations or problems, typical of the area of ¿¿¿¿connection, to donate responses to the various professional and social needs

Solve problems with initiative, make decisions, think creatively and critically, and communicate and convey knowledge, skills and competences in the field of industrial engineering.

Understand material and energy balances, biotechnology, mass transfer, separation operations, chemical reaction engineering, reactor design, and the valorisation and transformation of raw materials and energy resources.

Work in a multilingual and multidisciplinary environment.

DESCRIPTION OF CONTENTS

1. INTRODUCTION TO THE BASIC OPERATIONS OF CHEMICAL ENGINEERING

Heat transfer processes.

2. AN INTRODUCTION TO HEAT TRANSFER

Conduction, convection, radiation. Rate equation in molecular transport: Fourier's law. Rate equation in turbulent transport: individual coefficient. Estimation of individual coefficient of heat transmission. Transfer between phases overall coefficient. Heat transfer fluids. Fundamental equations of radiation.

3. HEAT EXCHANGERS

Classification and description. Concentric tubes heat exchangers. Design equations. Improper operation in concentric tubes heat exchanger. Effectiveness of a heat exchanger. Analysis of the functioning of a heat exchanger.

4. HEAT EXCHANGERS INDUSTRIAL USE

Types of industrial heat exchangers. Shell and tubes heat exchangers. Design of heat exchangers for industrial use. Comparative analysis of different types of heat exchangers. Practical aspects of the design of heat exchangers.

5. EVAPORATORS

Introduction. Fundamental equations in an evaporator. Material balance. Energy balance: dilute solutions, concentrated solutions. Rate equation. Design and operation of an evaporator: simple effect.

6. MULTIPLE EFFECT EVAPORATORS

Use of the energy of solvent vapour. Multiple effect evaporators. Advantages and disadvantages of different feeds. Design of a triple-effect evaporator fed directly, without boiling point elevation. Design of a triple-effect evaporator with direct feed, with boiling point elevation. Types of evaporators. Anomalies in the operation of an evaporator.

7. RADIATION EQUIPMENT

Radiation in the presence of other energy transport mechanisms. Individual coefficient of heat transmission by radiation. Combination of resistances to heat transport. Thermal insulation of pipe networks. Calculation of the optimal thickness of the insulation layer. True temperature of a gas flowing through a pipe.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	20,00
Classroom practices	25,00
Total hours	**45,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	4,00
Independent study and work	19,00
Preparation of lessons	26,00
Preparation for assessment activities	11,00
Resolution of case studies	7,50
Total hours	**67,50**

TEACHING METHODOLOGY

The development of the course is structured around theory classes and problems, and work.

In theory classes we will use the lecture model. The teacher will present on presentation and / or explain the contents of each issue impacting on key aspects for understanding.

Practical classes of problems will be developed following two models. In some classes the professor will resolve a number of sample problems for students to learn to identify the essential elements of the approach and problem resolution. In other kinds of problems will be the students, individually or arranged in grups, which should solve similar problems under the supervision of the teacher. After the work, the problems will be collected, analyzed and corrected by the teacher or the students themselves.

The proposed work to the student will be divided into three types: full Problems of similar complexity to those tests, questionnaires aimed at preparing the most important concepts of each topic and self-correcting tests, performed on the Virtual Classroom. Some of these activities will take place in class and the rest will have a timetable for completion and delivery by the students. After correction, students will be informed of their results and a summary of the most consolidated and more frequent failures.

EVALUATION

The assessment of student learning will take place following two ways:

Method A: By assessing the activities of students (questionnaires and problems) and the objective exams.

To be eligible for evaluation with the mode A, the student must have obtained in the proposed activities an average score greater than or equal to 5 (over 10). Once this requirement has been achieved, the final mark will be obtained as the greater of:

- the weight between the average mark of the objective exams (75%) and the average score of the activities (25%), provided that the average mark of the objective exams is equal to or greater than 4 (over 10).
- the average mark of the objective exams.

Method B: The note with this method is obtained by weighting of the final exam (80%) and the average score of the activities (20%), provided that the mark of the final exam is equal to or greater than 4 (over 10).

The subject is considered overcome when the mark obtained is equal to or greater than 5 (over 10).

Copying or plagiarism of any activity that is part of the evaluation will result in the impossibility of passing the course, and the student will then be subject to the appropriate disciplinary procedures indicated in the ACTION PROTOCOL FOR FRAUDULENT PRACTICES AT THE UNIVERSITY OF VALENCIA (ACGUV 123/2020).

In any case, the evaluation system will be governed by the Reglament d'Avaluació i Qualificació de la Universitat de València per a Títols de Grau i Màster (ACGUV 108/2017).

REFERENCES

- "Transmissió de calor" Sanchotello, Margarita; Orchillés, A. Vicent (PUV, 1997)
- "Transferencia de calor" Holman, Jack P. (McGraw-Hill, 2000)
- "Fundamentos de transferencia de calor" Incropera, Frank P.; de Witt, David P. (Prentice-Hall, 1999)
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- "Flujo de fluidos. Intercambio de calor" Levenspiel, Octave (Reverté, 1993)
- "Transferencia de calor aplicada a la ingeniería" Welty, James R. (Limusa, 1978)
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- "Termotecnia. Aplicaciones agroindustriales" Amigo, Pablo (Mundi-Prensa, 2000)
- "Radiative transfer" Hottel, Hoyt C.; Sarofim, Adel F. (McGraw-Hill, 1967)
- "Transferencias de calor y masa" Cengel, Yunus A.; Ghajar, Afshin J. (McGraw-Hill, 2011)