COURSE DATA

DATA SUBJECT

Code: 34756
Name: Basis of chemical engineering II
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2026-27

STUDY (S)

Degree	Center	Acad. year	Period
1401 - Degree in Chemical Engineering	Escola Tècnica Superior d'Enginyeria	2	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1401 - Degree in Chemical Engineering	Foundations of chemical engineering	COMPULSORY

COORDINATION

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SUMMARY

The subject *Basis of Chemical Engineering II* is part of the same name subject-matter whose overall objective is that students acquire and apply the basic principles of chemical engineering for subsequent application to the design and analysis of the performance of unit operations and chemical reactors. It is a compulsory subject that is taught in the second year of the Degree in Chemical Engineering during the first four-month period. The curriculum consists of a total of 6 ECTS.

This course aims to provide the knowledge of the fundamentals of momentum, heat and mass transfer processes, by introducing the rate equations and their combination with the balances. Thus, the fundamental tools for analysis and design the chemical or physical process are established, as necessary basis for the study of design equipment in the process industries.

This is a subject with a practical component in which, after the introduction of the concepts, it will be conducted numerous exercises and experimentation in the laboratory.

The **general objectives** of the course are:

- To acquire and to properly use the basic terminology and nomenclature of chemical engineering.
- To know the laws governing the momentum, heat and mass transfer in any physical or chemical process, to tackle then the equipment design of the chemical process industry.
- To use databases, empirical equations or estimation methods in order to calculate the physical, thermodynamic or transport parameters for the equipment design.
- To develop the skills to solve numerical problems in transport phenomena, and to interpret the results.
- To enhance skills in reasoning and systematic work.
- To develop skills for working in the laboratory and for data collection, processing and reporting results, focusing on the experimentation in the field of chemical engineering.

The course **contents** are: Fundamentals of Transport Phenomena. Unit Operations. Introduction to Chemical Engineering Laboratory.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

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

OTHER REQUIREMENTS

These concepts were recommended:

Solving systems of algebraic and differential equations
Rectangular, cylindrical and spherical coordinates systems
Chemical reaction kinetics and elemental stoichiometric calculations
Conservation laws
Balance approach

COMPETENCES / LEARNING OUTCOMES

1401 - Degree in Chemical Engineering

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.

Collaborate effectively in work teams, assume responsibilities and leadership roles, and contribute to collective improvement and development.

Design and manage applied experimental procedures, especially for determining thermodynamic and transport properties, and model phenomena and systems in chemical engineering, fluid flow systems, heat transfer, mass transfer operations, chemical reaction kinetics and reactors.

Saber comunicarse de manera efectiva, tanto de forma oral como escrita, adaptándose a las características de la situación y de la audiencia

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.

DESCRIPTION OF CONTENTS

1. INTRODUCTION TO TRANSPORT PHENOMENA

Transport Phenomena in Chemical Engineering. Transport mechanisms. Concept of unit operation. Classification of unit operations.

2. RATE EQUATIONS IN MOLECULAR TRANSPORT

Concept of rate equation. Momentum transport. Newton's law of viscosity. Heat Transfer. Fourier law of conduction. Mass transfer. Fick's law of diffusion. General unidirectional rate equation. Estimate of transport properties.

3. INTRODUCTION TO DESIGN EQUATIONS IN MOLECULAR TRANSPORT

Combining the property balances and the velocity laws: Equation of Motion, Equation of Energy and Diffusion equation.

4. UNIDIRECTIONAL STEADY STATE MOLECULAR TRANSPORT

Applying the design equations to the resolution of unidirectional molecular transport at steady state problems.

5. UNSTEADY STATE MOLECULAR TRANSPORT

Unidirectional transport in finite media. Simplified solution. Application to finite-dimensional bodies.

6. INTRODUCTION TO INTERPHASE TRANSPORT. TRANSPORT COEFFICIENTS

Definitions of individual transport coefficient. Interphase transport. Overall transport coefficients. Estimation of transport coefficients: semi-empirical equations and analogies between transport phenomena.

7. DESIGN EQUATIONS IN TURBULENT TRANSPORT

Property balances. Representation on the phase or equilibrium diagrams. Rate equations. Combination of the balances with the rate equations: design equations. Applying the equations to the design of basic operations.

8. LABORATORY OF BASIS OF CHEMICAL ENGINEERING II

Reynolds experiment. Determination of the viscosity of mixtures and their variation with temperature. Calculations and reporting. Sessions of autonomous resolution of complex problems.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	15,00
Laboratory	12,00
Classroom practices	33,00
Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours

Attendance at other activities	0,00
Individual or group project	40,00
Independent study and work	0,00
Preparation of lessons	25,00
Preparation for assessment activities	25,00
Resolution of case studies	0,00
Total hours	**90,00**

TEACHING METHODOLOGY

The development of the subject is structured around the theoretical and problem classes, laboratory practices and performing work.

In the theoretical classes model of lecture will be used. The teacher will present and / or explain the main contents of each issue to highlight those key aspects for subject understanding.

Practical sessions of problems will be developed following two models. In some of the classes, the teacher will solve a series of sample problems in order to teach students to identify the essential elements of the problem approach and resolution. In other practical sessions the students will solve similar problems. After the work has been completed, the problems will be collected, analyzed and corrected.

The proposed work to the student during the theoretical and practical classes will be carried out individually and it will consist of: Theoretical Questions, Numerical Questions and Problems. After correction, the students will be informed of their results and a summary of the most consolidated and more frequent failures.

Laboratory practice sessions, they will be developed following three models. An experimental laboratory session where some activities will be programmed to introduce the practice to be carried out and the experimental activities to acquire the laboratory data, which will be carried out entirely by the students under the supervision of the teacher; a session of analysis and treatment of the obtained data from the laboratory experiments; and two sessions of autonomous resolutions of problems.

The proposed work to the student during the laboratory practice sessions will be carried out in-group and it will consist of: Laboratory report and Complex Problems.

EVALUATION

Attendance to the laboratory sessions is a **mandatory** activity to overcome the subject. In addition, the experimental laboratory session is a **non-recoverable activity**.

FIRST AND SECOND CALL

Assessment in the **first and second call** will be conducted through the evaluation of a final exam, of the theoretical questionnaire, of the activities carried out throughout the course (problems, in-person

questionnaires) and of the laboratory activities (report and complex problems).

The final grade of the subject, as long as the minimum marks and the conditions explained below have been met, will be obtained as:

Final Mark = 0.7 (NE) + 0.1·(NCT) + 0.2 (NL)

Exam (NE): The note corresponding to this section will be obtained from the mark obtained in a **Final Exam of the whole subject** that will consist of a part of practical questions, a part of problems and a theoretical questionnaire. The minimum mark of the exam will be 5.0 out of 10.

Continuous Assessment (NC): The note corresponding to this section will be obtained from the marks obtained in the problems and the theoretical questionnaires solved individually delivered throughout the course.

Laboratory (NL): The note corresponding to this section will be obtained from the mark obtained in the report of the experimental practice (50%) and the delivered complex problems (50%). The minimum mark in the experimental practice report is 5.0 out of 10.

In order to pass the subject, the **Final Mark** obtained must be equal to or greater than 5 out of 10. The final mark of students who have not passed the course for having obtained in the Final Exam or in the experimental practice report marks less than the minimum required, will be the lowest of them.

If the subject is not exceeded, in the first call, by having obtained a grade lower than 5.0 in the report of the experimental practice, it must be submitted again the report on the second call on the date established.

The Not Presented grade will only be assigned if the final exam (NE) is not carried out.

In any case, the evaluation system will be governed by the established in the Reglament d'Avaluació i Qualificació de la Universitat de València per a Títols de Grau i Màster (http://links.uv.es/7S40pjF).

According to the Regulation of the advanced call to complete the studies of Degree (ACGUV 30/2015), the Academic Grade Commission establishes that in this subject it is not possible to request the advanced call if it has not been exceeded, prior to the request, the laboratory practices.

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).

REFERENCES

- Fenómenos de Transporte R. B. Bird, W. E. Stewart, E. N. Lightfoot Reverté, 1964

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- Incropera's principles of heat and mass transfer Frank P. Icropera, David P. Dewitt, Theodore L. Bergman, Adrienne S. Lavine Wiley, 2017

- Transferencia de calor y masa : fundamentos y aplicacions Çengel, Yunus A. 4a Ed. McGraw-Hill, 2011