Academic year 2026/2027

Course Guide:

PROJECTS

FACULTY OF CHEMICAL SCIENCES

1. IDENTIFICATION

Degree Programme	Bachelor's Degree in Chemical Engineering	Course Code	801554
Course Name	Projects	ECTS	9
Subject Area	Projects		
Module	Industrial Engineering		
Course Type	Compulsory	Year	Fourth Year
Semester	First Semester		
Department	Chemical and Materials Engineering		

Teaching Staff

Activity	Lecturer	Email	Office
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2. OBJECTIVES

General objective

This course introduces students to the methodology, management and organisation of projects in the field of Chemical Engineering, enabling them to integrate the knowledge and skills acquired in the other courses of the degree programme. It should also provide a foundation for the Final Degree Project.

After completing the course, students should be able to draft, plan, execute and manage industrial projects in the field of Chemical Engineering. By the end of the syllabus, students should have acquired the skills and competences required to successfully undertake the Final Degree Project, which is a requirement for the award of the Bachelor's Degree in Chemical Engineering.

Specific objectives

- Understand the basic aspects, methodology, organisation and management of Chemical Engineering projects.
- Introduce students to the legislative and regulatory framework in which project work is carried out in the field of Chemical Engineering.
- Introduce students to the technical and administrative procedures applicable to engineering work.
- Develop students' ability to make decisions, assess feasibility and plan engineering projects.
- Develop students' ability to design, develop, interpret and assess Chemical Engineering projects.
- Analyse and assess the environmental impact of projects.
- Provide students with knowledge of the applicable industrial safety regulations and how to integrate them into the project.

- Develop students' ability to prepare and formally present technical reports, projects, expert opinions and technical documentation in general.
- Lay the foundations of knowledge and skills require to complete the Final Degree Project.
- Develop teamwork skills.

3. PRIOR KNOWLEDGE AND RECOMMENDATIONS

Prior knowledge

To follow this course properly, students must have previously acquired the knowledge and skills covered in to following courses: Fundamentals of Chemical Engineering, Applied Computing, Graphic Expression, Thermodynamics and Chemical Kinetics, Applied Thermodynamics, Fluid Mechanics, Chemical Reaction Engineering, Thermal Engineering, Separation Operations, Process Engineering, Process Simulation and Control, and Environmental Technology. Although enrolment is not formally conditional upon this prior learning, effective mastery of this prior knowledge is essential to take this course with reasonable prospects of success.

Recommendations

Students are recommended to have a basic level of English enabling them to consult bibliographic sources in English, search for information, and communicate in writing and orally in that language. They are also recommended to be familiar with computer tools and software packages used to solve complex problems, as well as with applications for writing, editing, and presenting technical reports.

4. CONTENTS

Brief description

Project methodology, management and organisation. Standards, regulations and legislation. Feasibility study. Process engineering. Environmental impact. Industrial safety. Economic study and budget. Preparation and presentation of technical reports.

Course syllabus

<u>BLOCK 1. PROJECT ENGINEERING</u>

1. Engineering projects.

Definition and objectives of the project. Origin and classification of projects. Fundamental characteristics of the project. The project life cycle.

2. Preliminary studies.

Project feasibility. Market study. Project size. Process evaluation and selection. Location, site and environmental impact. Investment estimate. Financing. Cash flows. Project evaluation and analysis.

3. Project documentation.

Project report. Drawings. Specifications. Economic study and budget. Health and safety study. Environmental impact assessment.

4. Standards, regulations and legislation.

Definitions. Engineering standards. Main official regulations. Sources of standardisation and regulation. General legislation applicable to industrial projects. Permits and licences.

5. Project management.

Fundamentals. The project manager and the project team. Project definition and scope. Planning. Execution and control. Quality and risk management. Contracting, purchasing and procurement.

<u>BLOCK 2. PROCESS ENGINEERING</u>

6. Synthesis and evaluation of processes.

Design bases. Fundamentals of integrated process design. Reaction, separation and reaction-separation integration. Flow diagrams. Material and energy balances. Piping and instrumentation diagrams (P&IDs). Equipment lists. Process equipment layout.

7. Energy integration.

Fundamentals of Pinch analysis. Temperature-enthalpy composite curves. Cascade diagrams. Calculation of minimum utility requirements. Grand composite curve. Selection and sizing of utilities. Grid diagrams. Construction of minimum heat-exchanger networks. Network simplification and optimisation.

8. Equipment design.

Heuristic rules for rapid equipment design. Selection of materials. Specification sheets.

<u>BLOCK 3. SAFETY AND ENVIRONMENT</u>

9. Safety in the chemical industry.

History. Definitions and basic concepts. Safety management in the chemical industry. Emergency plans. Legislation.

10. Risk analysis and assessment.

General considerations. Functional analysis of operability (AFO/HAZOP). Fault tree. Dow Index.

11. Inherent safety in design.

Concept. Strategies. Safety throughout the project life cycle.

12. Environmental impact of chemical processes.

Environmental analysis of the process life cycle. Sources of waste emissions. Waste minimization strategies. Green chemistry. Environmental costs. Legislation.

<u>BLOCK 4. ECONOMIC ANALYSIS OF CHEMICAL PROCESSES</u>

13. Project investments.

Concept of investment. Machinery and equipment items. Fixed assets: composition and estimation methods. Working capital: composition and estimation methods.

14. Production costs.

Concept of cost. Cost distribution. Manufacturing costs. Management costs.

15. Economic evaluation of projects.

Time value of money. Depreciation/Amortisation. Inflation. Taxes. Cash flows. Profitability. Sensitivity and uncertainty analysis.

<u>BLOCK 5. DEVELOPMENT OF INTERPERSONAL AND COMMUNICATION SKILLS</u>

16. Preparation and presentation of technical reports.

Definitions. Characteristics of technical reports. Contents. Structure. Style guidelines. Teamwork. Oral presentation of technical reports. Audiovisual media.

5. COMPETENCES

General competences

CG2-MII1	Develop project organisation and management skills.

Specific competences

CE15-P1	Evaluate the real possibility of placing a chemical product on the market.
CE15-P2	Analyse the factors influencing the decision to determine the size of a chemical plant, the procedures for its calculation and the criteria for seeking its optimisation.
CE15-P3	Define, describe, and design the optimal production process for the efficient and effective use of available resources in obtaining a chemical compound.
CE15-P4	Recognise and assess the fundamental cost items in the production costs of a chemical plant or process unit.
CE16-P1	Identify and analyse the main risk situations relating to chemical, physical and biological pollutants generated by a chemical process.
CE17-P1	Estimate the amount of investment required for an industrial project using information provided by market, technical, and organizational studies.
CE18-P1	Identify and define the basic aspects, methodology, organisation and management of a process engineering project.
CE18-P2	Recognise the legal regulations applicable to industrial projects.
CE18-P3	Use the main criteria and techniques for evaluating the location of an industrial project.
CE18-P4	Recall safety regulations and the application of protocols in the field of industrial safety and hygiene.
CE18-P5	Use profitability measurement techniques to assess the economic feasibility of an industrial project.
CE18-P6	Prepare well-structured and well-written technical reports and present them using the most common audiovisual media.

Cross-cutting competences

CT2-II1	Demonstrate capacity for analysis and synthesis in Industrial Engineering.
CT3-II1	Organise and plan documents and projects in the field of Engineering.
CT4-II1	Communicate in Spanish using standard audiovisual media.
CT5-II1	Consult, use and analyse bibliographic sources.
CT5-II2	Use bibliography, specialised databases and resources accessible through the Internet.
CT6-II1	Use computer programs to calculate, design, simulate, approximate, and predict.
CT7-II1	Work in a team.
CT9-II1	Demonstrate professional ethical commitment.
CT10-II1	Integrate acquired knowledge and apply it to solving problems in Industrial Engineering.

6. WORKLOAD DISTRIBUTION BY ACTIVITY.

A total of 9 theoretical and practical ECTS credits are assigned to the course. In accordance with the criterion of 25 hours of student workload per credit, the time distribution is as follows:

Activity	In-class (hours)	Self-study (hours)	Credits
Lectures	36	54	3,6
Seminars	36	54	3,6
Tutorials/guided work	4	11	0,6
Coursework and examination preparation	3	27	1,2
Total	**79**	**146**	**9**

7. METHODOLOGY

Teaching will follow a blended methodology based on cooperative learning, collaborative learning and independent learning. This methodology will be developed through lectures, seminars and scheduled tutorials.

Lectures will be taught to the whole group. They will consist of lectures in which the course syllabus will be presented in an orderly manner. At the beginning of each topic, its content and main objectives will be clearly stated. At the end of the topic, a brief summary of the most relevant content will be provided, and new objectives will be proposed in order to interrelate the contents already studied. To facilitate students' monitoring of face-to-face classes, the teaching material used by the lecturer will be provided in advance. Each topic will be presented using the blackboard and PowerPoint-style slide presentations. Training activities will be developed through practical exercises or case studies related to safety in chemical plants, working with codes of good practice.

Seminars will be taught to the whole group and will have a twofold purpose. First, they will explore in greater depth specific aspects of the course that are addressed more generally in theory classes. To this end, students will work on solving practical cases related to the development of projects and process units. They will also be introduced to specialised bibliographic searches and to the evaluation and discussion of the information obtained. In addition, external specialists will deliver several presentations on project engineering. One of these presentations will address cases related to safety in chemical plants, working with codes of good practice. Practical exercises related to safety in chemical plants will also be solved using such codes. Second, the seminars will be used to present and discuss the partial and final results of a preliminary design project for a chemical plant, which students will carry out in small teams throughout the course. This preliminary project will be assessed as an independent or non-contact learning activity. Some of these activities will be carried out in English. Excel will be used for problem solving and Aspen Plus for project simulation. Directed activities will be carried out to determine and assess students' project-design ability using cutting-edge knowledge in the Chemical Engineering specialism.

Tutorials will be scheduled with small groups. They will address the questions raised by students during the independent completion of the tasks required for the team-based preliminary project. Some of these activities will be carried out in English.

The Virtual Campus will be used to facilitate smooth communication between lecturers and students and to make available the materials used in both theory classes and seminars. Part of the recommended bibliography and almost all the support material uploaded to the Virtual Campus for the development of the teaching activities of this course will be in English.

8. BIBLIOGRAPHY

Basic bibliography

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Complementary bibliography

- "Ullman's Encyclopaedia of Chemical Technology", Ed. Wiley-VCH, 6th ed., 2002.
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- Walas, S.M., "Chemical Process Equipment Selection and Design", Ed. Butterworth-Heinemann, 1st ed., 1990.
- Branan, C.R., "Rules of Thumb for Chemical Engineers", Ed. Gulf Professional Publishing, 3rd ed., 2002.
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- Vian, A., "*El Pronóstico Económico en Química Industrial*", Ed. Eudema, 1ª ed., 1991.
- Couper, J. R., "Process Engineering Economics", Ed. Marcel Dekker, 1st ed., 2003.
- Ray, M. S., Sneesby, M. G., "Chemical Engineering Design Project: a Case Study Approach", Ed. Gordon and Breach Science Publishers, 2nd ed., 1998.

9. EVALUATION

The student's academic performance and the final course grade will be calculated as a weighted average according to the following percentages, which will be maintained in all examination sittings:

❖ WRITTEN EXAMINATION: 40%

There will be a final examination covering the entire course, which will contribute 40% to the overall grade. It will be essential to obtain a minimum mark of 5 out of 10 in the written examination component in order to pass the course. This criterion will be maintained in the extraordinary examination session.

The examination will include theoretical questions (multiple-choice) and practical questions (problems) related to the course syllabus in order to assess the following competences: CG2-MII1, CE15-P2, CE15-P3, CE15-P4, CE16-P1, CE17-P1, CE18-P1, CE18-P3, CE18-P5, CT2-II1, CT10-II1. Multiple-choice questions will account for 30% of the written examination mark, while problems will account for 70%.

❖ PERSONAL WORK AND GUIDED ACTIVITIES: 60%

The assessment of students' individual learning work will take into account two factors:

- Assessment of work in face-to-face seminar classes.
- Presentation and defence of a chemical plant design project. Students will develop and orally defend, in small teams, a preliminary design project for a chemical plant proposed by the lecturer. After the presentation, each group will be asked questions from the lecturer and their classmates on the topic. The lecturer will assess the presentation quality of the submitted report, the clarity of its content, spelling and writing quality, as well as the clarity of the presentation and of the answers given during the oral presentation and defence. Some of these activities will be assessed in English. In addition to the project report, students must submit the simulation and scientific-calculation files developed during the preparation of the results. The project will be assessed by taking into account students' ability to use the most recent and promising knowledge and technologies being explored and developed in the field of Chemical Engineering.
- It will be necessary to obtain a minimum mark of 5 out of 10 in the project in order to pass the course. This criterion will be maintained in the extraordinary examination session.

The competences assessed in this activity will be the following: CGII-MII1, CE15-P1, CE15-P2, CE15-P3, CE15-P4, CE16-P1, CE17-P1, CE18-P1, CE18-P2, CE18-P3, CE18-P4, CE18-P5, CE18-P6, CT2-II1, CT3-II1, CT4-II1, CT5-II1, CT5-II2, CT6-II1, CT7-II1, CT9-II1, CT10-II1.

❖ ATTENDANCE AND PARTICIPATION IN CLASSES:

Attendance at all in-person activities is compulsory. In order to be eligible for the overall course assessment, students must have participated in at least 70% of the in-class classroom activities (lectures and seminars).

The final mark will result from the weighted average of the assessed activities. However, in order to pass the course, students must achieve the minimum mark established for each of them. If this requirement is not met, the final grade will be the weighted average obtained, capped at 4.5 out of 10.

The marks awarded for the activities included in the course assessment (tutorials, seminars, project, etc.) will be communicated to students in advance of the final examination so that they can adequately plan their study of this or other courses. In all cases, the minimum period of ten days between the publication of the marks and the date of the final course examination will be respected.

ACTIVITY SCHEDULE

UNIT	ACTIVITY	HOURS	GROUPS	START	END
1. Engineering projects	Lectures	2	1	1st Week	1st Week
2. Previous studies	Lectures	4	1	1st Week	2nd Week
3. Project documentation	Lectures	1	1	2nd Week	2nd Week
4. Standards, regulations and legislation	Lectures	1	1	2nd Week	2nd Week
5. Project management	Lectures	2	1	2nd Week	3rd Week
	Seminars	4	1		
6. Synthesis and evaluation of processes	Lectures	6	1	4th Week	5th Week
	Seminars	2	1		
7. Energy integration	Lectures	2	1	5th Week	6th Week
	Seminars	2	1		
8. Equipment design	Lectures	2	1	6th Week	7th Week
	Seminars	5	1		
9. Safety in the chemical industry	Lectures	1	1	7th Week	8th Week
10. Risk analysis and assessment	Lectures	2	1	8th Week	8th Week
11. Inherent safety in design	Lectures	2	1	8th Week	8th Week
12. Environmental impact of chemical processes	Lectures	2	1	9th Week	10th Week
	Seminars	4	1		
13. Project investments	Lectures	2	1	10th Week	10th Week
	Seminars	1	1		
14. Production costs	Lectures	2	1	10th Week	11th Week
	Seminars	1	1		
15. Economic evaluation of projects	Lectures	4	1	12th Week	12th Week
	Seminars	5	1		
16. Preparation and presentation of technical reports	Lectures	1	1	13th Week	13th Week
Presentation and defence of the project	Seminars	12	1	13th Week	15th Week
	Tutorial*	4	4	Weeks 2, 5, 9 and 13	

SUMMARY OF ACTIVITIES

TEACHING ACTIVITY	ASSOCIATED COMPETENCES	TEACHING ACTIVITY	STUDENT ACTIVITY	EVALUATION	P	NP	TOTAL	C
Lectures	CGII-MII1, CE15, CE16-P1, CE17-P1, CE18	Presentation of theoretical concepts.	Attention and active participation.	Written examination.	36	54	90	
Seminars/Guided coursework	CGII-MII1, CE15, CE16-P1, CE17-P1, CE18, CT2-III1, CT3-III1, CT4-III1, CT5-III1, CT5-III2, CT6-III1, CT7-III1, CT9-III1, CT10-III1	Further development of concepts and practical-case-study work. Coursework preparation.	Case discussion. Team project defence.	Assessment of solutions and of the project presentation and defence.	36	54	90	**60%**
Tutorials	CGII-MII1, CE15, CE16-P1, CE17-P1, CE18, CT2-III1, CT3-III1, CT4-III1, CT5-III1, CT5-III2, CT6-III1, CT7-III1, CT9-III1, CT10-III1	Guidance through explanations and bibliography.	Consultation on conceptual and methodological difficulties.	Written examination and guided work.	4	11	15	
Exams	CG2-MII1, CE15, CE16-P1, CE17-P1, CE18-P1, CE18-P3, CE18-P5, CT2-III1, CT10-III1	Exam preparation and marking.	Exam preparation and completion.	Examination marking.	3	27	30	**40%**

P: In-class activities

NP: Non-classroom activities (self-study)

C: Assessment weighting