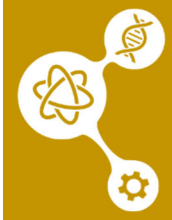
Academic Year 2026/2027

Course Guide:

APPLIED GRAPHIC EXPRESSION



FACULTY OF CHEMICAL SCIENCES

1. IDENTIFICATION

Degree Program	Bachelor's Degree in Chemical Engineering			Code	801541
Course	Applied Graphic Expression			ECTS	6
Subject Area	Graphic Expression				
Module	Basic				
Course Type	Compulsory	Year	Second	Semester	Second
Responsible Department	Chemical and Materials Engineering				

Teaching Staff

Activity	Lecturer	Email	Office
Course Coordinator	JESÚS LUENGO MAROTO	jesuluen@ucm.es	QB-547

Group A

Activity	Lecturer	Email	Office
Lectures Seminars Tutorials	JESÚS LUENGO MAROTO	jesuluen@ucm.es	QB-547

Group B

Activity	Teacher	Email	Dispatch
Lectures Seminars Tutorials	JESÚS LUENGO MAROTO	jesuluen@ucm.es	QB-547

2. OBJECTIVES

General Objective

Apply the concepts of Technical Drawing to the design of equipment and installations, identifying and knowing the international standards of the language of diagrams and industrial plans. In this way, the chemical engineer, in his professional performance, will be able to coordinate with other specialist engineers.

As this is the first subject that the student takes directly related to Industrial Drawing and Computer Aided Design, the first objective is to introduce the student to the different standards and their field of application. It is intended that the student handles those fundamental tools for the Chemical Engineer, such as internationally recognized graphic expression standards, identification of the different planes involved in chemical facilities, engineering and industrial plants.

Knowledge of computer-aided design (CAD), as a working tool in design and in its different phases.

Specific objectives

- Strengthen knowledge of Technical Drawing Standards and their application.
- Introduce the basic concepts of international standards into technical expression.
- Block, flow, and piping diagrams.
- Specific representations and implementation plans.
- Describe some of its applications to Computer Science.
- Transfer the knowledge of graphic expression to computer tools.
- Introduce some related packages of Computer Aided Design.
- Knowledge of design software (CAD).
- Recognize frequently used technical vocabulary and acronyms and their Spanish English equivalent.

3. PRIOR KNOWLEDGE AND RECOMMENDATIONS

Prior knowledge

Following this course satisfactorily requires the student to have previously acquired the knowledge and skills corresponding to the subjects that constitute the fundamental knowledge of Technical Drawing.

Recommendations

It is recommended that the student has a basic level of English that allows him or her to handle bibliography in English and it is recommended that the student is familiar with the basic aspects of handling computer tools and programs.

4. CONTENTS

Brief description

Technical drawing standards. Formats, lines and scales. Most common perspectives and their application. Orthogonal representation. Cavalry and axonometric perspectives. Sections, cuts and breaks. Sets and exploded views in industrial drawing.

Types of diagrams in a construction project. Block diagrams. Flow charts. Regulations in the symbology of process equipment. Distribution of the equipment in a flowchart. Diagrams of pipes and instruments and their symbology (P&ID's). Comparison between types of process diagrams. Basic aspects of instrumentation, control and safety in industrial facilities: control loops, equipment insulation, double blocking and drain valve systems, safety systems and overpressure relief (PSVs safety valves, rupture discs, alarms, etc.). Pipe networks, pipe racks and pipe isometrics. Data sheets. Other types of diagrams.

Knowledge of CAD Software: absolute, relative, spherical and cylindrical coordinates. Drawing classes. The most common systems of representation and handling of tools. Draw commands and modify commands. Magnification factors relative to the original size and current display. Texts of the drawing. Special characters. Text editing. Display control of text entities. Copying text from other software. Concept of layers. Layer removal and renaming. Consideration of layers. Comment. Surface states and joining elements by delimiting a drawing. Editing commands linked to dimension entities. Blocks. Insert as if it were a block. Modifying a block.

Course syllabus

Topic 0: Technical drawing. Rules. Perspectives.

Topic 1: Types of diagrams in a construction project

Topic 2: Block Diagrams

- 2.1 Basic concepts
- 2.2 Usefulness of the block diagram
- 2.3 Matter Balances in a Block Diagram
- 2.4 Energy Balance in a Block Diagram
- 2.5 What does a block include in a diagram?

Topic 3: Flowcharts

- 3.1 Elements of a Flowchart
- 3.2 Matter and energy balances
- 3.3 Team Numbering System
- 3.4 Elements of a process diagram.

Topic 4: Regulations in the symbology of process equipment

- 4.1 Possibility of using various standards. Flexibility
- 4.2 Flexibility of symbology
- 4.3 Distribution of equipment in a flowchart

Topic 5: Piping and Instrument Diagrams'P&ID) s)

- 5.1 Piping elements.
- 5.2 Pipes and valves (piping).
- 5.3 Instrumentation and control elements
- 5.4 Basic Standards of Instrumentation
- 5.5 Content to be incorporated into P&IDs

Topic 6: Comparison between process diagram types

Topic 7: Pipe Networks, Pipe Racks and Pipe Isometrics

- 7.1 Pipe networks
- 7.2 Pipe rack
- 7.3 Piping Design Procedures

Topic 8: Data Sheets

- 8.1 Function and Utility
- 8.2 Common data in any datasheet
- 8.3 Vessel Data Sheets
- 8.4 Tray Data Sheets
- 8.5 Dynamic Equipment Datasheets
- 8.6 Exchanger Data Sheets

Topic 9: Other Types of Diagrams

Topic 10: Computer-Aided Drawing (CAD)

5. COMPETENCES

General

CG1	Use concepts from basic and technological subjects that enable autonomous learning of new methods and theories and the ability to address new situations.

Specific

CE5-EG1	Interpret engineering graphical representations through knowledge and use of the applicable standards and conventions.
CE5-EG2	Use the symbology employed in drawings of industrial installations
CE5-EG3	Develop block diagrams and flow diagrams.
CE5-EG4	Use computer-aided design systems

Cross-cutting

CT6	Use computer tools and software.

6. WORKING HOURS AND DISTRIBUTION BY ACTIVITY

Activity	In-class (hours)	Self-study (hours)	Credits
Lectures / Seminars	45	82,5	5,1
Tutorials / guided work	1/2	3/6,5	0,5
Preparation of assignments and exams	4	6	0,4
Total	**52**	**98**	**6**

7. METHODOLOGY

In the **theoretical classes (in-class)** the student will be made aware of the content of the subject. At the beginning of each topic, the content and main objectives of that topic will be clearly stated. At the end of the topic, a brief summary of the most relevant content will be made, and new objectives will be set that will allow the interrelation of content already studied. During the presentation of contents, problems will be proposed that exemplify the concepts developed or that serve as an introduction to new content. To facilitate the student's monitoring of face-to-face classes, they will be provided with the teaching material used by the teacher on the Virtual Campus. The presentation of each of the topics will be made using the whiteboard and PowerPoint image presentations. Within this block there are sessions for the student to become familiar with specific software: Autocad (Technical Drawing) and Draw.io (Flowcharts, Block Diagrams and PIDs Diagrams).

In the **seminars (in-class sessions of drawing and diagram exercises)** practical cases will be proposed to be solved during the classes through the work of the students in small groups

and their subsequent sharing. Occasionally, some exercises may be collected by the teacher for evaluation.

In the **guided activities**, students must carry out and present exercises proposed by the teacher, which will be evaluated as autonomous or non-face-to-face work activities. The general objective of these works will be to familiarize the student with the use of design codes and conventions commonly used in Engineering.

Tutorials will be scheduled individually or with small groups. They will resolve the doubts raised by the students.

The Virtual Campus and/or photocopied material **will be used** to allow fluid communication between teachers and students and as an instrument to make the material that will be used in the classes available to students.

8. BIBLIOGRAPHY

Basic

At the beginning of the course, the recommended bibliography will be discussed, indicating the most relevant aspects of each text and the degree of suitability for the subject. A specific textbook will not be followed for the development of the subject. Recommended texts of a general nature are listed below.

- Palacios Cuenca, S.; Pérez Díaz, J. L.: *Expresión Gráfica en la Ingeniería*", Pearson Educación, 2005.
- Félez, J.; Martínez, M. L.: *Industrial Drawing*", Synthesis, 2004.
- Howard; Rase, F.: *Design of Pipes and Process Plants*", H. Blume Editions, 1973.
- Hidalgo de Caviedes, A.; Saldaña Albillos, M.: *Unidades Didácticas de la Asignatura de Técnicas de Representación y Dibujo*", UNED, 2007.

For the subject, Subject Notes have been developed, which will be available to the student on the Virtual Campus.

Part of the recommended bibliography and the support material that is deposited on the virtual campus for the development of the teaching activities of this subject will be in English.

Complementary

- Rase, F.; Barrow, M. H.: *Ingeniería de proyectos de plantas de proceso*", Mexico C.E.C.S.A., 1983.
- Vilbrandt, F. C.; Dryden, C. E.: *Ingeniería Química del Diseño de Plantas Industriales*", Mexico, Grijalbo, 1983.
- Saldaña Albillos, M.: *Techniques of Representation and Drawing. Addenda: 60 typical resolved exercises*", UNED, 2007.
- Technical Drawing Theory: www.dibujotecnico.com
- CAD Software: https://www.autodesk.es/
- Computer Technical Drawing: https://www.drawio.com/
- Computer Block and Flow Diagrams: https://www.drawio.com/
- Computer flow charts and PIDs: https://www.lucidchart.com/pages/es

9. ASSESSMENT

The student's academic performance, as well as the final grade for the course, will be calculated as a weighted average according to the percentages shown below. However, to pass the course, students must obtain the minimum grade established for each activity. If this requirement is not met, the final grade will be the weighted average, capped at 4.5 out of 10. This criterion shall apply to both the ordinary and extraordinary assessment periods.

All grades will be based on the absolute score out of 10 points, and in accordance with the scale established in RD 1125/2003. This criterion will be maintained in all calls, including the extraordinary call.

❖ WRITTEN EXAMS: 70%

A final exam will be held for the entire subject, both in the ordinary and extraordinary calls. In this exam, theoretical and practical questions related to the subject will be proposed.

In the ordinary and extraordinary call, the grades of the deliveries of the directed activities will be kept, so that the exam will have a weight of 70%.

With this exam, the general competence CG1 and the specific competences CE5-EG1, CE5-EG2, CE5-EG3 will be assessed.

Minimum Grade: 3

❖ GUIDED ACTIVITIES (WORK): 30%

Students must carry out and present the exercises proposed by the teacher, for evaluation as autonomous or non-face-to-face work, both in the ordinary and in the extraordinary call.

Among the exercises to be solved, there are exercises in which the student must handle Draw.IO. In these exercises, in addition to the corresponding report, the calculation programs/files developed by the student in the preparation of results will be delivered.

There will be a total of 2 directed activities of individual work that students must submit on a mandatory basis. Each activity will have the same weight, so that each one represents 15% of the overall grade of the subject.

The evaluation of these aspects will allow us to know the degree of achievement of the CG1 general competence and the CE5-EG2, CE5-EG4 and CT6 specific competences.

Minimum Grade: 3

ACTIVITY PLANNING - SCHEDULE

UNIT	ACTIVITY	HOURS	GROUPS	START	END
0. Technical drawing. Rules. Perspectives.	Lecture	5	1	1st Week	2nd Week
P0. Practical Technical Drawing Exercises	Tutoring*	6	1	2nd Week	4th Week
1. Types of diagrams for a construction project	Lecture	1	1	4th Week	4th Week
2. Block diagrams	Lecture	2	1	5th Week	5th Week
3. Flowcharts	Lecture	3	1	5th Week	6th Week
4. Regulations on the symbology of process equipment	Lecture	1	1	Week 6	Week 6
Q1. Block Diagrams and Flowcharts Practice	Tutoring*	6	1	Week 7	Week 8
5. Piping and Instrument Diagrams (P&ID's)	Lecture	6	1	Week 9	Week 10
6. Comparison between types of process diagrams	Lecture	1	1	Week 11	Week 11
Q2. Pipe and Instrument Practice (PIDs)	Tutoring*	5	1	Week 11	Week 12
7. Pipe networks, pipe rack and pipe isometrics	Lecture	1	1	13th Week	13th Week
8. Datasheets	Lecture	1	1	13th Week	13th Week
9. Other Types of Diagrams	Lecture	1	1	13th Week	13th Week
10. Computer-Aided Drawing (CAD)	Lecture	3	1	14th Week	14th Week
Q3. Computer-Aided Drawing (CAD) Practice	Tutoring*	3	1	15th Week	15th Week
Exams	Written exam	4	1	Determined by the Faculty	

* Scheduled tutoring is subject to possible modifications according to the joint planning of the course.

SUMMARY OF ACTIVITIES

ACTIVITY	ASSOCIATED COMPETENCIES	TEACHING ACTIVITY	STUDENT ACTIVITY	ASSESSMENT	P	NP	TOTAL	C
Lectures	CG1 CE5-EG1, CE5-EG2, CE5-EG3, CE5-EG4	Presentation of theoretical concepts.	Note-taking. Formulation of questions and doubts.	Grading of the written answers to questions related to the theoretical concepts explained.	45	82,5	127,5	
Tutorials	CE5-EG1, CE5-EG2, CE5-EG3, CE5-EG4	Help the student to direct their study with bibliographic explanations and recommendations.	Ask the teacher about the conceptual and methodological difficulties encountered when studying the subject.	Grading of the written answers to proposed practical cases related to the theoretical concepts explained.	1	3	4	**30%**
Guided activities	CE5-EG1, CE5-EG2, CE5-EG3, CE5-EG4, CT6	Proposal and follow-up of works	Written preparation of individual works.	Evaluation of the work.	2	6,5	8,5	
Exams	CG1, CE5-EG1, CE5-EG2, CE5-EG3, CE5-EG4, CT6	Proposal, monitoring and correction of the exam. Student's grade.	Preparation and realization.	Correction and assessment of exams.	4	6	10	**70%**

P: In-class activities

NP: Self-work

C: Qualification