



## Teaching Guide

| Teaching Guide      |                                                                                                                                                                                                                                                       |        |                    |           |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------------------|-----------|
| Identifying Data    |                                                                                                                                                                                                                                                       |        |                    | 2019/20   |
| Subject (*)         | Chemical Technology                                                                                                                                                                                                                                   |        | Code               | 610G01041 |
| Study programme     | Grao en Química                                                                                                                                                                                                                                       |        |                    |           |
| Descriptors         |                                                                                                                                                                                                                                                       |        |                    |           |
| Cycle               | Period                                                                                                                                                                                                                                                | Year   | Type               | Credits   |
| Graduate            | 2nd four-month period                                                                                                                                                                                                                                 | Fourth | Optional           | 4.5       |
| Language            | Galician                                                                                                                                                                                                                                              |        |                    |           |
| Teaching method     | Face-to-face                                                                                                                                                                                                                                          |        |                    |           |
| Prerequisites       |                                                                                                                                                                                                                                                       |        |                    |           |
| Department          | Química                                                                                                                                                                                                                                               |        |                    |           |
| Coordinador         | Ruiz Bolaños, Isabel                                                                                                                                                                                                                                  | E-mail | isabel.ruiz@udc.es |           |
| Lecturers           | Ruiz Bolaños, Isabel                                                                                                                                                                                                                                  | E-mail | isabel.ruiz@udc.es |           |
| Web                 |                                                                                                                                                                                                                                                       |        |                    |           |
| General description | The main objective of the course is to provide the students with basic knowledge of environmental engineering. It introduces the most important processes used in water treatment and recovery, waste gas treatment and waste treatment and disposal. |        |                    |           |

## Study programme competences

| Code | Study programme competences                                                                                                        |
|------|------------------------------------------------------------------------------------------------------------------------------------|
| A7   | Knowledge and application of analytical methods                                                                                    |
| A10  | Knowledge of chemical kinetics, catalysis and reaction mechanisms                                                                  |
| A11  | Knowledge and design of unit operations in chemical engineering                                                                    |
| A13  | Understanding of chemistry of main biological processes                                                                            |
| A14  | Ability to demonstrate knowledge and understanding of concepts, principles and theories in chemistry                               |
| A15  | Ability to recognise and analyse new problems and develop solution strategies                                                      |
| A16  | Ability to source, assess and apply technical bibliographical information and data relating to chemistry                           |
| A19  | Ability to follow standard procedures and handle scientific equipment                                                              |
| A20  | Ability to interpret data resulting from laboratory observation and measurement                                                    |
| A21  | Understanding of qualitative and quantitative aspects of chemical problems                                                         |
| A22  | Ability to plan, design and develop projects and experiments                                                                       |
| A24  | Ability to explain chemical processes and phenomena clearly and simply                                                             |
| A25  | Ability to recognise and analyse link between chemistry and other disciplines, and presence of chemical processes in everyday life |
| A28  | Acquisition, assessment and application of basic principles of industrial activity, organisation and task management               |
| B1   | Learning to learn                                                                                                                  |
| B2   | Effective problem solving                                                                                                          |
| B3   | Application of logical, critical, creative thinking                                                                                |
| B4   | Working independently on own initiative                                                                                            |
| B5   | Teamwork and collaboration                                                                                                         |
| B6   | Ethical, responsible, civic-minded professionalism                                                                                 |
| B7   | Effective workplace communication                                                                                                  |
| C2   | Oral and written proficiency in a foreign language                                                                                 |
| C5   | Understanding importance of entrepreneurship, and knowledge of resources available for people with business ideas                  |
| C6   | Ability to assess critically the knowledge, technology and information available for problem solving                               |
| C8   | Understanding role of research, innovation and technology in socio-economic and cultural development                               |

## Learning outcomes

| Learning outcomes | Study programme competences |
|-------------------|-----------------------------|
|-------------------|-----------------------------|



|                                                                                                                                                          |                                                            |                                        |                      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|----------------------------------------|----------------------|
| To apply the knowledge of Chemistry to the identification of the main environmental problems that concern wastewater, gaseous effluents and solid waste. | A10<br>A13<br>A14<br>A16<br>A24<br>A25<br>A28              | B1<br>B3<br>B7                         |                      |
| To know the available technologies to address water and atmosphere pollution and the management of solid waste.                                          | A7<br>A11<br>A13<br>A14<br>A15<br>A16<br>A24<br>A25<br>A28 | B1<br>B2<br>B3<br>B4<br>B5<br>B6<br>B7 | C2<br>C5<br>C6<br>C8 |
| To perform simple techniques for characterizing contaminated effluents.                                                                                  | A7<br>A19<br>A20<br>A21<br>A22                             |                                        |                      |

| Contents                                              |                                                                                                               |
|-------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| Topic                                                 | Sub-topic                                                                                                     |
| Chapter 1. Introduction to environmental engineering. | Overview of the environmental problems and their management.                                                  |
| Chapter 2. Wastewater treatment.                      | Introduction. Physical treatment processes. Biological treatment processes and technologies.                  |
| Chapter 3. Treatment of gaseous effluents.            | Introduction. Systems for pollution abatement. Treatment technologies to treat contaminated gases and vapors. |
| Chapter 4. Waste valorisation and treatment.          | Introduction. Types of Waste. Waste valorization and management. Waste treatment technologies.                |

| Planning                                                                                                                        |                                                  |                      |                               |             |
|---------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|----------------------|-------------------------------|-------------|
| Methodologies / tests                                                                                                           | Competencies                                     | Ordinary class hours | Student's personal work hours | Total hours |
| Introductory activities                                                                                                         |                                                  | 1                    | 0                             | 1           |
| Guest lecture / keynote speech                                                                                                  | A10 A11 A13 A14<br>A24 A25 A28 C2 C8             | 12                   | 30                            | 42          |
| Problem solving                                                                                                                 | A13 A14 A15 A16<br>A20 A21 A25 B1 B3<br>B4 B5 C2 | 12                   | 36                            | 48          |
| Laboratory practice                                                                                                             | A7 A19 A20 A21 A22<br>B3 B4 B5 B6 B7 C5          | 8                    | 8                             | 16          |
| Mixed objective/subjective test                                                                                                 | A13 A14 A16 A24 B2<br>B3 B7 C6                   | 2                    | 4                             | 6           |
| Personalized attention                                                                                                          |                                                  | 0                    | 0                             | 0           |
| (*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students. |                                                  |                      |                               |             |

| Methodologies |             |
|---------------|-------------|
| Methodologies | Description |



|                                 |                                                                                                                                                                    |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Introductory activities         | Presentation of the subject and the methodologies and evaluation criteria that will be used in the course.                                                         |
| Guest lecture / keynote speech  | Classes with the theoretical content of the subject.                                                                                                               |
| Problem solving                 | These sessions will address the resolution of practical exercises related to the design of some of the equipment used in pollutant treatment.                      |
| Laboratory practice             | Laboratory experiments to apply the acquired theoretical knowledge to practice. Acquisition of the basic skills and procedures related to the subject under study. |
| Mixed objective/subjective test | A final written exam to assess the knowledge acquired by the student will be held at the end of the course.                                                        |

## Personalized attention

| Methodologies | Description                                                                                                                                                                                                                                                                                                                                                                                                          |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|               | <p>The teacher will help the student with the doubts that may arise in performing the activities entrusted to it. It will take place in the timetable available to the teacher.</p> <p>In the case of justified exceptional circumstances, additional measures may be taken so that the student can pass the subject, such as flexibility in the delivery date of supervised projects and in practice schedules.</p> |

## Assessment

| Methodologies                   | Competencies                                     | Description                                                                                                                                                                                        | Qualification |
|---------------------------------|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| Problem solving                 | A13 A14 A15 A16<br>A20 A21 A25 B1 B3<br>B4 B5 C2 | Students will be asked to do and hand some of the proposed exercises to its evaluation.                                                                                                            | 20            |
| Laboratory practice             | A7 A19 A20 A21 A22<br>B3 B4 B5 B6 B7 C5          | Attendance to all of the laboratory activities is mandatory. In the evaluation of the lab work it will take account the attitude in the lab and the quality of the results and conclusions report. | 20            |
| Mixed objective/subjective test | A13 A14 A16 A24 B2<br>B3 B7 C6                   | Students must to do a final written test that will assess the acquired knowledge.                                                                                                                  | 60            |

## Assessment comments



To pass the subject, it is required at least a score of 4 (out of 10) in each of the assessment activities, and a global average score equal to or greater than 5 (out of 10). Even if the global grade is equal or greater than 5, if a student does not get the minimum score in any of the activities, the final mark will be 4,5 (fail).

In the second opportunity (July) only it's possible to improve the score in the test.

Only the students who did not do any of the assessment activities will be considered as "not presented".

Honor marks will be given priority in the first opportunity (June), in the second opportunity (July) they may only be granted if have not been exhausted in June.

The teaching-learning process, including assessment, refers to an academic course and, therefore, will restart as new with every academic year, including all activities and assessment procedures scheduled for that course.

In the case of justified circumstances, additional measures may be taken so that the student can pass the subject, such as flexibility in the delivery date of exercises and in practice schedules.

## Sources of information

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Basic         | <ul style="list-style-type: none"><li>- Davis e Masten (2005). Ingeniería y ciencias ambientales. McGraw-Hill</li><li>- Metcalf and Eddy (1995). Ingeniería de Aguas Residuales. Tratamiento, vertido y reutilización.. Labor.</li><li>- Henze, M. et al. (2008). Biological Wastewater Treatment. IWA Publishing</li><li>- Kennes, C. and Veiga, M.C. (2001). Bioreactors for waste gas treatment. Kluwer Academic Publishers</li><li>- Deublein, D. and Steinhauser, A. (2008). Biogas from waste and renewable resources: an introduction. Wiley-VCH</li></ul> |
| Complementary |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

## Recommendations

### Subjects that it is recommended to have taken before

Chemical Engineering/610G01033

### Subjects that are recommended to be taken simultaneously

### Subjects that continue the syllabus

### Other comments

(\*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.