Teaching Guide					
Identifying Data					2020/21
Subject (*)	Chemical Engineering			Code	610G01033
Study programme	Grao en Química				
Descriptors					
Cycle	Period	Year		Type	Credits
Graduate	1st four-month period	Third		Obligatory	6
Language	Spanish				
Teaching method	Hybrid				
Prerequisites					
Department	Química				
Coordinador	Kennes , Christian		E-mail	c.kennes@udc.es	
Lecturers	Kennes , Christian Soto Castiñeira, Manuel Vega Martin, Alberto de Veiga Barbazan, Maria del Carmen		E-mail	c.kennes@udc.es m.soto@udc.es alberto.de.vega@udc.es m.carmen.veiga@udc.es	
Web					
General description	La asignatura describe los conceptos básicos de la Ingeniería Química (operaciones unitarias, balances de materia, energía y cantidad de movimiento, fundamentos de fenómenos de transporte, y reactores químicos)				
Contingency plan	1. Modifications to the contents: No modifications 2. Methodologies *Teaching methodologies that are maintained Guest lecture/keynote lecture Problem solving Objective test Personalized attention 3. Mechanisms for personalized attention to students - email: Daily, from Monday till Friday, in order to request a virtual meeting to solve any doubts. During teaching hours and hours of personalized attention to consult about any topic or solve problems. ? Moodle: Daily, from Monday till Friday. According to the needs of the student. Making use of the ?thematic forum? to ask any specific question or request. ? Teams: Sessions for progressing in the theoretical part of the subject (large groups) and for solving problems/exercises (small groups) during the periods scheduled for this subject, with the corresponding professor. 4. Modifications in the evaluation *Evaluation observations: The same evaluation methodology will be maintained, no modifications are foreseen. Only the objective test will be performed virtually (through Moodle and/or Teams or any other platform with similar characteristics), for both the first opportunity as well as the second one. This situation is the same for any student (full-time, part-time, ?), as described in the "NORMA QUE REGULA O RÉXIME DE DEDICACIÓN AL ESTUDIO DE LOS ESTUDIANTES DE GRADO EN LA UDC (Arts. 2.3; 3.b e 4.5) (29/5/212). 5. Modifications to the bibliography or webgraphy No modifications.				

Study programme competences	
Code	Study programme competences

A11	Knowledge and design of unit operations in chemical engineering
A15	Ability to recognise and analyse new problems and develop solution strategies
A19	Ability to follow standard procedures and handle scientific equipment
A20	Ability to interpret data resulting from laboratory observation and measurement
A25	Ability to recognise and analyse link between chemistry and other disciplines, and presence of chemical processes in everyday life
B2	Effective problem solving
B5	Teamwork and collaboration
C2	Oral and written proficiency in a foreign language
C3	Ability to use basic information and communications technology (ICT) tools for professional purposes and learning throughout life

Learning outcomes			
Learning outcomes	Study programme competences		
Know the fundamentals of unit operations in Chemical Engineering and of their design	A11 A15 A19 A20 A25	B2 B5	C2 C3
Apply mass and energy balances to unit operations and (bio)reactors	A11 A15 A19 A20 A25	B2 B5	C2 C3
Know the fundamentals of applied kinetics and of the design of (bio)reactors	A15 A19 A20	B2 B5	C2 C3
Know the fundamentals of mass transfer and heat transfer	A11 A15 A19 A20 A25	B2 B5	C2 C3

Contents	
Topic	Sub-topic
1. Introduction to Chemical Engineering.	Fundamentals of chemical engineering. Representative examples of processes in the chemical industry. Definitions of common use: (non) continuous operation, (non) steady-state, equilibrium stages, contact between phases, etc.
2. Fundamentals of unit operations.	Classification of unit operations. Mass transfer-, heat transfer-, simultaneous mass and heat transfer-, and momentum transfer- operations. Representative examples of unit operations. Equipment description.
3. Transport phenomena.	Mass transport. Heat transfer. Momentum transfer. Fundamentals of rheology. Viscosity. Analogy between different transfer processes and their governing laws. Examples.
4. Introduction to balance equations.	General problem-solving strategies. Different types of balances. Dimensions, units, and their conversion.
5. Mass balances on non-reactive processes.	General case. Recycle, purge, and by-pass. Steady- and non-steady- state.
6. Mass balances on reactive processes.	Simple and multiple reactions. Recycle, purge, and by-pass. Steady- and non-steady-state..
7. Energy balances.	Forms of energy. Fundamentals of energy balances. Steady- and non-steady- states.

8. Chemical reactors and bioreactors.	Ideal batch reactors and continuous reactors. Constant and variable volume/density reactors. Design equations. Non-ideal flow. Multiple reactors. Rate equations. Determination of kinetic data.

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Laboratory practice	A11 A19 A20 B2 B5 C2 C3	10	15	25
Guest lecture / keynote speech	A11 A15 A25 B2 C3	26	65	91
Problem solving	A11 A15 B2 C3	9	20.25	29.25
Mixed objective/subjective test	A11 A15 A25 B2	3	0	3
Personalized attention		1.75	0	1.75
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	Description
Laboratory practice	Experimental work during which the students will use the laboratry set-up in order to check compliance with theoretical models in practice.
Guest lecture / keynote speech	Background and theoretical aspects of each topic will be explained, several examples and problems will be studied and solved and some basic exercises will be solved in large groups.
Problem solving	Sessions in which the students must solve proposed exercises and problems related to various topics, in small groups.
Mixed objective/subjective test	Written exam consisting of questions about theroy and/or problems.

Personalized attention	
Methodologies	Description
Laboratory practice Problem solving	The students will resolve exercises individually (Small student groups) and will attend the practical work in the laboratory with the help and personalised attention of the professor of practicals. The guidelines to be followed will be explained before each laboraory session. The students with part time dedication will have to justify their absence in case of not being able to attend classes on the planned schedule. Exercices handed out by the teacher will have to be solved and delivered to the professor, on the planned date, by all students.

Assessment			
Methodologies	Competencies	Description	Qualification
Laboratory practice	A11 A19 A20 B2 B5 C2 C3	Puntuásese o traballo realizado no laboratorio e o informe final	15
Guest lecture / keynote speech	A11 A15 A25 B2 C3	Participación en clase e resolución de exercicios.	10
Mixed objective/subjective test	A11 A15 A25 B2	Exame escrito (teoría e/ou problemas)	75

Assessment comments

- The work done in the laboratory will be taken into account as well as the report describing the results, corresponding to the analysis of data, and conclusions. Both aspects will represent 20% of the final mark.
- Active assistance to all activities (full time students) as well as exercises to be solved individually and delivered to the professor: 20% of the final mark. For part-time students, the mark will be based on solved exercises to be delivered to the professor.
- Final examination: 60% of the final score.
- The overall score will be the sum of the above described marks. It will be considered that the student did not present the subject´s exam if he/she did not go for the final examination.
- In order to pass, the student should obtain a mínimum mark of 5/10 in the final exam; otherwise the final grading will be "fail" (4.9). The student will also fail in case the exercises to be solved and delivered to the professor have not been delivered or have not been delivered on time, before the deadline.
- The "matrícula de honor" will be rewarded to the students that achieved the maximum score in the first opportunity of evaluation. In the second opportunity, the same marks will be maintained for the lab-course (20% of the final score) as well as assistence (full time students) and delivery of the exercices (20% of the final score) but it will be required to repeat the final written exam that will represent 80% of the final score. For successive academic courses, a new teaching-learning process will start again, and the student will therefore have to repeat all activities and examinations for that new academic course.
- The completion and delivery of exercises is mandatory ("grupos reducidos").
- Second opportunity: the marks obtained by the students in each of the tests, except the written exam, during the academic year, will be maintained to calculate the score of the next opportunity, applying the same percentages as for the first opportunity. This means that the written exam (Objective test) represents 60% of the final score, both in the first and the second opportunity.o

Sources of information	
Basic	- COSTA LÓPEZ y col. (). Curso de Química Técnica: Introducción a los procesos, las operaciones unitarias y los fenómenos de transporte en la Ingeniería Química. Editorial Reverté, Barcelona - LEVENSPIEL, O., (). Ingeniería de las reacciones químicas. Ed. Reverté, Barcelona - COSTA NOVELLA y col. (). Ingeniería Química. Vol. 1. Conceptos generales. Edición Alhambra, Madrid - THOMPSON, E.V. & CECKLER, W.H., (). Introducción a la Ingeniería Química. McGraw-Hill - FELDER, R.M. & ROUSSEAU, R.W., (). Principios elementales de los procesos químicos. Addison- Wesley Iberoamericana, Wilmington - HIMMELBLAU, D.M., (). Principios y cálculos básicos de Ingeniería Química. C.E.C.S.A. México
Complementary	

Recommendations
Subjects that it is recommended to have taken before
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.