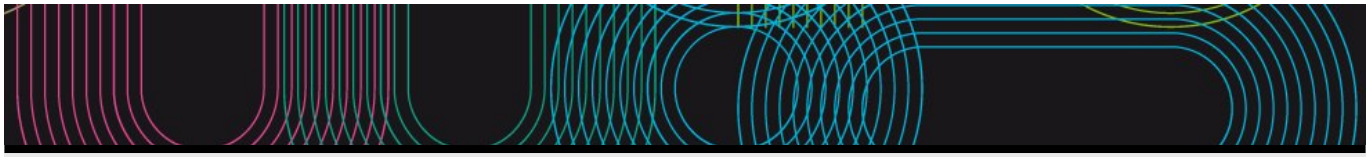

IDENTIFYING DATA				
Introduction to chemical engineering				
Subject	Introduction to chemical engineering			
Code	O01G281V01912			
Study programme	(*)Grao en Enxeñaría Agraria			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	3rd	2nd
Teaching language	Spanish Galician			
Department				
Coordinator	Santos Reyes, Valentín			
Lecturers	Outeiriño Rodríguez, David Santos Reyes, Valentín			
E-mail	vsantos@uvigo.es			
Web				
General description	This subject includes the basic principles governing a process operation, being the basis for further aproach to unit operations and the transport phenomena involved. More specifically, the issues addressed are: - Material and Energy Balances. - Applied chemical kinetics and ideal reactors. - Introduction to process control.			

Competencies	
Code	
A2	Students will be able to apply their knowledge and skills in their professional practice or vocation and they will show they have the required expertise through the construction and discussion of arguments and the resolution of problems within the relevant area of study.
B1	Students will be able to develop analysis, synthesis and information-management skills for application in the agricultural, food and environmental sectors.
B3	Students will develop personal skills to engage in critical, constructive thinking.
C31	Ability to understand and use the principles of food engineering and its essential operations.
C39	Ability to understand and use procedures of automation and process control.
D5	Problem-solving and decision-making skills.

Learning outcomes				
Expected results from this subject	Training and Learning Results			
RA1: To know and apply knowledge of mathematics, physics, chemistry and engineering.	A2	B1	C31	
RA2: To analyze systems employing material and energy balances	A2	B1 B3	C31	D5
RA3: Capacity to know, understand and employ the principles of engineering, basic operations and processes related to food industries	A2		C31 C39	D5
RA4: To know the principles of chemical and biological kinetics, and their application in the design and operation of ideal chemical reactors or basic bioreactors.		B3	C31	D5
RA5: To know the basics of a control system for an industrial process.	A2	B3	C31 C39	D5

Contents	
Topic	
THEME 1) Introduction	1. Definitions concerning Chemical Engineering 2. Chemical Industry and Unit Operations 3. Clasification of Unit Operations

THEME 2) Physical-Mathematical utilities	1. Units and related issues 2. Uncertainty. 3. Methods for equation resolution 4. Linear regression 5. Numerical Integration. 6. Graphical diferentiation 7. Triangular diagram
THEME 3) Conservation laws. General Balance Formulation	1. Conservation laws for mass, energy and momentun 2. Macroscopic and y microscopic systems 3. Property streams: Definition and clasification 4. Property transport: General concepts 5. General Balance equation
THEME 4) Material Balances	1. Introduction to the material balances 2. Monophasic Systems 2.1. Study in stationary state 2.2. Study in non stationary state 3. Biphasic systems under thermodynamic equilibrium and stationary state
THEME 5) Energy Balances	1. Therms present in the macroscopic energy balance 2. Macroscopic Systems 2.1. Systems in stationary state 2.2. Systems in non stationary state 3. Enthalpy Balance 3.1. Non-reactant Systems 3.2. Reactant Systems under stationary state 3.2.1. Entalphies of reaction 3.2.2. Thermodynamic Cycles
THEME 6) Chemical kinetics and ideal reactors	1. Chemical kinetics 2. Reaction rate 3. Reversibility of chemical reactions 4. Reaction rate equation 5. Analysis of chemical kinetic equation: application to constant volume systems 5.1. Integral method 5.2. Differential method 5.3. Initial rate method 6. Study of ideal isothermic reactors 6.1. Batch Reactor 6.2. Continuous Stirred Tank Reactor (CSTR) 6.3. Plug Flow Reactor (PFR)
THEME 7) Introduction to process control	1. Definitions and basic concepts 2. Process control strategies: Feedback, feedforward and cascade control 3. Instrumentation 4. Analysis and design of control systems

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	28	5.6	33.6
Problem solving	28	5.9	33.9
Autonomous problem solving	0	60	60
Laboratory practical	14	8.5	22.5

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Lecturing	Exposition at classroom of the basic principles of the subject.
Problem solving	Realization in the classroom of proposed exercises and/or questionnaires related to the studied theme. The professor will solve a large part of those exercises, and will propose to the students, individually or in group, the resolution of the remaining related exercises
Autonomous problem solving	Exercises proposals related to the different thematic sections of the subject will be periodically delivered to the students for autonomous resolution, outside the classroom. Resolutions of these exercises would be upload to the e-learning platform of the University of Vigo. Students will then have access to the corrected version. The exercises will be evaluated and considered in the final qualification
Laboratory practical	Experiments and laboratory practices related will be carried out at the laboratory. Data analysis and discussion, as explanation of applied methologies, will be considered for evaluation.

Personalized assistance

Methodologies	Description
Problem solving	Clarification of doubts that may arise in solving the proposed problems. Incentivation to student participation to discuss possible alternatives for problem resolution.
Laboratory practical	Monitoring the realization of laboratory practices, guiding in the proper handling of equipment, focusing on measurement uncertainties, or solving questions that may arise. Clarify doubts during data processing (classroom) and during preparation of additional material (outside the classroom).
Autonomous problem solving	Clarification of doubts that may arise in the resolution of the proposed works/exercises. Feedback once corrected, so students can check the correct solving and their mistakes. Communication/interaction with students will be done preferably through the e-learning platform of the University of Vigo and in the tutorials of the professors.

Assessment

	Description	Qualification		Training and Learning Results		
Lecturing	An exam considering the whole matter, with questions about theoretical concepts. RA1, RA2, RA3, RA4 e RA5	20		B1	C31 C39	D5
Problem solving	An exam of the whole subject, proposing the numerical resolution of practical cases. It will be carried out jointly with the "Lecturing" exam RA1, RA2, RA3, RA4 e RA5	30	A2	B1 B3	C31	D5
Autonomous problem solving	Avaliation of the resolution of the proposed exercises send by students to the e-learning platform of the University of Vigo. RA1, RA2, RA3, RA4 and RA5	28	A2	B1 B3	C31 C39	D5
Laboratory practical	Attendance, attitude and aptitude at the laboratory will be considered in evaluation. Additionally, the evaluation includes practice report, spreadsheets with data analysis, and a short exam. RA1, RA2, RA3, RA4 e RA5	22	A2	B1 B3	C31	

Other comments on the Evaluation

1. It is necessary to pass the principal exam of the whole subject, including both related to "Lecturing" and to "Problem solving" methodologies (obtaining a minimum of 5 points on a 10 base). In other case the global qualification of the subject will be the one corresponding to the exam.
2. It is mandatory the assistance to the laboratory practices and the delivery of complementary material (reports, spreadsheets with data analysis). The evaluation of this issue will include aptitude and laboratory skills, quality of the complementary material, and an exam. It is necesary to obtain a minimum qualification of 4 (Base 10) in each of the three items. In case of documented justified absence at laboratory the student will have the option of an exam including both theoretical and laboratory skills aspects. In any of the cases, it is necessary to obtain a minimum qualification of 5 in "Laboratory Practices" (Base 10) to surpass the subject.
3. In the case of students not assisting to the methodologie "Autonomous problem solving", they will have the alternative possibility to realize an additional exam, in the same date as the principal exam, including questions/problems treated in the deliveries carried out during the academic course.
4. In July students can opt for examining of the exam parts or of the methodologies not surpassed in June, or of those that wish to improve their previous June qualification. The assigned qualification will be the best of that obtained in June or July for every exam part or methodology.
5. Those students having done less than 30% of the methodology "Autonomous problem solving" and not making the principal exam, the obtained qualification will be "not presented". In other case the qualification will be thatcalculated following the above exposed procedure.
6. Communication with students will be made through the e-learning platform of the University of Vigo.
7. Students can opt to be examined in the "End of Career" call. In this case the qualification will correspond to that obtained in an exam, including questions/problems considered in lecturing, classroom work, problems and/or exercises proposed for realization outside the classroom and further delivery, and laboratory practises.
8. Official dates for the realization of the examinations: June 01, 2020, at 16.00 and July 02, 2020, at 16.00. The date for the realization of the "End of Career" examination is October 09, 2019, at 16.00. Considering possible mistakes and/or modifications, please check it at the Faculty board and/or Faculty website.

Sources of information
Basic Bibliography
Felder, R.M. e Rousseau, R.W., **Principios elementales de los procesos químicos**, Limusa Wiley, 2003
Himmelblau, D.M., **Principios básicos y cálculos en ingeniería química**, Prentice-Hall Hispanoamericana, 1997
Complementary Bibliography
Levenspiel, O., **Ingeniería de la reacciones químicas**, Reverté, 2001
Calleja Pardo, G. y col., **Introducción a la ingeniería química**, Síntesis, 1999
Toledo, Romeo T., **Fundamentals of food process engineering**, Springer, 2007
Ollero de Castro, P y Fernández Camacho, E., **Control e Instrumentación de Procesos Químicos**, Síntesis, 1997

Recommendations