Teaching Guide				
Identifying Data				2018/19
Subject (*)	Advanced Organic Chemistry		Code	610G01030
Study programme	Grao en Química			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	1st four-month period	Fourth	Obligatory	6
Language	SpanishEnglish			
Teaching method	Face-to-face			
Prerequisites				
Department	Química			
Coordinador	Jimenez Gonzalez, Carlos	E-mail	carlos.jimenez@udc.es	
Lecturers	Jimenez Gonzalez, Carlos Quintela Lopez, Jose Maria	E-mail	carlos.jimenez@udc.es jose.maria.quintela@udc.es	
Web				
General description	This main goal of this subject is to provide students a deeper understanding of the synthetic strategies in the modern organic chemistry today, with special focus on aspects related to the stereochemical evolution of organic reactions. Therefore, new concepts in the study of stereochemistry of organic compounds and their reactions will be discussed, the fundamental aspects of the analysis Retrosynthetic and general strategies of organic synthesis. Particularly will be the main types of organic reactions in the carbon-carbon and carbon-heteroatom bond formation. Some advanced techniques in the laboratory of Organic Chemistry will be also studied			

Study programme competences	
Code	Study programme competences
A1	Ability to use chemistry terminology, nomenclature, conventions and units
A4	Knowledge of main types of chemical reaction and characteristics of each
A6	Knowledge of chemical elements and their compounds, synthesis, structure, properties and reactivity
A9	Knowledge of structural characteristics of chemical and stereochemical compounds, and basic methods of structural analysis and research
A10	Knowledge of chemical kinetics, catalysis and reaction mechanisms
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
A17	Ability to work safely in a chemistry laboratory (handling of materials, disposal of waste)
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
A26	Ability to follow standard laboratory procedures in relation to analysis and synthesis of organic and inorganic systems
B2	Effective problem solving
B3	Application of logical, critical, creative thinking
B4	Working independently on own initiative
C1	Ability to express oneself accurately in the official languages of Galicia (oral and in written)

Learning outcomes			
Learning outcomes	Study programme competences		
Further knowledge of the most important principles of stereochemistry and conformational analysis of organic compounds	A1 A9	B2	C1
Be able to predict and explain the stereochemistry evolution of chemical reactions	A1 A9		

Possess knowledge of the main features, the main explanatory theories and mechanisms of the main reactions of C-C bond and C-heteroatom bond formation	A1 A4 A10 A14 A15 A21	B2	C1
Possess knowledge of the interconversion methods of the main functional groups	A1 A4 A6 A14	B2 B3	
Possess knowledge of the main objectives in organic synthesis, the main strategies of synthesis and the retrosynthetic analysis	A1 A4 A14	B2	
Possess knowledge of some advanced techniques in the research laboratory of Organic Chemistry	A17 A19 A20 A26	B2 B3 B4	

Contents	
Topic	**Sub-topic**
Chapter 1. Stereochemistry and conformational analysis	Static and dynamic stereochemistry. Stereoselective and stereospecific chemical reactions (chemo-, regio- and stereoselective/specific reactions). Conformational analysis: conformational effects on reactivity.
Chapter 2. Pericyclic reactions	Introduction: characteristics of pericyclic reactions and theoretical approaches. Electrocyclic, Cycloaddition reactions and sigmatropic rearrangements.
Chapter 3. Free-Radical reactions	Generation and stability of free radicals. Main free-radical reactions.
Chapter 4. Generation of carbon-carbon bond by enols and enolates.	Alkylation, acylation and conjugate addition of enols and enolates
Chapter 5. Generation of carbon-carbon bond by organometallic compounds	Organometallic reagents to make carbon-carbon bonds. Reactions involving transition metal complexes.
Chapter 6. Generation of carbon- heteroatom bonds	Generation of carbon and oxygen, nitrogen, halide and sulfur bonds. Applications of organoboron chemistry to the generation of carbon-heteroatom bonds.
Chapter 7. Functional group interconversion reactions.	Main Functional group interconversion reactions Functional group interconversions through reduction and oxidation reactions.
Chapter 8. Protective groups in organic synthesis	The role of protective groups in organic synthesis. The concept of orthogonal sets. Hydroxyl, diols, aldehyde and ketone carbonyl, carboxylic acid and amine protecting groups.
Chapter 9. Retrosyntetic analysis.	Synthetic analysis and planning. Retrosyntetic analysis methodology. Types of transformations: disconnections, connections, functional group interconversion, addition and removing functional groups. Economic issues in retrosyntetic analysis. Illustrative synthesis. s

Planning				
Methodologies / tests	**Competencies**	**Ordinary class hours**	**Student?s personal work hours**	**Total hours**
Introductory activities	A14	1	0	1
Guest lecture / keynote speech	A1 A4 A6 A9 A10 A14	25	62.5	87.5
Problem solving	A15 A21 B2 B3 B4 C1	9	18	27

Laboratory practice	A17 A19 A20 A26	10	15	25
Mixed objective/subjective test	A1 A4 A6 A9 A10 A14 B2 B3 C1	4	4	8
Personalized attention		1.5	0	1.5
(*)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	An introduction to the subject will be presented to the students where the tasks to be performed along the course and the methodologies, assessment methods and the most relevant literature will be explained. It will be held the first day.
Guest lecture / keynote speech	It is planned to carry out 25 sessions of lectures in one group where the theoretical contents of the subject together with relevant illustrative examples will be presented. It will consist mainly of Power Point presentations. Students will have copies of all the presentations via the Moodle application, so that students can prepare them before classes. Interactive student participation will be encouraged at all times.
Problem solving	It is planned to carry out 9 problem seminar sessions in small groups where students will solve the problems elaborated by the teacher. Students will have in advance notice of such problems through the Moodle application. These seminars will also be used to solve any doubts that arise during the theoretical classes
Laboratory practice	It is planned to carry out three experimental working sessions in which students will have to perform the experiments scheduled. The students will have the procedure and information about such experiments in advance through the Moodle application, so that they can prepare them before the start of the experiment at the laboratory. The student will have to demonstrate the know-how of the experiment before entering the laboratory. They have to elaborate a laboratory notebook which has to be given to the teacher at the end of the experimental work.
Mixed objective/subjective test	A final exam have to be done by the student on the dates established by the Faculty Board. Additionally, there is no mandatory midterm exam which will be eliminatory, so that students who pass this test does not need to be tested by that part at the final exam.The aim of these exams will be evaluate the knowledge and skills acquired by students.

Personalized attention	
Methodologies	**Description**
Problem solving Laboratory practice	This activity will mainly focus on resolving the doubts that may arise when students are trying to solve individually the problems. It will take place in the timetable of tutorials available to the teacher. In addition, this personalized attention will take place in interviews that the student has to perform before carrying out the experiments scheduled practices

Assessment			
Methodologies	**Competencies**	**Description**	**Qualification**
Problem solving	A15 A21 B2 B3 B4 C1	Student attendance at these seminar classes will be evaluated and their active participation will be assessed by questioning both in the classroom and through email. They will also be evaluated in the resolution of the problems at the seminars.	15
Laboratory practice	A17 A19 A20 A26	Firstly, students will be evaluated through a personal interview before they start each experiment. Then the student work at the laboratory will be evaluated from the point of view of organization, management skills to handle all chemicals, equipment and apparatus with care. Finally, the laboratory notebook that student will submit at the end of the experiments will be also evaluated. The attendance and pass these experimental classes are a necessary condition to pass this subject. Attendance at these experimental classes avoids to be considered as not presented.	15

Mixed objective/subjective test	A1 A4 A6 A9 A10 A14 B2 B3 C1	Students will have to solve similar problems in the written exams to those done at the seminar classes. There are two exams: the first one or non compulsory partial exam will take place in about half of semester and the final exam to be held on a fixed date on the calendar established by the Faculty Board. The partial exam is not compulsory and is eliminatory, so that students who pass it, they do not have to be evaluated from this part at the final exam.	70

Assessment comments
Students must attend all experimental laboratory classes in order to pass this subject. They must reach at less a 45% for each evaluation items and they must reach equal to or greater than 5 points average rating. An essential requirement to pass the subject is to pass the experimental laboratory clases. A student shall be considered ?not presented? when he is not attend the experimental laboratory classes and he is not present at the final exam. Students will have two opportunities: the first one in January and the second one in July. Students will keep the rates from experimental laboratory classes and from the seminars at the second opportunity in July. This new exam will be held on dates determined by the Faculty Board and the qualification will replace the one obtained in January. Students at the second opportunity may only be eligible for honors if the maximum number of them for this subject, according to the academic regulations, has not been covered in full at the first opportunity. In the following academic courses, students will have to perform all activities that are scheduled for that course. The student who has not passed the laboratory practices will have to perform a test in the laboratory where he will perform the repetition of a part that will be indicated by the teacher. He must pass this test as an essential condition to pass the matter in that second opportunity. Part-time students or students with special academic permission (according to the rules of the UDC): The same evaluation criteria listed above are applied, but it´s not mandatory to attend classroom lectures, to hand-in the supervised projects and to attend the objective test. It is compulsory to attend laboratory practical sessions. It will be tried to fit the dates to the student's availability. The final grade will be the sum of 10% of the mark obtained in the practical sessions and 90% of the mark obtained in the mixed test. The same criteria will be applied to both opportunities. Students who has not attended the final exam will be assessed as "non attendance"

Sources of information	
Basic	- Clayden, J.; Greeves, N.; Warren, S.; Wothers, P., (2012). Organic Chemistry. Oxford, University Press - Ege, S. (1997). Química Orgánica: Estructura y reactividad. Barcelona. Reverté - Carda, M., Marco, J.A., Murga, J., Falomir, E. (2010). Análisis retrosintético y síntesis orgánica. Castellón de la Plana, Universitat Jaume I - Quiroga Feijóo, M. L (2007). Estereoquímica: conceptos y aplicaciones en química orgánica. Madrid, Síntesis - McMurry, J. (2000). Química Orgánica. México. Thomsom - Harwood, L. M.; Moody, C. J.; Percy, J. M. (1999). Experimental Organic Chemistry. Standard and microscale 2º Ed.. Oxford: Blackwell Science

Complementary	- Carey, F. A.; Sundberg, R. J. (2007). Advanced Organic Chemistry 5º Edición. New York: Springer - Smith, M. B.; March, J (2007). March?s Advanced Organic Chemistry 6º Ed.. New York: Wiley - Norman, R. O. C.; Coxon, J. M. (1993 (2001 imp.)). Principles of Organic Synthesis. Cheltenham (RU): Nelson Thornes - Carda, M., Rodríguez, S., González, F., Murga, J., Falomir, E., Castillo, E. (1996). Síntesis Orgánica. Resolución de problemas por el método de la desconexión. Castellón de la Plana: Universitat Jaume I - Eliel, E. L., Wilen, S.H. (1994). Stereochemistry of organic compounds. New York : John Wiley & Sons

Recommendations
Subjects that it is recommended to have taken before
Organic Chemistry 1/610G01026 Organic Chemistry 2/610G01027 Intermediate Organic Chemistry/610G01028 Experimental Organic Chemistry/610G01029 Chemistry Laboratory 2/610G01032
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
Medicinal Chemistry/610G01040 Final Dissertation/610G01043
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.