Teaching Guide				
Identifying Data				2015/16
Subject (*)	Compostos organometálicos en síntese e catálise		Code	610509011
Study programme	Mestrado en Investigación Química e Química Industrial			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	1st four-month period	First	Optativa	3
Language	Spanish			
Teaching method	Face-to-face			
Prerequisites				
Department	Química Fundamental			
Coordinador		E-mail		
Lecturers	Sarandeses Da Costa, Luis Alberto	E-mail	luis.sarandeses@udc.es	
Web				
General description	This subject, which belongs to Synthetic Chemistry block, studies the structure and reactivity of organometallic complexes and their catalytic applications in chemical synthesis. Also, this subject is essential for understanding other subjects of the Master belonging to the blocks of Biological Chemistry and Nanochemistry and New Materials.			

Study programme competences / results	
Code	Study programme competences / results
A1	Define concepts, principles, theories and specialized facts of different areas of chemistry.
A2	Suggest alternatives for solving complex chemical problems related to the different areas of chemistry.
A3	Apply materials and biomolecules in innovative fields of industry and chemical engineering.
B1	Possess knowledge and understanding to provide a basis or opportunity for originality in developing and / or applying ideas, often within a research context
B2	Students should apply their knowledge and ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study.
B3	Students should be able to integrate knowledge and handle complexity, and formulate judgments based on information that was incomplete or limited, include reflecting on social and ethical responsibilities linked to the application of their knowledge and judgments.
B7	Identify information from scientific literature by using appropriate channels and integrate such information to raise and contextualize a research topic
B10	Use of scientific terminology in English to explain the experimental results in the context of the chemical profession
B11	Apply correctly the new technologies to gather and organize the information to solve problems in the professional activity.

Learning outcomes			
Learning outcomes	Study programme competences / results		
Predict the stability and reactivity of organometallic complexes according to their electronic characteristics..	AC1 AC2	BC1 BC2 BC3 BC7 BC10 BC11	
Propose reasonable mechanisms, based on the basic organometallic reactions, for reactions catalyzed for organometallic complexes.	AC1 AC2 AC3	BC1 BC2 BC3 BC7 BC10 BC11	

Use reasoning based on steric and electronic effects to predict how changes in reagents, metals and ligands affecting the course of reactions.	AC1	BC1 BC2 BC3	
Propose synthetic routes with key steps based on organometallic complexes.	AC1 AC2 AC3	BC1 BC2 BC3	
Read and critically interpret current scientific papers, with understanding and explanation of its contents and significance.		BC1 BC7 BC10 BC11	

Contents	
Topic	**Sub-topic**
Topic 1. General characteristics of organometallic complexes.	1) Formalisms: a) oxidation state, b) electronic configuration, coordination number, and 18e- rule, c) classes of ligands. 2) Considerations about the bond. 3) Structural considerations.
Topic 2. Organometallic reactions mechanisms.	1) Associative and dissociative mechanism. 2) Oxidative addition and reductive elimination. 3) Insertions and eliminations. 4) Attacks on nucleophilic and electrophilic ligands coordinated to the metal. 5) Transmetalation.
Topic 3. Cross-coupling reactions. Heck reaction.	1) Cross-coupling reactions of Csp3 organometallic species. 2) Cross-coupling reactions of Csp2 organometallic species. 3) Cross-coupling reactions of Csp organometallic species. 4) Heck reaction.
Topic 4. Carbonylative and decarbonylative reactions.	1) General Reactivity of metal carbonyls. 2) Carbonylative coupling reactions catalyzed by palladium and carbonylation of alkenes and alkynes. 3) Carbonylations of industrial interest: Monsanto process; hydroformylation (oxo process). 4) Decarbonylative reactions.
Topic 5. Metal-carbene complexes.	1) Electrophilic carbenes (Fischer carbenes): preparation and reactivity. 2) Nucleophilic carbenes (Schrock carbenes). 3) Metathesis of alkenes: general mechanism, ROMP and RCM.
Topic 6. Metal-alkyne complexes.	1) Structural Aspects. 2) Metal-alkyne stable complexes: complexes of Co as protecting groups of alkynes and Nicholas reaction. 3) Pauson-Khand reaction. 4) alkyne cycloaddition reactions.
Topic 7. Metal-alkene complexes, metal-diene and dienyl complexes. Reactions via n3-allyl complexes. Metal-arene complexes.	1) Metal-alkene complexes of palladium and iron. 2) metal-diene: stabilization of allyl cations and nucleophilic addition. 3) Complexos n5-dienyl: synthetic applications. 6) Reactions of allylic substrates catalyzed by Pd, Ni and other metals. 7) Metal-arene complexes of groups 6 and 8 (Cr, Fe, Ru).

Planning				
Methodologies / tests	**Competencies / Results**	**Teaching hours (in-person & virtual)**	**Student?s personal work hours**	**Total hours**
Problem solving	A1 A2 A3 B1 B2 B3 B7 B10 B11	9	0	9
Mixed objective/subjective test	A2 A3 B2 B3 B11	2	0	2
Guest lecture / keynote speech	A1 A2 A3 B1 B2 B3 B7 B10 B11	12	52	64
Personalized attention		1	0	1
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	**Description**

Problem solving	Seminars with the Master's own teaching staff, guests or business professionals. Interactive sessions related to different subjects with discussions and exchange of views with students. Resolution of practical exercises (problems, multiple choice questions, interpretation and processing of information, evaluation of scientific publications, etc.).
Mixed objective/subjective test	The final exam will cover all the contents of the subject.
Guest lecture / keynote speech	Theoretical classes. Lectures (using slate, computer, projector), supplemented by their own online teaching tools.

Personalized attention	
Methodologies	**Description**
Problem solving	Os alumnos disporán de atención personalizada no horario de tutorías do profesor para a aclaración dos conceptos fundamentais da materia exposta nos grupos grandes, a resolución de cuestións individuais expostas nos seminarios e nas sesións maxistrais. Ademais, o alumno poderá recibir atención personalizada sobre calquera aspecto da materia durante o horario de tutorías do profesor.

Assessment			
Methodologies	**Competencies / Results**	**Description**	**Qualification**
Problem solving	A1 A2 A3 B1 B2 B3 B7 B10 B11	Continuous evaluation will count 40% in the grade for the course and consist of two components: interactive small group classes (seminars) and highly interactive small group classes (tutorials). Seminars and tutorials include the following problem solving and case studies (15%), writing papers and written (5%) reports, oral presentation [(case studies, problems), 10%] and oral questions during the course (10%).	40
Mixed objective/subjective test	A2 A3 B2 B3 B11	The final exam will cover all the contents of the subject.	60

Assessment comments

Sources of information	
Basic	- Hegedus, L. S.; Söderberg, B. C. G. (2009). Transition Metals in the Synthesis of Complex Organic Molecules 3rd Ed.. University Science Books - Bates, R. (2012). Organic Synthesis using Transition Metals. Wiley - Beller, M.; Bolm, C., Eds. (2004). Transition Metals for Organic Synthesis: Building Blocks and Fine Chemicals, 2nd Ed.. Wiley-VCH - De Meijere, A.; Diederich, F., Eds. (2004). Metal-Catalyzed Cross-Coupling Reactions, 2nd Ed.. Wiley-VCH - Crabtree, R. H.; Peris Fajarnés, E., Eds. (1997). Química organometálica de los metales de transición. Publicacions de la Universitat Jaume I
Complementary	

Recommendations
Subjects that it is recommended to have taken before

Profundización en Química Orgánica/610509004
Profundización en Química Inorgánica/610509003
Subjects that are recommended to be taken simultaneously
Análise Estrutural Avanzado/610509005
Mecanismos de reacción e catálise/610509009
Síntese estereoselectiva/610509012
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.