Teaching Guide				
Identifying Data				2019/20
Subject (*)	Efficient and innovative building materials		Code	670526003
Study programme	Mestrado Universitario en Edificación Sostible (Plan 2017)			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	1st four-month period	First	Obligatory	3
Language	SpanishGalicianEnglishItalian			
Teaching method	Face-to-face			
Prerequisites				
Department	Construcións e Estruturas Arquitectónicas, Civís e Aeronáuticas			
Coordinador	Fernandez Prado, Ruben	E-mail	ruben.fprado@udc.es	
Lecturers	Fernandez Prado, Ruben Souto Blazquez, Gonzalo	E-mail	ruben.fprado@udc.es g.souto@udc.es	
Web				
General description	In the last years has taken place a big development in innovative and efficient materials for the edificación and in concrete the takeoff the nanotechnology affecting to all the sectors of the society, with a big immediate future in applications in materials for the construction and with an even more promising future like line of investigation in new materials. All the developed countries are making a big encourage investor that has gone growing from finals of the years 90 until positioning like the fields with greater investment. In Europe pose politics of R&D thanks to which already carry evolving material that finish being the base of applications that are regenerating the industry. In tuning with are politics in the National Plan of Scientific Investigation, Development and Technological Innovation 2008-2011 already poses the nanociencia com or strategic action with the end to improve the competitiveness of the Spanish industry. Like this as the new materials and the Nanotechnology find in the first steps of his development opening wide horizons in the development and application of new materials that can contribute improvements in the field of the edificación. This subject pretends show a global vision of these new materials with special incidence in the Nanociencia.			

Study programme competences / results	
Code	Study programme competences / results
A1	CE01 Deseñar sistemas construtivos eficientes e sustentables, mediante a aplicación de solucións técnicas e sistemas construtivos tradicionais ou avanzados.
A3	CE03 Coñecer e aplicar as solucións tecnolóxicas necesarias para mellorar o comportamento térmico da envolvente dun edificio.
B1	CB01 Posuír e comprender coñecementos que acheguen unha base ou oportunidade de ser orixinais no desenvolvemento e/ou aplicación de ideas, a miúdo nun contexto de investigación.
B2	CB02 Saber aplicar os coñecementos adquiridos e a súa capacidade de resolución de problemas en contornas novas ou pouco coñecidos dentro de contextos máis amplos (ou multidisciplinares) relacionados coa súa área de estudo.
B3	CB03 Ser capaces de integrar coñecementos e enfrontarse á complexidade de formular xuízos a partir dunha información que, sendo incompleta ou limitada, inclúa reflexións sobre as responsabilidades sociais e éticas vinculadas á aplicación dos seus coñecementos e xuízos.
B4	CB04 Saber comunicar conclusións ?e os coñecementos e razóns últimas que as sustentan? a públicos especializados e non especializados dun modo claro e sen ambigüidades.
B5	CB05 Posuír as habilidades de aprendizaxe que permitan continuar estudando dun modo que haberá de ser en gran medida autodirigido ou autónomo.
B7	CG02 Capacidade de organización e planificación.
B12	CG07 Traballo en equipo.
B17	CG12 Adaptación a novas situacións.
B18	CG13 Creatividade.
B22	CG17 Sensibilidade cara a temas ambientais.
B24	CG19 Orientación ao cliente.

B25	CG20 Coñecer os principios básicos do paradigma da sustentabilidade, os seus debates e implicacións ambientais, socioculturais e económicas.
B26	CG21 Entender e coñecer as dinámicas e problemáticas aparecidas co fenómeno da globalización e a súa relación coa sustentabilidade global.
B27	CG22 Coñecer o impacto que o uso da tecnoloxía ten sobre a sociedade que o adopta e os principios básicos para unha tecnoloxía da sustentabilidade.
B28	CG23 Analizar os fluxos materiais e enerxéticos que se dan nun sistema e a súa interrelación co territorio e os recursos que o sostén.
B29	CG24 Coñecer a lexislación vixente e a normativa aplicable en materia de sustentabilidade, eficiencia enerxética e xestión da calidade ambiental no ámbito da edificación.
B30	CG25 Coñecer os principios físicos relacionados cos problemas enerxéticos e de sustentabilidade e saber aplicalos no deseño construtivo.
B31	CG26 Deseñar, planificar, executar e avaliar proxectos tecnolóxicos, científicos ou de xestión nun marco de sustentabilidade.
B32	CG27 Analizar e comparar as prestacións de distintas alternativas tecnolóxicas, e seleccionar as solucións máis adecuadas con criterios de sustentabilidade e eficiencia.
B33	CG28 Xestionar a explotación do edificio, implementando as melloras necesarias para adecuar os parámetros ambientais e enerxéticos.
C6	CT06 Valorar críticamente o coñecemento, a tecnoloxía e a información dispoñible para resolver os problemas cos que deben enfrontarse.
C7	CT07 Asumir como profesional e cidadán a importancia da aprendizaxe ao longo da vida.
C8	CT08 Valorar a importancia que ten a investigación, a innovación e o desenvolvemento tecnolóxico no avance socioeconómico e cultural da sociedade.

Learning outcomes			
Learning outcomes	Study programme competences / results		
When finalizing the subject, the student will be able of: Know and choose material and innovative constructive systems with criteria of sustainability and efficiency for the new work and the rehabilitation.	AC1 AC3	BC1 BC2 BC3 BC4 BC5 BC7 BC12 BC17 BC18 BC22 BC24 BC25 BC26 BC27 BC28 BC29 BC30 BC31 BC32 BC33	CC6 CC7 CC8

Contents	
Topic	Sub-topic
1. INTRODUCTION	Innovative materials: a vision of the evolution and future development.
2. NORMATIVE FRAME	Applicability of rule to new materials.

3. MATERIALS EVOLVED	3.1. Structural materials in-situ and prefabricated 3.2. Materials for covers and impermeabilizaciones 3.3. Special glasses 3.4. Products for masonry. Works of factory 3.5. Insulating materials and súper-insulating 3.6. Inner finishings: Pavings, paintings, false ceilings and signposts. 3.7. Materials for installations 3.8. Others Physical behavior-chemical of the material technological Properties of the materials. Provision. Compatibility of the materials and use in innovative constructive systems. Applications in new work and rehabilitation. Methods of election of materials and constructive systems with criteria of sustainability and efficiency. Practical cases and examples of works built.

4. NANOTECNOLOGICAL MATERIALS	4.1 INTRODUCTION To THE NANOTECHNOLOGY o Introduction, What is the nanotechnology? Sistem Ace for his observation, methods of measurement, microscopes, concepts o Development of the nanotechnology, projection. O it Combines ecology and economy. O Properties of the nanopartículas individual o Nanocúmulos metallic o Nanopartículas semiconductoras o molecular Cumuluses and of noble gases o Methods of synthesis o Or tros products in other sectors: micromotores, components miniature, superficial treatments, nanosensores, nanotegidos, others. O Build nanoestructuras Top-Down and Bottom -Up 4.2 EFFECTS o effect loto, ? ejem plos. O Self-cleaning: photocatalysis examples o Easy-to-clean (ETC): o Air-purifying o Anti-fogging o Fragance capsules o Therm to the insulation: VIPs (vacuum insulation panels) o Therm to the insulation aerogel o Temperature regulation: Phase change materials (PCMs) o UV protection o Solar protection o Fire-proof o Anti-graffiti o Anti-reflective o Antibacterial o Anti-fingerprint o Scratchproof and abrasion-resistant 4.3 APPLICATIONS FOR THE CONSTRUCTION o Nanoestructuras of carbon: Cumuluses of carbon, Nanotubos of carbon, applications o bulky Materials nanoestructurados o Ferromagnetism nanoestructurado o optical Spectroscopy and vibracional: infrared frequency and luminescence o Autoensamblaje and catálisis o Com organic places and polymers o biological Materials

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A3 B1 B22 B24 B25 B26 B27 B28 B29 B30 B33 C6 C7 C8	9	0	9

Supervised projects	A1 A3 B1 B2 B3 B4 B5 B7 B12 B17 B18 B22 B24 B25 B26 B27 B28 B29 B30 B31 B32 B33 C6 C7 C8	0	53	53
Collaborative learning	A1 A3 B1 B2 B3 B4 B5 B7 B12 B17 B18 B22 B24 B25 B26 B27 B28 B29 B30 B31 B32 B33 C6 C7 C8	9	0	9
Oral presentation	B4 B7 B12 B17 B18 B32	3	0	3
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**
Guest lecture / keynote speech	It will realize an exhibition of the contents through audiovisual means. They will be able to organize conferences in the classroom or the assistance to sessions of notable conferences organized externamente about innovative and efficient materials.
Supervised projects	Along the course, the student will develop a work in team that will conclude with a brief oral presentation in front of his mates. The work will consist in the development of a technical proposal of a new product, element or innovative constructive system, advanced and efficient for the edificación. Will be able to carry out two alternative strategies: - Innovation with new materials, products or constructive elements. - New application of a material, product or existent element (p. ej: Material of waste or by-product of the industry) In each work, will study like minimum the following appearances: - Description, composition and applications of the product / element / constructive system. - Design of the resultant constructive system. Technical feasibility of the proposal. - Durability of the proposal. - Improvements that provides the proposal. - Assessment of the solution of recycled of the material of waste. - Sustainability in the industrial production of the product / element / constructive system. Each team will be able to pose freely any proposal that adjust to the general requirements established. Nevertheless, the professors will orient to the students in relation with the subject that propose, and reserve the right to readjust the subjects with educational ends. It exists the possibility that a same work was developed jointly in the matters ?Constructive systems advanced? And ?Innovative constructive materials and efficient?. For this, the subject proposed will have to fulfill the requirements established in the educational guides of both matters simultaneously, and will have to be approved by the professors of the matter before his start. In this case, the work will have to have an extension and a level of development in accordance with the time of dedication foreseen in the planning of both matters.

Collaborative learning	The system of unroll of the work tutelado will be a combination between the work of house and the follow-up in the classroom by part of the professor. He work in the classroom treats of a group of procedures of education-learning guided of face-to-face form the supported with technologies of the information and the communications, that base in the organization of the class in small groups in which the alumnado works jointly in the resolution of tasks assigned by the profesorado to optimize his own learning and the one of the others members of the group.
Oral presentation	It will realize a presentation of the work tutelado in front of the mates, the professor will boost the participation in the discussion about the subject after the presentation. It will be compulsory the presentation of an academic work writing, a presentation type power-point and a signpost summary in size To1 on cardboard feather.

Personalized attention	
Methodologies	**Description**
Supervised projects Guest lecture / keynote speech Collaborative learning Oral presentation	The student will be attended in tutorial hours for explanations about the subjects treated in the activities proposed. The professor will realize a follow-up with attention to groups of work guiding them in the development of the same.

Assessment			
Methodologies	**Competencies / Results**	**Description**	**Qualification**
Supervised projects	A1 A3 B1 B2 B3 B4 B5 B7 B12 B17 B18 B22 B24 B25 B26 B27 B28 B29 B30 B31 B32 B33 C6 C7 C8	It will realize in group awarding the same note to all the components of the group. The professors reserve the right to assign different qualifications to each component, when they detect differences in the level of work of each one.	50
Guest lecture / keynote speech	A3 B1 B22 B24 B25 B26 B27 B28 B29 B30 B33 C6 C7 C8	It will be compulsory the assistance at least of 80% of the sessions	20
Oral presentation	B4 B7 B12 B17 B18 B32	Professors will value the skills of the students as well as the audiovisual means, models, signposts, samples to real scale, etc. that they use in the same.	30

Assessment comments
The subject is proposed with a system of continuous evaluation, for which is important the assistance of the student to the activities proposed. This type of evaluation develops with the support of the personalized attention of the professor, with special importance of the work developed during the course, that concludes with the oral presentation of the same. This continuous evaluation conforms the first opportunity to surpass the asignatura. In case that it do not reach a minimum in the activities proposed will offer two options to the student that constitute the second opportunity to surpass the asignatura: redo the work arriving to a greater technical depth of the subject treated and his presentation through the platform of teleformación in the dates designated to such effect, or the realization of a final examination. In case that a team of students develop a same work of conjoint form in the matters "constructive Systems advanced" and "innovative constructive Materials and efficient", in both matters will correspond him the same qualification - in the corresponding parts to the work and to his oral presentation -.

Sources of information	
Basic	
Complementary	

Recommendations
Subjects that it is recommended to have taken before
Subjects that are recommended to be taken simultaneously
Advanced building systems/670526005
Subjects that continue the syllabus
Proxectos de i+d+i:relación investigación empresa/670503002
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.