



Teaching Guide

Identifying Data					2022/23
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, Cívís e Aeronáuticas				
Coordinador	Fernandez Prado, Ruben	E-mail	ruben.fprado@udc.es		
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Web					
General description	<p>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.</p> <p>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.</p> <p>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.</p> <p>This subject pretends show a global vision of these new materials with special incidence in the Nanociencia.</p>				

Study programme competences / results

Code	Study programme competences / results
A1	CE01 Diseñar 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 Trabajo 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 Diseñar, 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 afrontarse.
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
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1. INTRODUCCIÓN SOSTENIBILIDAD MATERIALES.
HORMIGÓN ARMADO

Sostenibilidad hormigón
Emisiones CO2 de hormigón armado
Esquema de Elkington
Sociedad ?construcción
Expectativa de vida
Análisis de ciclo de vida
Consumo y emisiones
Energía consumida en la vida útil de un edificio
Respuesta de Europa a la energía
Construir ? Consumir
Qué aporta el hormigón a la sostenibilidad
ejemplos:
- Autocompactantes
- Con áridos reciclados
- Ligeros
- Alta resistencia
- Porosos
- Autoreparables
- Bicapa
- Con fibras
- Traslúcido



2. MADERA

sistemas construcción en madera acero

Sistemas estructurales superficiales

- Vigas sección doble t
- Vigas mixtas madera acero
- Vigas microlaminada LVL
- CFRW Carbon fiber reinforced wood
- AFRW advanced fiber reinforced wood
- Anthony power beam
- ARMALAM Steel-reinforced Laminated wood
- Steel Beam (Allied steel)
- West system epoxy
- HTS-Hybrid-Beams
- Paneles estructura 3d

tableros

- de madera maciza
- derivados de la madera
- Alistonado
- alistonado en alma y chapa
- alistonado macizo
- ensamblados
- derivados de la madera
- contrachapados
- microlaminado
- Contrachapados alta densidad
- laminado
- de partículas o aglomerado
- de virutas
- OSB oriented strand board
- de virutas madera y magnesita
- de fibras (dm)
- mixtos
- madera cemento (tipo viroc)
- acústico (akustic andamasa)
- melaminizado con estructura
- Con núcleo aligerado
- Polipropileno y nido de abeja
- núcleo aligerado. nido de abeja
- fibra de vidrio y espuma
- placas fenolicas y núcleo de poliestireno expandido
- Madera / poliestireno

OTROS

- Madera flexible
- Mdf flexible
- Tablero madera flexible
- Madera flexible por forma y sección
- Suelo radiante. panel compacto madera
- Plástico madera
- Madera, aluminio, juntas, vidrio



- Plástico como sistema unión. Termo-retractil
- DIY resina inyectada en madera
- Led technology / madera
- Metal / madera
- Gomas aislamiento / madera
- Panel acero, hormigón, madera
- Panel acero, hormigón, madera, acabado
- Mobiliario con linóleo
- sanitarios
- Madera con cremallera
- Madera transparente



<p>3. MATERIALES NANOTECNOLÓGICOS</p>	<p>3.1 INTRODUCCIÓN Á NANOTECNOLOXÍA</p> <ul style="list-style-type: none">- Introducción, Que é a nanotecnoloxía? Sistem as para a súa observación, métodos de medición, microscopios, conceptos- Desenvolvemento da nanotecnoloxía, proxección.- Combina ecoloxía e economía.- Propiedades das nanopartículas individuais- Nanocúmulos metálicos- Nanopartículas semiconductoras- Cúmulos moleculares e de gases nobres- Métodos de sínteses- Outros produtos noutros sectores: micromotores, compoñentes miniatura, tratamentos superficiais, nanosensores, nanotegidos, outros.- Construír nanoestructuras Top-Down and Bottom -Up <p>3.2 EFECTOS</p> <ul style="list-style-type: none">- efecto loto, ? ejem plos.- Self-cleaning: photocatalysis exemplos- Easy-to-clean (ETC.):- Air-purifying- Anti-fogging- Fragrance capsules- Thermal insulation: VIPs (vacuum insulation panels)- Thermal insulation aerogel- Temperature regulation: Phase change materials (PCMs)- UV protection- Solar protection- Fire-proof- Anti-graffiti- Anti-reflective- Antibacterial- Anti-fingerprint- Scratchproof and abrasion-resistant <p>3.3 APLICACIÓNS PARA A CONSTRUCIÓN</p> <ul style="list-style-type: none">- Nanoestructuras de carbono: Cúmulos de carbono, Nanotubos de carbono, aplicacións- Materiais voluminosos nanoestructurados- Ferromagnetismo nanoestructurado- Espectroscopia óptica e vibracional: frecuencia infravermella e luminiscencia- Autoensamblaje e catálisis- Com postos orgánicos e polímeros- Materiais biolóxicos
<p>4. CERRAMIENTOS OPACOS DE FACHADA</p>	<p>.</p>
<p>5. VIDRIOS</p>	<p>.</p>



<p>6. BIOMATERIALES</p> <p>7. OTROS</p>	<p>Materiales, productos, sistemas</p> <p>Materiales de la biomasa</p> <ul style="list-style-type: none"> - Biomaterial descartes girasol - Paneles de cáscara de maní <p>Bioplásticos</p> <ul style="list-style-type: none"> - Bioplástico de pescado - Bioplástico con desechos marinos - Biopolímero de algas como plástico <p>Bacterias que calcifican textiles mat. Constru.</p> <p>Tableros con cáscaras de patatas</p> <p>Hongo que repara hormigón</p> <p>Aguahoja del MIT Media Lab</p> <p>Pavimento modular conchas mejillones</p> <p>Ladrillo ecológico indio</p> <p>Placas de micelios</p> <p>Pabellón Shell Mycelium</p> <p>Pabellón de algas</p> <p>Baldosas con algas: Indus</p> <p>Paneles acústicos de micelios</p> <p>Ataúd de micelio de hongo living cocoon</p> <p>Algas, aislamiento térmico</p> <p>Black brick</p> <p>Biocemento con levadura de cerveza y peróxido de hidrógeno</p> <p>Ladrillos con lodos de depuradoras</p> <p>Ladrillos de hongos más resistente que el hormigón. Hy-fi torre de ladrillos de hongos</p> <p>Ladrillos de desechos de piel animal</p> <p>Piel estructural (structural skin)</p> <p>Posos de café como material</p> <p>Karuun: de ratán</p> <p>YAKISUGI: madera quemada</p>
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Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Guest lecture / keynote speech	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
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	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	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	<p>It will realize an exhibition of the contents through audiovisual means.</p> <p>They will be able to organize conferences in the classroom or the assistance to sessions of notable conferences organized externally about innovative and efficient materials.</p>
Supervised projects	<p>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:</p> <ul style="list-style-type: none"> - 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) <p>In each work, will study like minimum the following appearances:</p> <ul style="list-style-type: none"> - 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. <p>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.</p> <p>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.</p>
Collaborative learning	<p>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.</p> <p>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.</p>



Oral presentation	<p>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.</p> <p>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.</p>
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Personalized attention

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

Assessment

Methodologies	Competencies / Results	Description	Qualification
Guest lecture / keynote speech	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 be compulsory the assistance at least of 80% of the sessions	20
Oral presentation	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	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
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

Assessment comments

<p>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.</p> <p>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.</p> <p>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 -.</p>
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Sources of information

Basic	
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Complementary	
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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.