



Teaching Guide

Teaching Guide				
Identifying Data			2022/23	
Subject (*)	Advanced building systems		Code	670526005
Study programme	Mestrado Universitario en Edificación Sostible (Plan 2017)			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	Yearly	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	
Lecturers	Fernandez Prado, Ruben Souto Blazquez, Gonzalo	E-mail	ruben.fprado@udc.es g.souto@udc.es	
Web				
General description	The progress and development of the technology provides us new materials with new characteristic and benefits. His combination and the peculiarities in his use in relation with the architectural project, the needs, the typology, the atmospheric conditions, the durability arrives to cover the expectations that nowadays asks to a constructive solution reaching the requests that the normative demand us until arriving to culminate the most sophisticated requests. In the technological evolution to the service of the edificación is indispensable to give an answer that sume in a constructive system the solution to the need, the aesthetics, the economy, the sustainability. With these criteria has a notable importance the evolution of systems from the recycled of by-products. In this subject pretends study the materials and constructive systems evolved fulfilling with the standars described and posing bases that allow to the student the study of new materials for his application to the edificación with a rational use of the natural resources.			

Study programme competences

Code	Study programme competences
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 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	
- General knowledge of the constructive systems evolved and of the most recent investigations that have carried out in this field.		AC1	BC1 CC6
		AC3	BC2 CC7
- Capacity to evaluate the adecuación to determinate applications of the new materials and of his constructive systems associated, under criteria of durability, economy, sustainability, aesthetic, etc.			BC3 CC8
			BC4
			BC5
			BC7
			BC12
			BC17
			BC18
			BC22
			BC24
			BC25
			BC26
			BC27
			BC28
			BC29
			BC30
			BC31
			BC32
			BC33

Contents	
Topic	Sub-topic



1. ESTRUCTURAS

Prelosa aligerada con bolas Cobiax
Casa Trufa y la vaca Paulina
Dasparkhotel
Hormigón textil Concrete canvas
Casa con sacos de tierra
Encofrados hinchables
Encofrados de cera reutilizables
Prelosa Leca
Hangar desplegable
Piscinas de paredes de acero inox
flexypool
Hinchables
Antisísmica madera. Anclajes-amortiguadores
Flexbrick
Pres-lam
3dcons

BLOQUES
BLOQUES ISOTEX
BLOCO SICAL
BRIKAWOOD
LOKNBLOK
OSBLOCK MUR ISOLE
GABLOK
MALAYSIA INTERLOCKING BRICKS
NUDURA INSULATED CONCRETE FORMS
COMFORTBLOCK



2. SISTEMAS CONSTRUCTIVOS CON MADERA

SISTEMAS

- Sistema troncos
- Entramado poste viga
- Sistema entramado ligero
- Prefabricado o placas
- Prefabricado módulos

SISTEMAS ESTRUCTURALES ESPACIALES

- madera
- madera acero
- otra arquitectura ejemplos de aplicaciones

UNIONES

- aluminio
- conector oculto

REHABILITACIÓN

- forjados mixtos
- sensores
- sistema Beta
- Refuerzo vigas en forjados

PAVIMENTOS

- parquet industrial
- bambú
- parquet entarugado
- pavimento mosaico
- Pavimento madera exterior Ventilado sobre vigueta
- pavimento Loseta. Enjaretado de madera
- pavimento Tarima exterior de madera compuesta
- Parquet piscinas entarugado
- Suelos técnicos elevados losetas
- panel en aglomerado para suelos sobre elevados
- Colores, tintes, texturas, técnica de fabricación
- cortes imposibles
- con machihembrados imposibles

ACABADOS INTERIORES

- panel con fijación oculta
- Dameado de madera
- panel tejido de madera
- panel con fijación oculta
- Recubrimiento papel
- Panel curvado con molde
- Madera laminada curvada con molde

OTROS

- madera flexible
- aplicaciones
- papeles periódico madera



- sanitarios
- mantas
- otras uniones de madera
-

3. FACHADAS OPACAS	3.1 FACHADAS VENTILADAS LIGERAS 3.2 SISTEMAS VENTURE 3.3 FACHADAS VENTILADAS CON REVESTIMIENTOS CONTÍNUOS
4. CERRAMIENTOS DE VÍDRIO	.



5. INSTALACIONES

energías renovables: últimos sist. Const.

Características renovables:

De fuentes naturales inagotables

Áreas de trabajo:

Generación de energía

Calefacción/refrigeración de aire/agua

Transporte

Sistemas autónomos fuera de la red

Energías:

Solar

Fotovoltaica

hidráulica

Eólica

Eléctrica

Mecánica

Hidráulica

Eléctrica

Mecánica

Geotérmica

Mareomotriz

Biomasa

Biogas

EJEMPLOS:

- Paneles solares para imprimir
- Máquina de bajo costo para imprimir paneles solares
- Panel solar de doble cara
- Panel solar de día y de noche
- Panel solar textil. Tela fotovoltaica
- Cinta solar enchufe
- Perlas de vidrio sobre células solares
- Nanopaneles para luz infrarroja
- PEROVSKITA Cualquier superficie genera energía solar
- Techo orgánico fotovoltaico
- Globos solares
- Esferas solares
- Paneles solares transparentes
- Vidrio fotovoltaico flexible
- Vidriera panel solar
- Fotografías en paneles solares
- Panel solar desplegable
- Unidad móvil generadora de energía
- Smartfower pop + genera y almacena
- Grafeno: generación solar con gotas de lluvia
- Enchufe solar para ventanas
- Apoyo paneles
- Colocación sin taladrar cubierta
- Luz natural al interior. Tubo solar



- Orientador de luz solar
- Espejos auto-orientables de luz solar
- limpieza
- Robot de limpieza
- Células solares invisibles
- Árbol solar
- Paneles solares en mobiliario
- Pavimentar carreteras con paneles solares
- Pavimentar carreteras con paneles solares/recarga
- aceras solares
- Recarga inalámbrica de coches
- Carril bici solar
- Barreras acústicas solares en autopistas
- Cubiertas solares para autopistas
- Generador eléctrico con agua de lluvia
- Generador eléctrico con agua de lluvia
- Generador eléctrico tuberías
- Generador eléctrico de geometría variable

EÓLICOS



6. EJECUCIÓN INNOVADORA

PRODUCTIVIDAD EN CONSTRUCCIÓN

Índice de digitalización industrial global

Productividad en sector de la construcción

CAUSAS DE BAJA Productividad en sector de la construcción

ESTRATEGIAS A SEGUIR (digitalizar)

Breve historia de robots en arquitectura

SISTEMAS DE ROBOTIZACIÓN

1. PRIMERA MECANIZACIÓN NO ROBÓTICA

- Máquina enfoscadora
- Colocación de adoquín con máquina
- Máquina de corte circular YQJ 1500
- Construcción bóveda
- Planta de reciclaje móvil
- Limpieza de fachadas en altura
- Robot demolición corte con agua
- Robot demolición Husqvarna
- Super Guzzila spg 002

2. PREFABRICACIÓN DIGITAL A MEDIDA

Mecanizados digitales

Moldeado sin molde de elementos de hormigón

Ensamblajes particulares

Impresión 3d

- corte con laser
- Ejecución de pilares y vigas de sección variable FABRICACIÓN DIGITAL
- Ejecución colaborativa de robots

3. FABRICACIÓN IN SITU

Maquinaria cartesiana

Encofrados flexibles ligeros

Conjuntos autoportantes

Robótica de construcción

- Robot cartesiano de pintura PROYECTO INVISIO
- Construcción Impresora 3d para edificio de 5 pisos
- Casas impresas hormigón 3d
- SQ3D imprimir una casa en 12 h. por 2.000\$
- Impresión 3d para vivienda en 3er mundo
- Robot impresión 3d
- Pintura con dron
- Scribit
- Mini Builders
- Cogiro: Robot de cables
- Montaje armado con robot
- HADRIAN X105 Máquina automatizada de albañilería

4. TECNICAS COLATERALES

Sostenibilidad, rendimiento y aplicabilidad



Métodos computacionales

Fundamentos de robótica: percepción, movilidad y destreza

- Bolígrafo de impresión 3d
- Mini brazo robótico
- Enjambre de robots
- Casco inteligente
- Exoesqueletos construcción
- Exoesqueletos pasivos
- Paexo: Trabajo por encima de cabeza
- Guardian XO
- Raytheon Sarcos Modified Ditch Witch

ROBOTS HUMANOIDES

- Robot humanoide HRP-5P



Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student's personal work hours	Total hours
Guest lecture / keynote speech	A3 B1 B2 B26 B27 B28 B29 B30 C6	9	0	9
Supervised projects	A1 A3 B1 B3 B5 B7 B12 B17 B18 B22 B24 B25 B26 B27 B28 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	B3 B4 B7 B12 B18 B24	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 externally about constructive systems evolved.



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. For his realization, it is proposed two types of alternative work between which will be able to opt. Nevertheless, the professors will orient to the student in relation with the subject that propose, and reserve the right to readjust the subjects with educational ends. A) 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. B) Study of a constructive system evolved existent, composed by: - Description of material / product / element / system used. - Comparison with other existent constructive systems alternative. - 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 develop the tutelage work will be a combination between the homework and the follow-up in the classroom by the professor. The work in the classroom treats of a group of procedures of education-learning guided of face-to-face form or supported with technologies of the information and the communications, that base in the organization of the class in small groups in which the students works jointly in the resolution of tasks assigned by the professors 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 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 A1 on cardboard feather.

Personalized attention

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

Assessment			
Methodologies	Competencies	Description	Qualification
Supervised projects	A1 A3 B1 B3 B5 B7 B12 B17 B18 B22 B24 B25 B26 B27 B28 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 B2 B26 B27 B28 B29 B30 C6	It will be compulsory the assistance at least of 80% of the sessions	20
Oral presentation	B3 B4 B7 B12 B18 B24	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 presentation.	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 work. This continuous evaluation conforms the first opportunity to pass the subject. In case that it do not reach a minimum in the activities proposed it will offer two other options to the student that constitute the second opportunity to pass the subject: remade 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 tutorial 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
Efficient and innovative building materials/670526003
Subjects that continue the syllabus
Proyectos 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.