FACULDADE DE ARQUITETURA
UNIVERSIDADE DE LISBOA

FICHA DE UNIDADE CURRICULAR

Unidade Curricular

202599304 - Workshop BioLab

Tipo

Optativa

Ano lectivo	Curso	Ciclo de estudos	Créditos
2025/26	Doutoramento Arquitetura	3º	10.00 ECTS

Idiomas	Periodicidade	Pré requisitos	Ano Curricular / Semestre
Português ,Inglês	semestral		

Área Disciplinar

Arquitetura

Horas de contacto (semanais)

Teóricas	Práticas	Teórico práticas	Laboratoriais	Seminários	Tutoriais	Outras	Total
0.00	0.00	2.00	0.00	0.00	0.00	0.00	2.00

Total Horas da UC (Semestrais)

Total Horas de Contacto	Horas totais de Trabalho
28.00	75.00

Docente responsável (nome / carga lectiva semanal)

José Nuno Dinis Cabral Beirão

Outros Docentes (nome / carga lectiva semanal)

Manuela Cristina Paulo Carvalho	0.30 horas
Susana Maria Gouveia Rosado	0.30 horas
José Nuno Dinis Cabral Beirão	0.30 horas
Ana Mestre (FBAUL)	0.30 horas
Carolina Delgado	0.60 horas
Rafael Calado (BioLab)	0.20 horas
João Canilho Santos (BioLab)	0.30 horas
Caterina Plenzick	0.30 horas
Carlos Roque (BioLab)	0.20 horas

Guilherme Martins (BioLab)	0.20 horas

Objetivos de aprendizagem (conhecimentos, aptidões e competências a desenvolver pelos estudantes)

O programa do Workshop visa atingir os seguintes objetivos:

- Desenvolver conhecimentos sobre materiais biológicos disponíveis para aplicação em diversos domínios da construção ou como elementos autónomos com potencial competitivo (económico e ecológico) na construção civil.
- Desenvolver competências laboratoriais na realização de pesquisas detalhadas sobre comportamentos de materiais, características biológicas, aspetos (re)produtivos e aplicabilidade na forma pura ou composta com outros materiais que não comprometam os requisitos de sustentabilidade.
- Desenvolver a capacidade de prosseguir científica e experimentalmente as experiências necessárias com biomateriais para demonstrar as suas qualidades e vantagens sobre os concorrentes industriais.
- Desenvolver competências técnicas (metodológicas e relacionadas com ferramentas) para abordar as complexidades do problema de estudo.
- Desenvolver competências técnicas e laboratoriais para o estudo e abordagem de biomateriais.
- Desenvolver capacidades de síntese e comunicação de ideias e visões de desenvolvimento implícitas na utilização de biomateriais, produzindo discursos científicos e filosóficos que sustentem as suas vantagens em contribuir para a formação de sociedades sustentáveis e em equilíbrio harmónico com o planeta.

Conteúdos Programáticos / Programa

As aulas combinam fundamentos teóricos e práticos.

- Introdução à Prática Laboratorial, utilização segura de Máquinas e esterilização de processos com microrganismos.
- Metodologias de biomimética. Design Baseado na Natureza: Bioestratégias para Projetar para a Sustentabilidade.
- Materiais Bioinformados para Arquitetura e Design: Um novo campo de trabalho, exemplos de investigação e práticas de campo. Biomateriais compósitos para arquitetura e design. Biomateriais aglutinantes e substratos. Estado da Arte.
- Design Computacional aplicado a Biomateriais: As Geometrias da Natureza e as suas aplicações através da Modelação
- Design Circular e Bioestratégias para a Circularidade
- Digital Fabrication e Soft Robotics
- Engenharia de Compósitos de Cogumelos, projetando com Micélio. Materiais à base de micélio, estado da arte.
- Oficina participativa: Fabricação de um objeto sólido feito de micélio

Tópicos Avançados em Apoio à Decisão e Gestão da Informação

Demonstração da coerência dos conteúdos programáticos com os objectivos de aprendizagem da unidade curricular

Os conteúdos teóricos da UC apresentam-se e estruturam-se numa lógica de aprender fazendo. Os conceitos teóricos são apresentados e sequencialmente trabalhados na sua prática e/ou implementação através das ferramentas laboratoriais em aprendizagem que lhes servem de suporte. Relaciona-se conhecimentos e conceitos com as práticas de laboratório e com as características físicas e comportamentais dos materiais.

Metodologias de ensino (avaliação incluída)

A metodologia de ensino estrutura-se numa lógica de aprender fazendo relacionando conhecimentos e conceitos com as práticas de laboratório e com os objetivos comportamento dos materiais em estudo no seu respetivo campo de aplicação.

As tarefas e desafios estruturam os conteúdos das aulas permitindo introduzir os conceitos teóricos em simultâneo com os métodos e ferramentas colocando o aluno no processo de resolução ativa dos problemas.

A avaliação é realizada de forma contínua e acompanhada no tempo de contacto em aula. Os trabalhos são elaborados ao longo das aulas e terão elementos específicos para entrega decorrentes do trabalho com as ferramentas, dados e projetos usados durante as aulas. Será estabelecida uma relação integrada com os objetivos das disciplinas de Projeto Integrado.

Constituem elementos de avaliação a participação e interesse demonstrados em aula, bem como assiduidade e a pontualidade. A assiduidade às aulas, não pode ser inferior a 75%.

A avaliação contínua resulta da combinação ponderada dos seguintes elementos:

• Assiduidade – 15%;

• Trabalhos Práticos – 30% e 35%;

• Apresentação dos Trabalhos Práticos e Relatório - 20%.

Para se dispensar a exame a avaliação dos trabalhos práticos tem de ser igual ou superior a 10 valores. O Exame (1ª e 2ª chamada) é constituído pela entrega e apresentação dos Trabalhos Práticos. No Exame de Época Especial, aplicam-se as mesmas regras e ponderações da avaliação contínua.

Demonstração da coerência das metodologias de ensino com os objectivos de aprendizagem da unidade curricular

As aulas enquadram o uso prático das ferramentas laboratoriais com a teoria suportada nas leituras disponibilizadas patentes na bibliografia, bem como nos tutoriais de apoio disponibilizados aos alunos. Os alunos deverão desenvolver as suas capacidades de manipulação em laboratório com os materiais estudados traçando relações com os objetivos corportamentais e características dos materiais que se pretendem estudar e/ou desenvolver.

Bibliografia Principal

Alaneme, Kenneth Kanayo, Justus Uchenna Anaele, Tolulope Moyosore Oke, et al. 2023. “Mycelium Based Composites: A Review of Their Bio-Fabrication Procedures, Material Properties and Potential for Green Building and Construction Applications.” *Alexandria Engineering Journal* 83: 234–50. https://www.sciencedirect.com/science/article/pii/S1110016823008979.

Andrade, Tarciana, José Beirão, Amilton Arruda, and Natália Vinagre. 2024. “Kinetic Module in Bimetal: A Biomimetic Approach Adapting the Kinetic Behavior of Bimetal for Adaptive Façades.” *Materials & Design* 239 (March): 112807. https://doi.org/10.1016/j.matdes.2024.112807.

Crawford, Assia. 2023. *Designer’s Guide to Lab Practice*. Routledge. https://www.taylorfrancis.com/books/mono/10.4324/9781003363774/designer-guide-lab-practice-assia-crawford.

Enzi, Vera, Blanche Cameron, Péter Dezsényi, Dusty Gedge, Gunter Mann, and Ulrike Pitha. 2017. “Nature-Based Solutions and Buildings – The Power of Surfaces to Help Cities Adapt to Climate Change and to Deliver Biodiversity.” In *Nature-Based Solutions to Climate Change Adaptation in Urban Areas: Linkages between Science, Policy and Practice*, edited by Nadja Kabisch, Horst Korn, Jutta Stadler, and Aletta Bonn. Theory and Practice of Urban Sustainability Transitions. Springer International Publishing. https://doi.org/10.1007/978-3-319-56091-5_10.

Jalali, Sara, Lidia Badarnah, and Eleonora Nicoletti. 2025. “Biomimetic Adaptive Solar Building Envelopes: Trends, Challenges, and Opportunities for Sustainable Applications.” *Renewable and Sustainable Energy Reviews* 215: 115586. https://www.sciencedirect.com/science/article/pii/S136403212500259X.

Sun, Wenjing, Mehdi Tajvidi, Christopher G. Hunt, Gavin McIntyre, and Douglas J. Gardner. 2019. “Fully Bio-Based Hybrid Composites Made of Wood, Fungal Mycelium and Cellulose Nanofibrils.” *Scientific Reports* 9 (1): 3766. https://doi.org/10.1038/s41598-019-40442-8.

V.A. 2022. Material Cultures: Material Reform Building for a Post-Carbon Future. Mackbooks. https://www.livrariaamaisa.pt/sustentabilidade-ecologia/29483-material-cultures-material-reform-building-for-a-post-carbon-future.html.

Vašatko, Hana, Lukas Gosch, Julian Jauk, and Milena Stavric. 2022. “Basic Research of Material Properties of Mycelium-Based Composites.” *Biomimetics* 7 (2): 51. https://www.mdpi.com/2313-7673/7/2/51.

Zimele, Zinta, Ilze Irbe, Juris Grinins, Oskars Bikovens, Anrijs Verovkins, and Diana Bajare. 2020. “Novel Mycelium-Based Biocomposites (Mbb) as Building Materials.” *Journal of Renewable Materials* 8 (9): 1067–76. https://www.researchgate.net/profile/Oskars-Bikovens/publication/343391385_Novel_Mycelium-Based_Biocomposites_MBB_as_Building_Materials/links/5f27c50fa6fdcccc43a61d69/Novel-Mycelium-Based-Biocomposites-MBB-as-Building-Materials.pdf

Bibliografia Complementar

Webgrafia:

https://criticalconcrete.com/research/

https://mycelium-tectonics.com/

https://materiability.com/portfolio/mycelium-tectonics/

https://www.dezeen.com/2014/07/01/tower-of-grown-bio-bricks-by-the-living-opens-at-moma-ps1-gallery/

https://somfoundation.com/fellow/davis-ghazvinian-gursoy-oghazian-pecchia-west/

https://ecovative.com/

https://www.builderonline.com/products/mycoboard-offers-an-innovative-sustainable-solution-for-

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https://www.archdaily.com/988017/mushroom-mycelium-bricks-and-water-purifying-tiles-10-innovative-and-sustainable-building-materials

https://www.archdaily.com/979161/replacing-cement-with-waste-embracing-the-circular-economy-with-polymer-technology

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CURRICULAR UNIT FORM

Curricular Unit Name

202599304 - Workshop BioLab

Type

Elective

Academic year	Degree	Cycle of studies	Unit credits
2025/26	Phd Architecture	3	10.00 ECTS

Lecture language	Periodicity	Prerequisites	Year of study/ Semester
Portuguese ,English	semester		

Scientific area

Architecture

Contact hours (weekly)

Tehoretical	Practical	Theoretical-practicals	Laboratory	Seminars	Tutorial	Other	Total
0.00	0.00	2.00	0.00	0.00	0.00	0.00	2.00

Total CU hours (semester)

Total Contact Hours	Total workload
28.00	75.00

Responsible teacher (name /weekly teaching load)

José Nuno Dinis Cabral Beirão

Other teaching staff (name /weekly teaching load)

Manuela Cristina Paulo Carvalho	0.30 horas
Susana Maria Gouveia Rosado	0.30 horas
José Nuno Dinis Cabral Beirão	0.30 horas
Ana Mestre (FBAUL)	0.30 horas
Carolina Delgado	0.60 horas
Rafael Calado (BioLab)	0.20 horas
João Canilho Santos (BioLab)	0.30 horas
Caterina Plenzick	0.30 horas
Carlos Roque (BioLab)	0.20 horas
Guilherme Martins (BioLab)	0.20 horas

Learning objectives (knowledge, skills and competences to be developed by students)

The Workshop program aims to achieve the following objectives:

- Develop knowledge about biological materials available for application in various construction domains or as stand-alone elements with competitive potential (economic and ecological) in civil construction.
- Develop laboratory skills in conducting detailed research on material behavior, biological characteristics, (re)productive aspects, and applicability in pure form or in combination with other materials that do not compromise sustainability requirements.
- Develop the ability to scientifically and experimentally pursue the necessary experiments with biomaterials to demonstrate their qualities and advantages over industrial competitors.
- Develop technical skills (methodological and tool-related) to address the complexities of the study problem.
- Develop technical and laboratory skills for the study and approach to biomaterials.
- Develop capabilities for synthesizing and communicating ideas and development visions implicit in the use of biomaterials, producing scientific and philosophical discourses that support their advantages in contributing to the formation of sustainable societies in harmonious balance with the planet.

Syllabus

Classes combine theoretical and practical foundations.

• Introduction to Laboratory Practice, safe use of machines, and sterilization of processes with microorganisms.

• Biomimetic methodologies. Nature-Based Design: Biostrategies for Designing for Sustainability.

• Bioinformed Materials for Architecture and Design: A new field of work, research examples, and field practices. Composite biomaterials for architecture and design. Binder and substrate biomaterials. State of the art.

• Computational Design applied to Biomaterials: The Geometries of Nature and their applications through Modeling.

• Circular Design and Biostrategies for Circularity.

• Digital Manufacturing and Soft Robotics.

• Mushroom Composite Engineering, designing with Mycelium. State-of-the-art mycelium-based materials. • Participatory Workshop: Making a Solid Object from Mycelium

• Advanced Topics in Decision Support and Information Management

Demonstration of the syllabus coherence with the curricular unit´s learning objectives

The theoretical content of the course is presented and structured according to a learning-by-doing logic. Theoretical concepts are presented and worked through sequentially in practice and/or implementation using the laboratory learning tools that support them. Knowledge and concepts are related to laboratory practices and the physical and behavioral characteristics of materials.

Teaching methodologies (including evaluation)

The teaching methodology is structured around a learning-by-doing approach, connecting knowledge and concepts to laboratory practices and the objectives of the materials being studied in their respective fields of application.

Tasks and challenges structure the class content, allowing students to introduce theoretical concepts simultaneously with methods and tools, engaging them in the process of active problem-solving.

Assessment is conducted continuously and monitored during class contact time. Assignments are developed throughout the class and will have specific delivery elements resulting from the work with the tools, data, and projects used during class. An integrated relationship will be established with the objectives of the Integrated Project courses.

Participation and interest demonstrated in class, as well as attendance and punctuality, are the assessment elements. Class attendance cannot be less than 75%.

Continuous assessment is based on the weighted combination of the following elements:

• Attendance – 15%;

• Practical Assignments – 30% and 35%;

• Presentation of Practical Assignments and Report – 20%.

To be exempt from the exam, the practical assignments must be graded at or above 10. The Exam (1st and 2nd call) consists of the submission and presentation of the Practical Assignments. In the Special Period Exam, the same rules and weightings as for continuous assessment apply.

Demonstration of the coherence between the Teaching methodologies and the learning outcomes

Classes incorporate the practical use of laboratory tools with theory supported by the readings available in the bibliography, as well as the supporting tutorials provided to students. Students should develop their laboratory handling skills with the materials studied, establishing relationships with the corporate objectives and characteristics of the materials to be studied and/or developed.

Main Bibliography

Alaneme, Kenneth Kanayo, Justus Uchenna Anaele, Tolulope Moyosore Oke, et al. 2023. “Mycelium Based Composites: A Review of Their Bio-Fabrication Procedures, Material Properties and Potential for Green Building and Construction Applications.” *Alexandria Engineering Journal* 83: 234–50. https://www.sciencedirect.com/science/article/pii/S1110016823008979.

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