UNIVERSIDADE DOS AÇORES

Academic Syllabus

1. Name of the course

- EN: Sustainable Materials for a Circular Future
- PT: Materiais Sustentáveis para um Futuro Circular

2. Work hours /ECTS

Contact hours		Total work hours	ECTS	US Credits
Theoretical	14	145 (RISD 145)	6	3
Theoretical-practical	7			
Lab	7			
Seminar	6			
Field work	8			
Internship	0			
Tutorial guidance	0			

3. Teachers responsible for the course

Professor Laura Briggs from Rhode Island School of Design
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4. Course description

Islands nations are at the forefront of climate change mitigation as their specific geography makes them more susceptible to rising oceans and at the same time, their remoteness involves an autonomy and self-reliance. As the urgency of the pursuit of resiliency grows, islands have the potential to act as incubators and leaders in green designed futures. The Portuguese volcanic islands of the Azores are an example. Situated along the mid-Atlantic Ocean ridge, where the plates of Europe, Africa and America meet. It is designated as a UNESCO's Global "Geoparks", a network established to protect biodiversity, promote geological heritage and support sustainable economic growth. It is a place between, part of Portugal, at western edge of European Union and with deep ties to New England through waves of emigration.

In this 4-week summer course, we will learn about design with nature by working with natural systems. We will explore the potential of biomaterials in design through laboratory and studio work. Biofibers were for

centuries, one of the primary materials used in the design of ordinary products and building components. With the introduction of plastics and other synthetic materials at the advent of the 20th century, the use of the natural materials declined. But thanks to a growing environmental consciousness and new attitudes, traditional crafts are being reconsidered in innovative ways. In the Azores and Portugal, the traditional handicraft culture has an important role. Artisans continue to create beautiful objects including woven baskets, hats and shades. We will observe these traditions and look at new approaches to biomaterials that use multiple techniques from woven fibers, pressed composite containers, to 3d printed for a varied set of applications. After learning about material potential, each student will propose an application and develop a prototype.

5. Learning outcomes

OBJECTIVES
This course's main purpose is to develop introduce students to:

1. Ongoing research into the rapidly evolving world of sustainable materials
2. The different characterization methods of materials and to understand their advantages and disadvantages
3. The rapidly evolving world of bio-design in replacing petroleum-based products.
4. Hybrid laboratory / design studio approaches to bio-design.
5. The importance of the Circular Economy.
6. Have students understand the implications that sustainable materials have in the ecosystem and circular economy

LEARNING OUTCOMES
By the end of this course students will develop:

- A deeper understanding of sustainable materials.
- The ability to analyze the properties of different materials and design with this knowledge
- Fluency in understanding the foundational ecological framework.
- Development of critical thinking and practical skills.
- A personal stance open to re-evaluation through lab-based research methods.
- Familiarity with the research and debates of leading thinkers in sustainable materials.
- Collaborative skills across disciplines.

6. Content

SEMINAR CLASSES
1.1 Introduction to Sustainable Materials: Overview of sustainable materials; Historical context and development.
1.2 Methods of Material Characterization: Mechanical, thermal, and chemical-physical properties; Testing methods and standards
1.3 Fundamentals of Materials Physics: Atomic structure and bonding; Crystallography and material structure, and differing potential for applications
1.4 Bio-design Principles: Definition and significance; Key concepts and strategies

1.5 Analytical Techniques in Bio-design: Spectroscopy, mechanical compression testing, and microscopy; Application in material analysis
1.6 Healthy Material practices: origins, practices, Red List materials and market barriers.
1.7 Circular Economy Principles: Definition and importance; Key strategies and frameworks
1.8 Sustainable Material Innovations: Recent advancements and case studies; Challenges and opportunities
1.9 Environmental and Economic Impacts: Lifecycle assessment; Cost-benefit analysis
1.10 Future Trends in Sustainable Materials: Emerging technologies; Predictions and future directions

THEORETICAL-PRACTICAL LAB CLASSES
2.1 Material Synthesis and Production: Synthesis of biopolymers; Production techniques for sustainable materials
2.2 Property Analysis of Materials: Testing mechanical properties; Analyzing thermal stability
2.3 Thermodynamics and Kinetics in Material Science: Thermodynamic principles in material stability; Kinetics of material transformations
2.4 Developing New Materials: Combining different fibers and polymers; Experimentation with fillers and additives
2.5 Bio-design in Practice: Creating bio-designed products; Evaluating bio-design efficacy
2.6 Advanced Analytical Techniques: Applying spectroscopy and mechanical tests; Data interpretation and analysis
2.7 Circular Economy Applications: Implementing circular economy principles in material production; Case studies and practical applications
2.8 Comparative Studies of Sustainable Materials: Comparing properties and performance; Evaluating environmental impact
2.9 Practical Project Development: Developing and presenting a sustainable material project; Collaborative and individual projects

FIELD WORK
Students will explore the rural and urban landscapes of the Azorean Islands by walking and sketching. We will examine the intersection of the local ecology and contemporary cultural practices, by engaging local ecologists, designers and artists. Along the way we will learn about resource management and the local wood industry as well as the use of invasive biofibers. We also will visit a local arts organization called Walk&Talk who will be planning their bi-annual summer arts festival. In addition, students will be exposed to local craft traditions from stone masonry, wood working, to embroidery to learn from the past and to look toward an ecologically hopeful future.

7. Demonstration of the syllabus' coherence with the course's learning outcomes

The seminar classes will allow students to develop a deep understanding of all the contents that we propose to teach. It will be the first introduction on the topics, and it will be complemented with all the other points of the syllabus.

Theoretical-practical Lab / Studio classes will be very important in solidify the knowledge that will be provided in the theoretical lectures. In the laboratory, students will learn with a hands-on-approach how to produce

different types of materials and will analyze their properties. Also, students will be encouraged to make their own materials, mixing different types of fibers, fillers and polymers and production processes. In the studio, students will be asked to consider applications and be asked to produce a prototype using the biomaterials they are developing. Applications range from simple containers to building components. The field work and the seminar will give students a broader understanding of sustainability and materials while assessing the best practices and want they can do.

8. Teaching methodology

- Lectures introducing theoretical concepts
- Practical laboratory sessions for hands-on experience
- Design studio exploration sessions to synthesize learning into project idea.
- Group discussions of project direction
- Field visits to observe and learn from real-world applications
- Seminars for in-depth exploration of specific topics
- Daily sketch book to observe things we are seeing and generate thoughts

9. Assessment

- Formative assessment (oral interaction, desk crits): 20%
- Intermediate assessment (Research Assignments): 30%
- Final assessment (Final Project): 50%

10. Demonstration of the coherence between the teaching methodologies and the learning outcomes

All learning outcomes will be addressed either by the laboratory work, research assignments, desk crits, and oral interaction in and out of the classes.

11. Bibliography

Bibliography for reference purposes, selected readings will be assigned with seminar lectures.

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