Research – Development – Innovation Syllabus

<table>
<tr><td rowspan="5">1. General Informations</td><td colspan="5">Course title: Biodesign Challenge New York: Co-Designing with Living Organisms for Future Ecosystem Resilience</td></tr>
<tr><td colspan="5">Course coordinator(s) / lecturer(s): Ference Kovács N. , Lücking Malu
Contact details: kovacs.nagy.ferenc@mome.hu, lucking@mome.hu</td></tr>
<tr><td>Level and Code:
M-KF-E-301-IK-242502-01</td><td>Position in the Curriculum:</td><td>Recommended semester:</td><td>Credits:
5</td><td>Teaching hours: 48
Student workload: 150</td></tr>
<tr><td>Related codes:
B-KF-401-IK-242502-01
M-KF-301-IK-242502-01</td><td>Type: combined</td><td>Is it open to sign-up as an elective?</td><td colspan="2">Specific pre-conditions to sign-up as an elective:</td></tr>
<tr><td colspan="5">Interlinkages / prerequisites, parallel units:

Courseweek: Ecosystems of 2080: Designing with Nature for a Resilient Future</td></tr>
<tr><td rowspan="2">2. Targeting</td><td colspan="5">Aims and principles of the course:

Students enrolled in the Ecosystems of 2080 course week will receive priority for participation in this global Biodesign Challenge course.

The course invites students to design innovative solutions for ecosystems affected by climate change, focusing on harnessing the resilience of nature to tackle future environmental challenges. The objective is to develop sustainable, nature-based design strategies that can adapt to the ecological shifts anticipated in various habitats. Through collaborative projects, students will explore how to work with living organisms as partners in design, crafting concepts that support ecological health and resilience.

One case study, for example, involves Lake Balaton, which faces increasing risks of eutrophication due to rising summer temperatures in Hungary. Drawing inspiration from the natural water-purifying mechanisms of intertidal zones—where species like macroalgae and mussels maintain ecosystem balance—students will examine potential biodesign solutions to mitigate these impacts. Throughout the course, you will investigate similar scenarios, using nature-inspired strategies to address the challenges faced by different ecosystems.

By the end of the course, students will present their concepts in a final project for the global Biodesign Challenge. The top team will have the chance to compete internationally in New York, showcasing their innovative ecological designs. This course emphasizes interdisciplinary collaboration, the application of biodesign principles, and a commitment to environmental stewardship.</td></tr>
<tr><td colspan="5">Intended learning outcomes / professional and transitive competencies:
(in accordance with the subject description)

Knowledge: Gain a deep understanding of the ecological impacts of climate change and the potential for nature-based design solutions; learn foundational principles of biodesign and ecological sustainability; acquire knowledge of working with and designing for specific ecosystems.</td></tr>
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	Skills: Strengthen research skills by analyzing ecological data and case studies; enhance design thinking and prototyping abilities focused on sustainability; develop collaboration and communication skills within diverse teams. **Attitudes/Attributes**: Adopt a mindset of environmental stewardship; value interdisciplinary approaches; demonstrate curiosity and innovation in applying nature-based solutions; recognize the ethical implications of ecological design. **Autonomy and Responsibility**: Manage project timelines effectively, especially when engaging with real-world ecological data; take ownership of individual and group contributions; practice self-assessment and reflect on the impact of design decisions on ecosystem health.
3. Itinerary	Course content (topics and themes): • **Biodesign Principles and Nature-Based Solutions** • **Climate Change Impact on Ecosystems** • **Biomimicry and Co-Design with Living Organisms** • **Sustainable Prototyping with Biomaterials** (e.g., mycelium, algae) • **Introduction to Ecological Data Analysis** • **Ethics in Biodesign and Environmental Stewardship** • **Hands-on Lab Work**: Growing, Harvesting, and Experimenting with Bio-based Materials • **Communication and Storytelling for Biodesign Projects**
	RDI methods and tools used in the course: **Qualitative Methods**: • Expert interviews to gain insights on biodesign and ecological challenges **Prototyping**: • prototyping with bio-based and living matter • Lab experiments to grow and manipulate biomaterials and organisms • Digital design tools (e.g., Rhino, Fusion 360) for prototype simulation **User Testing**: • Prototype testing and feedback from experts and stakeholders • Iterative testing and refinement of designs • Ecological impact assessments to evaluate sustainability and effectiveness
	Specificity of the learning process: Teaching method: • Project-based learning • Hands-on lab experimentation

- Expert interviews and feedback sessions
- Collaborative workshops
- Iterative prototyping and testing

Schedule:

- **Phase 0 (Week 1)**: Introduction to Biodesign Principles & Methods; Overview of the course and learning outcomes; Learning about sustainability, biomimicry, and ecological design principles
- **Phase 1 (Weeks 2-4)**: Research on ecosystems and climate change impacts by 2080; Analyze case studies and expert insights on environmental challenges
- **Phase 2 (Weeks 5-7)**: Learn from nature and biomimicry to develop design concepts aimed at restoring ecosystem balance; Concept development and feedback
- **Phase 3 (Weeks 8-10)**: Prototyping and iterative testing of biodesign solutions using mycelium, algae, and other materials; Refinement based on feedback
- **Phase 4 (Week 11)**: Final presentation preparation, storytelling, and project refinement for the Biodesign Challenge

Tasks and assignments (with student notional workload):

In-Class Work (42 hours total):

- **Lectures & Workshops**: Introduction to biodesign principles, sustainability, biomimicry, and ecosystem research (6 hours)
- **Lab Work & Prototyping**: Hands-on experimentation with bio-based materials (mycelium, algae) and iterative prototyping (20 hours)
- **Consultations & Expert Feedback**: Group discussions, mentor check-ins, and peer reviews for design refinement (8 hours)
- **Design Critiques & Collaboration**: Feedback sessions on design concepts and prototypes (8 hours)

Independent Work (110 hours total):

- **Research & Data Collection**: Study ecosystems, climate change impacts, and relevant case studies (30 hours)
- **Concept Development**: Develop biomimicry-based design solutions and refine ideas (30 hours)
- **Prototyping & Iteration**: Continue working on prototypes and refining designs based on in-class feedback (30 hours)
- **Storytelling & Final Presentation**: Crafting a narrative, preparing visual materials, and finalizing the presentation (15 hours)
- **Reflection & Documentation**: Journaling the design process, challenges, and insights (5 hours)

	Learning environment: Biolab & Classroom
4. Evaluation	Assessment: The course is completed through active participation in lectures, workshops, group work, lab experimentation, consultations, and the final presentation. Assignments: Students will work individually and in groups to conduct ecosystem research, develop biodesign concepts, and create a series of prototypes using bio-based materials like mycelium and algae. The final product should demonstrate an innovative biodesign solution for restoring ecosystem balance, accompanied by a compelling narrative that highlights sustainability and ecological impact. Assessment method: Evaluation is based on class attendance, participation in workshops, interim presentations of research and prototypes, group collaboration, and the final presentation of the biodesign project. Assessment criteria: Since the course is centered around a team project, the final grade will reflect both individual contributions and group performance. Grades will be determined by the student's engagement, participation in their assigned roles, contribution to the design and prototyping process, and the effectiveness of their final presentation.
	Calculation of grade: Attendance and active contribution 30% Group project concept & research 20% Group project Prototyping 20% Interim presentation 10% Final presentation 20%
	Prior learning recognition (based on application):
	Recommended readings: Further readings, documents, sources:
	Additional information: Due to the high number of applicants, we ask that you submit a motivation letter explaining why you want to join the course and what skills you possess that would be a valuable contribution to the group. (Max 200 words.)
	Schedule and venue for personal consultation: TBA